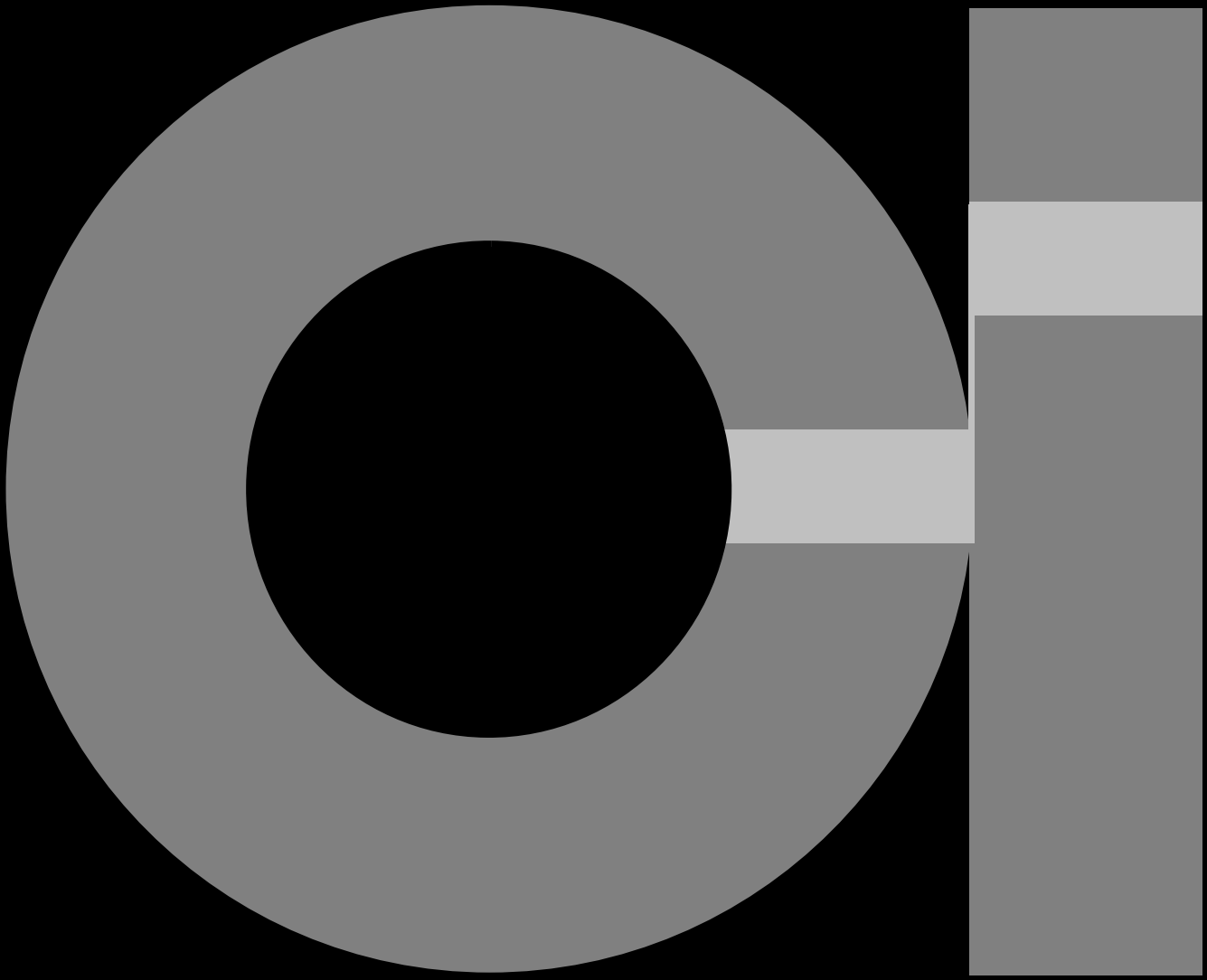

PLANNING IN TIMES OF UNCERTAINTY

CITTA 2ND ANNUAL CONFERENCE ON PLANNING RESEARCH

EDITED BY PAULO PINHO AND VITOR OLIVEIRA

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PROCEEDINGS OF CITTA 2ND ANNUAL CONFERENCE ON PLANNING RESEARCH

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Preface

Paulo Pinho
Director of CITTA

The second annual conference of CITTA took place in a time of economic decline, raising unemployment, and deep concerns about our near future. The general theme of the conference – *Planning in Times of Uncertainty* – aimed to capture these particular circumstances. Our objective was to gather a number of theoretical and practical contributions, coming from the planning research field, which would approach the challenges ahead from a positive and constructive perspective.

Planning as both a professional field and as a scientific discipline, has long seemed to be better equipped to deal with managing growth and change, rather then decline, complexity and uncertainty. However, we firmly believe that planners' understanding of the spatial dimension of social, economic and environmental processes may provide an important help to find a way out of this current crisis. Our planning doctrines, paradigms, methods and techniques have to be revisited and reinvented to face the challenges ahead. In this difficult context, it is time to discuss the role of planning research to prepare a more balanced, sustainable and socially sensitive future.

This book contains a selection of the large number of papers presented at the conference. This selection reflects the work carried out at the CITTA research centre, as well as some of the most relevant research work carried out elsewhere in other Portuguese research centres and abroad. Generally speaking, the organization of the papers closely follows the conference programme. The first part of this book includes Patsy Healey's keynote speech and the presentations at the plenary sessions of two European research projects; MOPUS – Mobility Patterns and Urban Structures, and SUME – Sustainable Urban Metabolism for Europe. The second part covers seventeen papers included in the Planning and Environmental Assessment tracks. The third part gathers seven papers presented in the Urban Planning and Housing track. The fourth part, dedicated to Transport Planning and Logistics, includes six papers. Finally, the fifth part includes a number of short papers that did not follow the suggested format but, nonetheless, deserve publication in our opinion. To all authors and contributors involved we would like to express our most sincere thanks.

Part 1. Keynote speech

Rethinking the relations between planning, state and market in unstable times

Patsy Healey
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1 Unstable times

For the past decade, analysts of urban and regional development dynamics in Western Europe have emphasised how established arrangements for promoting and governing territories and localities have been destabilised. The literature refers to fragmented versus integrated governance activity; multi-level versus hierarchical government systems; disjunctions between administrative, functional and cultural conceptions of place; diffuse and conflicting conceptions of place and spatial connectivity versus cohesive, integrated conceptions[1]. The result has been interpreted as a governance landscape of institutional complexity, mirroring the complexity of the relations which transect, intersect and clash in urbanised areas. Research into governance processes shows that some localities seem overwhelmed by this complexity and instability, unable to generate sufficient energy and cohesion to create coalitions with the capacity to become pro-active in shaping place futures. In other localities, in contrast, considerable governance capacity has evolved, through which responses to unstable conditions have been characterised by innovative experimentation, leading in some cases to transformations in governance cultures and practices. Such research has begun to show how and why some localities have greater ability to become pro-active sites of governance activity, with the capacity to 'act *for* themselves', transforming their processes and practices in doing so[2].

This work has drawn on concepts which emphasise the mobilisation of actors and networks, the use of arenas and discourses and the formation of coalitions and 'regimes'. With a keen eye for contingencies and local specificities, analysts have either been cautious about over-generalisation, or have found that generalisations become unstuck when they hit the ground of diverse experiences. This has encouraged a research emphasis in fields such as urban and regional research on the activities and power of agency – of particular organisations and actors[3]. Such an emphasis is paralleled in practical affairs through the emphasis on the 'innovative entrepreneur', and the 'enabling and facilitating' public actor, taking initiatives and promoting projects. Both assume that pro-active governance demands strategic capacity, which can mobilise and co-ordinate development activity. In this climate of ideas, rules and regulations are often dismissed as an inheritance of outdated attempts to 'control' what happens or as an old-fashioned approach to territorial development (Albrechts 2001).

Yet, just as much as strategic energy, these legal and administrative procedures and practices have always played an important role in shaping the contexts in which innovative activity and experimentation takes place. They have had a 'structuring' role. Structural explanations for the changing and variable forms of urban and regional dynamics more usually focus on economic forces, as in Harvey's arguments for a shift from 'managerialist' to 'entrepreneurial' governance

[1] See Gualini 2006, Healey 2006, Lefevre 1998, Salet and Thornley 2003.
[2] See Le Galès 2002, Cars et al. 2002, Goodwin et al. 2006.
[3] This has been a key emphasis in my own work.

regimes, or Jessop's claim of a shift from 'welfare' to 'workfare' modes of regulating social order (Harvey 1989, Jessop 1995). Interpreters who wish to highlight the pervasive shifts in governance rhetoric and practices these days often express this is as a hegemonic emphasis on the policy primacy of concerns with 'economic competitiveness', and an expression of a 'neo-liberal' ideology.[4] For some time, however, social science inquiry has been critical of too strong an emphasis on structuring dynamics. In a 'post-modernist' intellectual climate, there has been a critical scepticism about 'grand narrative' explanations. These have seemed to crowd out the ability to recognise specific local contingencies (Painter and Goodwin 2000, Jessop and Sum 2006). Yet too much of an emphasis on uncovering the specificities of particular development pathways can neglect the way these specificities are shaped by powerful exogenous forces.

The collapse of the global capitalist financial system from 2007 and its consequences for economic activity and public sector finance have brought the importance of structuring systems back into the forefront of attention. In particular, they have highlighted the social institutions necessary for 'markets' of various kinds to be constructed. The crisis has underlined the role of government regulations and practices in reducing the risk and uncertainty which undermine market activity. Just as, in late 1980s Britain, the celebration of the innovative property entrepreneur helped to create a steep boom/bust phenomenon, so has the hyper-celebration of the clever financial innovator come to haunt the global banking system. This leads some to argue that financial markets should be kept under firm regulatory control, perhaps even taken into full public control and management, while innovative entrepreneurs should be squeezed out of economic activity altogether. But the record of state control is not such a 'shiny' one, being prone to subversion by private interests, inefficiency and inertia.

Markets, as a mechanism for allocating resources and for mobilising creative energy, have been valuable ways of undertaking economic activity for millennia. Although markets, and the activities of merchants, have at times been squeezed out of social systems, it seems highly unlikely that market mechanisms will disappear from the complex urbanised societies of the 21st Century. What instead needs to focus our attention, as researchers and policy advisers in the field of urban and regional dynamics, is the way market activity is structured. Markets, our welfare economics textbooks tell us, involve 'willing buyers' and 'willing sellers' in an interaction regulated by the 'price mechanism'. But what institutions 'structure' the values of goods to buyers and the production processes which makes goods available for sale? In what arenas do market transactions take place? Over what time periods are prices established and realised? What governance mechanisms intrude open these processes?

Such questions certainly need careful attention in the financial sector at the present time. But the markets that need special attention from those concerned with the spatial dimensions of urban and regional development are those involved in land and property development processes. It is on these processes and in relation to the markets relevant to them that urban planning has a powerful actual and potential leverage. We should be asking, in these present 'destabilised times', how are such processes faring? Are there any generalisations we can make across Europe about the impact

[4] Even the idea and practices of 'collaborative planning' have been criticised as a 'neo-liberal' idea, see Bengs 2005 and for a critique of this view, see Sager 2009/10.

on land and property development processes of shifts and instabilities in governance processes and of the shocks to the financial system and its general knock-on economic effects? Or are the experiences of different places and countries so variable that we need to maintain our attention firmly on local specificities? Are there general lessons about how to 'manage' local land and property development markets which we can exchange from one place to another? Or should our research and policy focus remain centred on agency power? Is the policy message that we should devote our attention to 'inventing' appropriate responses to the particular conditions in our own cities and regions?

2 Market shaping and land and property development dynamics

Land and buildings on land have always presented a difficult problem to address in terms of a market. As many have argued, land as such is not generally 'produced' by human effort[5], although its qualities and locational characteristics are deeply affected by the way we think about, use and invest in land and property, and by the role of access and ownership of land and property in the societies of which we are a part. How we think about these issues affects how land and property 'values' are established, and to whom that value accrues. This in turn shapes the institutions – formal and customary law, regulations to set the relation between 'public' and 'private' interests in land and property development, what is seen to be acceptable public intervention in development activity, etc – within which specific market activity develops. Land and property development institutions, with their organisations and practices, then develop within this context. These include the kinds of firms which engage in development activity, the 'marketplaces' where transactions are negotiated, and the terms of these transactions. Ball (1983, 1998) calls these institutions the 'structures of provision' through which building types are produced. Specific instances of development activity, the focus of both many planning research studies and local policy conflicts, express these 'layers' of institutional shaping. In other words, local land and property development activity occurs in contexts which are structured in particular ways. They may also, through generating particular localised ways of operating within structuring parameters, create another institutional layer. Such localised processes may, from time to time, unsettle and change the wider context. So the field of land and property development activity has an intrinsic social scientific interest because of the complexity of the interrelation of structuring forces and agency activity. Neither 'grand narrative' nor ethnographic 'case story' can by itself penetrate easily the role of land and property development dynamics in urban and regional development.

The above underlines that a lot of social, institutional work is needed to turn land and property, and hence land and property development activity, into a market form. And the institutions created are prone 'failure'. Development timescales are often long. Both buyers and sellers may be large corporations or landowners, able to act as oligopolies. How land is owned may be linked historically to the role and fate of past landed aristocracies, to the extent to which property is considered as an investment rather than for its use value, and, in the present period, to the closeness of the nexus between investment in land and property and other forms of financial investment. In the UK, as in the

[5] The exceptions are the substantial efforts in reclaiming land from the sea, and other ways in which 'natural' landscapes have been re-modelled on a large scale to make them habitable.

US, the investment emphasis has grown particularly close in recent decades, which is one reason why a collapse in housing property values has had such a massive consequence, causing not just the de-valuing of the holdings of many financial institutions, but of many households and firms. For many builders and developers, the consequences have been a massive 'destruction' of value, a sudden bust after a long and exaggerated boom. As in previous property busts, the land and property development sector has turned to government and demanded action. Whereas in boom periods, the demand has been for release from 'bureaucracy' and 'regulatory constraint', so in bust periods, the demand is for protection from instability and uncertainty. The 'innovative entrepreneur' is replaced by the risk-averse asset manager (Adams 1994, Healey 1998).

Planning systems and practices get buffeted by these demands and the economic winds that blow them. In the 1970s, some argued that planning activity merely reflected market dynamics, or the interests of powerful players in land and property markets[6]. Subsequent research inquiry also showed that planning institutions, strategies and practices had a role in shaping such markets. Such institutions operate 'structurally' by shaping expectations. In England, for example, most planning strategies express the deeply-embedded societal view that development should not be allowed to sprawl across the 'countryside'. In the Netherlands, planning strategies indicate not just where development will be encouraged and discouraged, but what investment projects are likely to come on stream, allowing developers to assess land and property value consequences. In both countries, the institutions and practices related to formal 'planning systems' help to structure negotiations over how the value of a development should be distributed, as between developers, owners and end-users, infrastructure and service providers, local communities, wider interests, and the state generally.

Some argue that land and its development are so problematic to treat in a marketised way that they should owned as well as regulated by the public sector – nationally, regionally and/or locally[7]. In times of property bust, developers, landowners and residents often look to the state to take over failed projects and derelict sites. Those who argue that the central aim of planning activity is to promote social justice and/or environmental sustainability also doubt whether land and property development should be treated in a market form. This leads to an emphasis on the role of planning systems as a mechanism to restrict market activity which threatens such values. These arguments suggest that the role of planning strategies and other instruments is not to protect market operators from their own behaviour but to force them, if still given some opportunity, to take on these values. This can lead to planning strategies which are strong on rhetoric and to demands for strong regulatory powers. Whether the result is compliance (as in the Netherlands) or evasion (as in Italy) depends then on the relative strength of 'planning' institutions and other societal institutions in structuring land and property development practices (UN-Habitat 2009). However, another way forward is to work with awareness that land and property development activity benefits, in the long-term, from an institutional framework which 'smooths' the tendencies to boom and bust. This suggests that planning systems and practices have a potentially significant role in managing markets, as well as in promoting a recognition of responsibilities for the wider social and environmental contribution of any land and property development (Healey 1992a,b). A period of a collapse in value

[6] See, for example, Castells 1977, Scott and Roweis 1977.
[7] For several decades from the 1940s, development land in the Netherlands and Sweden was primarily in public ownership.

may stall land and property activity for a long while. But it may also be a period when the public sector has an opportunity to accumulate land and property assets, as private owners 'default', and to build a strategic framework through which development activity, when it revives, can be shaped in ways which promote wider objectives than just the maximisation of profits. What mechanisms are available to achieve this?

3 Managing land and property development activity

Table 1 summarises the main instruments available to the public sector through which to manage and shape land and property development markets. A critical instrument for a land and property 'market' to operate are rules governing property units, tenure and rights to sale. In some situations, these can be so complex that land and property proves an unattractive investment. Or people bypass legal means of occupying land, producing the semi-legal and informal settlements so common these days around many rapidly expanding cities outside North America and Europe (see UN-Habitat 2009). Planning systems come into play by giving some spatial specification to limits on land and property development rights, using instruments for deploying regulatory powers and powers for land acquisition. Planning systems also promote the co-ordination of development activity, and express the values of the 'public realm' which individual owners and developers are encouraged to absorb into their development projects. It is here that plans and strategies play a crucial role. However, if formal legal instruments are disregarded or distorted in the way they operate, then such plans and strategies may have little leverage on the development which actually takes place[8].

Table 1. Mechanisms for managing land and property development activity

Mechanism	For example ...
Defining rules for the operation of land and property development markets.	Through rules governing land ownership, tenure and land/property transactions Through regulations governing how land can be used and developed. Through regulations governing the contributions private developers must make to the 'public realm' (as in development charges and developer contributions to public facilities and services)
Direct development: Acting as landowner and developer	Providing public housing, developing business parks, building new towns, and initiating and managing major area redevelopment projects.
Facilitating land assembly	Through powers of compulsory purchase (expropriation) for public purposes, such as a major development project.
Providing financial incentives	Grants and tax exemptions to reduce the costs of a private sector development project
Facilitating co-ordination and hence reducing transaction costs	Through negotiation and mediation processes
Providing spatial organising concepts, to focus development attention	Through spatial strategies and area master plans.

The weight given to such instruments, even when available through legislation, varies from place to place, as does the way they are interpreted and used in practice. In Western Europe, persuasive spatial strategy-making became neglected in the 1980s, with the focus instead on the project, and on land use regulation (Healey et al. 1997, Albrechts 2001). In the 1990s, the

[8] Land allocation processes through formal plans may also be 'distorted' by practices which focus on political or private gains from development, rather than for the formal development purposes to which the plans are supposedly directed. See UN-Habitat 2009.

significance of spatial strategy-making was given greater emphasis, partly to improve co-ordination, and partly to regulate the external effects which the promotion of individual projects created across the wider urban and regional space. These effects were evident not just in rising pollution and congestion due to the strategic neglect of key infrastructures such as transport investment. They were also manifest in the growing spatial inequalities across urban areas due to the investment focus on releasing market potential rather than attending to areas where market attention was lacking. The competition between projects and the lack of clarity about public infrastructure investment also created market uncertainties[9]. Some of those involved in the resurgence of spatial strategy-making very clearly saw the major role of spatial strategies in managing urban land and property development markets (Mazza 2004).

To illustrate the changing balance of planning instruments for managing land and property development markets, I now look at the case of England (see Table 2). This shows a steady shift from a strong public sector role as a provider, developer and owner of land and property, to an increasing role as a 'market manager', although this latter role is rarely explicitly acknowledged and continually contested. Instead, the public sector - and 'the planners' - have been caricatured as bureaucratic meddlers, following arcane procedures, inhibiting exciting designs and preventing the provision of needed buildings. Developers, in turn, are caricatured as money-grubbing capitalists, out to displace beautiful views and hard-working small businesses which appear in the path of their overblown ambitions.

Table 2. Shifts in the role of different mechanisms in England

	1950s-1960s	1970s-1980s	1990s-2000s	2010s
Defining rules	XX	XXX<	XXXX	????
Direct development	XXXX	XX>	X<	<<
Land assembly	XXX	X>	X<	??<<
Financial incentives		X<	XXX<	>>
Co-ordination	(via strategy)		XXX	<<<???
Spatial concepts	XXX	X>	X<	<<<???

< = expanding; < = diminishing

What is then the next stage in this story? It is widely acknowledged that the British economy has, in Europe, been one of the most severely affected by the financial and economic crisis of 2007-2008. Land and property development activity in England has been battered by the financial collapse, especially in the buoyant south, where growth driven by the powerhouse of the financial sector. From the late 1990s, as the financial sector boomed, national government vigorously promoted the expansion of housing development to accommodate the rapidly rising demand and to increase the amount of low cost housing. Pressures were put on the planning system, which has long been a site of intense struggle between conservation and environmental values demands for new development locations, to release land for development. Planners and many development industry actors then struggled to contain new development initiatives within the framework of approved plans. Locating

[9] This has been especially evident in the UK.

land released in planning frameworks was necessary to provide legitimacy to land allocation decisions[10].

As a result of the negotiative efforts of many planners and developers, a good many sites were allocated for development during the 2000s, with substantial contributions negotiated for public infrastructure, justified through formal strategic plans. National government also claimed to demand that development sites were allocated through approved planning frameworks, but had difficulty in grasping that this meant accepting the validity of many environmental concerns and the importance of co-ordinating the allocation of development land with infrastructure investment. There has been a lot of experimentation and slow learning going on, but so far the ability of the public sector to provide clarity about development directions, regulatory requirements and infrastructure projects and their funding has been compromised by failures to understand the dynamics of different land and property development markets and struggles over where intense conflicts are to be resolved. Governance capacity in this area has thus been full of instability and uncertainty[11].

The property development sector in the UK is dominated by large firms and investment companies. Since the 1970s, it has become increasingly intertwined with the financial sector. As a result, property boom turned to bust very quickly from 2007. Severely affected by financial collapse and consequent economic recession, firms went bankrupt or withdrew from development projects, leaving incomplete schemes and vacant sites across our cities. Developers have sought relief from contracts with municipalities which demanded significant contributions to major infrastructures and other public realm requirements. The output of development, instead of growing with the allocation of sites and the negotiation of infrastructure payments, has slumped. Some large scale residential developers ceased building on all development sites for a while, as they could not sell their stock.

Meanwhile, the public finances are overwhelmed by a debt mountain which will take many years to reduce. It is widely recognised the funds for capital investment, whatever government is in place, will be very limited. Yet planning issues, and especially the relation between development, conservation and infrastructure provision, are a key plank of the opposition agenda, which is also committed to giving more powers to local authorities and 'sweeping away' the agencies at national and regional level which have been struggling to get some inter-departmental and inter-municipal co-ordination under the present government[12]. The prospect for many localities is a relapse into a stagnation which in past periods of sluggish development activity leaves the built environment scarred by poor maintenance, empty buildings and overgrown development sites. That leaves spatial strategies and skilled co-ordination work as the critical tools available not just to 'manage' land and property development markets back into activity, but to 'nurture' them.

It is this which creates a significant opportunity for a market shaping role. Both local communities and private development interests would welcome more co-ordination between the

[10] For accounts of this complex interaction between planning, housing and economic policy, see Dixon and Adams 2008, Watkins 2008.
[11] For an example of this, see the recent experiences in the East of England (see Healey 2007, Chapter 5).
[12] Labour administrations have tended to favour regional development agencies, and the 1997 incoming Labour government was committed to regional devolution in some form. This occurred in Scotland and Wales, but was more weakly developed in England. Since then, in England, opposition parties have emphasised devolution to the municipal level. Meanwhile, local authorities in some areas have taken various initiatives to strengthen local coalitions within and between municipalities. Both Tories and Liberals, the current opposition parties, are committed in a general way to such a municipal 'devolution' agenda.

allocation of land for development and the provision of infrastructure. But it is possible to do more. There is a chance to assist market activity so long as this supports the values of social and environmental responsibility. The struggles of the 2000s over the location and form of new development show such an 'attitude' developing both in redevelopment work and in developments on greenfield sites. If these transformations in attitudes and expectations can be carried forward into the 2010s, then the contribution of the combined efforts of public shaping and private development activity could prevent our cities turning bleak again, provide more of the much needed low-cost housing which has been lacking for so long, and significantly improve the environmental quality of the country's built stock. But achieving such transformations demands sustained social and institutional work to build governance capacities to act in this strategic, market management way.

4 Market shaping and governance capacity

In the perspective of critical urban political economy, it is claimed that moments of severe crisis lead to substantial political and economic transformations. In the present moment, all three 'circuits' of David Harvey's analysis of capitalism are in crisis, with political systems struggling to patch up and stabilise fractured systems[13]. In such a context, the fortunes of urban areas across Europe are likely to depend not just on how national and global economic dynamics develop but on the local governance capacity to reduce the damaging impacts of a long period of economic difficulty. How effectively those involved in such activity are able to do this will depend on their capacity to create a co-ordinated agency capacity which can act strategically across an urban area. In other words, it is the work of agency which generates new structuring possibilities when established structures weaken or collapse. In England, with its over-centralised and heavy state, one of the most interesting developments in the 2000s has been the evolution of such capacity in a number of places, both in areas experiencing substantial growth, and in some of the older industrial urban agglomerations[14]. A significant motivation behind the alliances, development companies and partnerships which have emerged in these areas has been to create local capacity to make use of opportunities provided by national government programmes while limiting the tensions and confusions which are carried in the shifting sands of national investment and regulatory initiatives. Similar stories of the building up of local capacity are to be found across Europe (Salet and Thornley 2003), and also, in the US, in Portland, Oregon, and in the Salt Lake City area in Utah.[15]. In such situations, local governance processes not only shape local development conditions and development opportunities. They may also provide beacons which shape how both private developers and the public sector agents work elsewhere, a kind of bottom-up transformation of the 'structures of provision' of property development.

What, then, seem to be key elements of such a governance capacity? One is a capacity that might be called 'structural grasp'. By this I mean the ability to see, in the fine details of localised

[13] See Harvey 1982. In this landmark text, Harvey describes the three circuits through which capital is accumulated in capitalist economies – through exploiting primary resources, through industrial production and through financial systems. He provides a very perceptive account of the crisis-prone nature of each system and the potential for all systems to be in crisis at once.

[14] These are to be found both in areas experiencing growth pressures and in cities where urban regeneration has long been a priority.

[15] For Portland, see Abbott 2001; for Utah, see Briggs 2008.

phenomena, the wider social, environmental, economic and political forces which help to produce such details – to use a metaphor, the ability to 'see the world in a grain of sand'. No urban region is an isolated island and all depend in one way or another on their position within wider economic, social, political and environmental relations. Here David Harvey's analysis of the opportunities for urban regions in a new global economic order may still have value. Rather than merely all competing in a similar 'league', in which most were bound to fail, he suggested that a region could develop its position within the international division of labour or within the spatial division of consumption. Or it could compete for global command functions or to attract funds targeted at redistributing surpluses (Harvey 1985, Chapter 8). The economic story of Britain in the past 20 years can be read as the result of a strategy of competing to become Europe's global financial centre. Portuguese cities have competed to capture European Union structural (redistribution) funds. Many cities in Europe in the 2000s sought to locate themselves on a map of cultural activities and tourist destinations, Harvey's 'spatial division of consumption'. But at the same time, a more localised focus may provide a way forward, centred on promoting the livability and sustainability of urban areas as experienced in the daily lives of people across an urban area. Such a focus could be a way of creating an environment which both limits adverse impacts and generates values which attract wider attention. The instances of Vancouver, in Canada, and Portland, in the US, provide examples where such attention, sustained over 30 years, has created the localities which are now widely appreciated as 'good cities' in which to live, work and visit[16].

Such 'structural grasp', linked to a capacity to see the relation of a specific situation to wider forces, and vice versa (how an evolving world might touch the many and diverse 'grains of sand'), is the essence of strategic thinking. It involves a continual interaction, in thought and in wider discussion, between 'parts' and 'wholes' (see Churchman 1979, Healey 2009). This converts the sociological discussion of the relative importance of structure and agency, and the significance of focusing on the interactions between the two, into an active practice. But this is no abstract conception. Such thinking needs to be fed with a good, detailed understanding of local dynamics, and the way different relations connect all kinds of different 'parts' to different 'wholes'. Just as we need careful work on ecological systems, and on the relations within various parts of the economy – the financial services, the wine industry, the logistics of the retail sector, etc - so too do we need careful work on the relations and practices of the land and property development sector[17].

But there is another aspect of governance capacity which has an important role in supporting strategic efforts to shape land and property development activity so that it contributes to improving urban and regional futures. Strategic power lies not just in control of specific organisations and formal instruments of government. It is sustained also by what is lodged in the culture of a political community. In England, too much sprawling development across our valued 'countryside' is always going to be resisted. The idea that urban development should be 'contained' within defined areas is not just some planning idea imposed on the country at large. The idea reflects and gets its power

[16] I use these examples in my own forthcoming book, which draws on experiences where planning ideas and practices are judged to have brought significant benefits to the quality of urban life, see Healey 2010.

[17] Although there has been a steady stream of 'institutionalist' work on land and property development activity, particularly centred around David Adams in the UK, Barrie Needham, in the Netherlands, and at the Politecnico di Torino, in Italy, there has been surprising little academic work on the land and property development sector, particularly from a more economic and sociological point of view.

from its resonance with deep cultural values. In England, attitudes to the rural landscape are tied into conceptions of national identity and cultural value. This also provides a strong basis for support for a wider environmental agenda.

But such values do not just shape the principles expressed in planning systems and practices. The relations between cultural values and those embedded in planning activity are not just a one-way street. Struggles in and around the practices of a planning system can also help to develop and focus the values of a political community. The stories of the development of Vancouver and Portland demonstrate this well. They show how, over time, discussion and debate about how to shape neighbourhood change and how to manage urban growth slowly changed urban political cultures so that new understandings about the important qualities of both cities were generated. These in turn shaped how development industry actors thought about what projects to promote and the parameters within which they should be negotiated. The 'culture' as well as the laws and the work of municipal planners and other agencies framed the institutional context within which local land and property development 'markets' worked. This 'culture' generated expectations not only about what development should look like and how its impacts should be managed. It also shaped the development process itself, and in particular, the way that residents, other specific stakeholders, and citizens at large were expected to have a voice in shaping what happened in 'their' city.

The academic contribution

In the last quarter of the 20th Century, the dominant interpretation of the relation between state and market has been that the inertia and inefficiency of overly bureaucratic states has held back market innovation, and hence impeded economic growth. This encouraged all kinds of initiatives which contributed to the fragmentation and destabilisation of urban and regional governance institutions across Europe. The crisis of the late 2000s has brought back into a sharp focus the need for effective governance capacity, in order to help stabilise markets, creating sufficient certainty and direction to breathe life back into them. This is particularly important for land and property development markets, which are so prone to 'market failure'. What can urban analysts and planning academics contribute to this re-thinking of the relation of state/market relations at the present time?

One contribution lies in our role as scholars and researchers. Through research, we can help to expand the knowledge base available to our political communities and to enhance the 'intelligence' of democratic debate[18]. We do this as part of our job description, but it would be particularly helpful to have more work on land and property development dynamics, focusing on the institutional relations of the sector. This demands careful, well-grounded empirical research which gets underneath the persuasive rhetoric and the aggressive language of dispute which often colours the reporting of development issues. We also need to develop skills in conveying this understanding to the different members of our political communities. Second, we often act as consultants to various actors involved in local land and property development processes. As we engage in such work, it would be valuable at the present time if we also thought about the contribution we inevitably make both to generating the 'intelligence' of our political community and to building governance capacity to manage markets

[18] I make reference here to the pragmatist argument for cultivating the capacity for 'intelligent debate', as a basis for a richly democratic polity, Dewey 1927.

into the future. Finally, we also play an important role as activists and 'public intellectuals', promoting some issues into the public realm. Here we need to pay careful attention to how our interventions affect the way issues are understood and discussed.

In other words, as academics we are not on the sidelines of these difficult and unstable times in our work as researchers, consultants, activists and public intellectuals. We are deeply involved in shaping governance capacity in our localities, and need to think carefully about the social, political and moral dilemmas such involvements generate for us. In conclusion, perhaps the key message we can offer our polities at the present period is to encourage other actors to use the perceptions of instability and crisis in a strategic way, as an opportunity to take stock, to re-think policies, projects and practices, and to build the intelligence and coalitions which could bring future benefits for the many not just the few in our localities.

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Research Projects

MOPUS – Mobility Patterns and Urban Structure

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Several authors argue that the sustainable development of urban mobility needs a holistic approach. The need to integrate land use and transport policies has been widely recognised as a more effective approach to meeting new mobility requirements, than traditional transport planning. Nevertheless these integrated policies have seldom seen turning into practice. Furthermore, policies dealing with personal behaviour and choice and taking into consideration socio-economic and demographic conditions are also being increasingly suggested. This research project is based on two previous research projects concerned with complementary factors and motivations underlying urban passenger mobility patterns. One of these research projects, carried out in the Research Centre for Territory, Transport and Environment (CITTA), is focused on the concept of 'Structural Accessibility' and has been applied to the Metropolitan Area of Oporto. This methodology, the Structural Accessibility Layer (SAL), is designed to reveal the potentials of land use and transport systems to provide the necessary conditions (although not necessarily sufficient) for sustainable mobility. It is also able to provide a design-support tool for sustainable mobility policies. The other research project developed a comprehensive study of urban structure and travel behaviour and has recently been applied to the Copenhagen Metropolitan Area. The aim of this methodology (the Aalborg University Methodology), focusing on behavioural aspects, is to identify the overall relationships as well as the more detailed mechanisms through which the location of residence influence travel behaviour. It goes into the complex relationships between urban land use and travel, including a comprehensive analysis of socioeconomic as well as of attitudinal characteristics of travellers. The possibility to combine these two complementary research methodologies is the distinctive and innovative contribution of this project. This combination will involve the application of the SAL to the Copenhagen metropolitan area and the application of the Aalborg University methodology to the Oporto Metropolitan Area. In this way, the structural and behavioural aspects of mobility patterns will be analysed and compared in both case studies. In addition, this project is expected to provide clear evidence of the real importance of different metropolitan structures, since the Metropolitan Area of Oporto clearly is a polycentric urban structure, whereas the Metropolitan Area of Copenhagen is very much a typical monocentric metropolis.

Keywords: Mobility Policies, Accessibility, Urban Structure, Sustainable Metropolis.

1 Introduction

In recent years, mobility patterns have undergone significant changes. The escalating use of the private car for the satisfaction of ever-growing travel needs has, among other factors, contributed to undermine the quality of life, as well as the economic competitiveness and the overall sustainability of metropolitan areas. It is, therefore, important to address our increasing travel needs within the framework of sustainable development. The choice of urban mobility policies can no longer be solely directed towards fighting the effects of current travel patterns. A broad understanding of the aspects influencing travel behaviour is crucial for the definition of effective mobility policies.

The 'predict and provide' paradigm of traditional transport planning is clearly inadequate for the management of current mobility needs. Within the new 'predict and prevent' paradigm, urban mobility management policies are facing new challenges. In this respect, the EC has identified the

following two main requirements: reduction of travel needs and making remaining travel more sustainable. However, these requirements go well beyond the normal scope of transport planning. Several authors argue that the sustainable development of urban mobility needs a holistic approach. The need to integrate land use and transport policies has been widely recognised as a more effective approach to meeting these new mobility requirements, than traditional transport planning. Nevertheless these integrated policies have seldom seen turning into practice. Furthermore, policies dealing with personal behaviour and choice and taking into consideration socio-economic and demographic conditions are also being increasingly suggested.

This research project is based on two previous research projects concerned with complementary factors and motivations underlying urban passenger mobility patterns. One of these research projects, carried out in the Research Centre for Territory, Transport and Environment (CITTA), is focused on the concept of 'structural accessibility' within urban metropolitan areas. This approach considers only structural factors, i.e. factors related to the land use and the transport system, and has been applied to the Metropolitan Area of Oporto. This methodology, the Structural Accessibility Layer (SAL), is designed to reveal the potentials of land use and transport systems to provide the necessary conditions (although not necessarily sufficient) for sustainable mobility; it is also able to provide a design-support tool for sustainable mobility policies.

The other research project developed a comprehensive study of urban structure and travel behaviour, the Aalborg University Methodology, and has recently been applied to the Copenhagen Metropolitan Area. The aim of this methodology, focusing on behavioural aspects, is to identify the overall relationships as well as the more detailed mechanisms through which the location of residence influence travel behaviour. In important ways the Copenhagen Metropolitan Area study goes beyond the scope of previous investigations into the complex relationships between urban and use and travel, including a comprehensive analysis of socioeconomic as well as of attitudinal characteristics of travellers.

The possibility to combine these two complementary research methodologies is the distinctive and innovative contribution of this proposal. This combination will involve the application of the SAL to the Copenhagen metropolitan area and the application of the Aalborg Univeristy methodology to the Oporto Metropolitan Area. In this way, the structural and behavioural aspects of mobility patterns will be analysed and compared in both case studies, taking advantage of the previous work already carried out in both sides. In addition, and despite the significant differences between the social and economic characteristics of the metropolitan areas of Oporto and Copenhagen (although fairly similar in area and population size) this project is expected to provide clear evidence of the real importance of different metropolitan structures, since the Metropolitan Area of Oporto clearly is a polycentric urban structure, whereas the Metropolitan Area of Copenhagen is very much a typical monocentric metropolis.

2 Objectives

The principal objective of MOPUS is to assess the influence of alternative urban structures of metropolitan areas on sustainable mobility, comparing, in particular, one monocentric and one polycentric structure.

The operational and secondary objectives are as follow:

- to provide a deeper understanding of the relationship between urban structure and travel behaviour;
- to assess the accessibility potential of urban structures;
- to typify the relationships between travel behaviour and potential accessibility;
- to develop social profile and area based targeted policies to enhance sustainable mobility patterns in the metropolitan areas of Oporto and Copenhagen;
- to recommend integrated land use and transport strategies tailored to the specific physical and functional characteristics of these two metropolitan areas;
- to promote and generalize the combined application of structural and behavioural methodological approaches in mobility studies.

3 State of the Art

There has been a growing consensus on the need for policy measures to strive for sustainability of urban mobility patterns. To make these actions efficient, policy measures must act on the factors influencing travel patterns and not simply on their symptoms. Therefore, a thorough understanding of the reasons underlying trip-making is needed (e.g. Kitamura et al., 1997; Handy, 1996).

Travel has been rising, presenting more complex patterns and becoming more difficult to predict. The research fields concerned with the study of the factors and motivations underlying travel behaviour have also become increasingly complex, taking into consideration an ever growing number of aspects. This research field is vast but somehow disarticulated, lacking a systematic a methodological approach, as well as, in most cases, a genuine concern on its applicability to policy making. Land use, transports and individual aspects are generally considered part of the most important factors influencing travel behaviour.

Most publications studying factors influencing travel behaviour are individual case studies evaluating the influence of land use. Many of these case studies reach different results and conclusions (for broad literature reviews on this subject see, for instance, Handy, 1996; Ewing & Cervero, 2001; Wee, 2002). The volume of literature on how land-use patterns and built environment influence urban travel demand has exploded over the past decade (Cervero, 2002). It is fair to say that most authors believe that land use has an influence on travel behaviour (e.g. Handy, 1996; Cervero & Kochelman, 1997; Ewing & Cervero, 2001; Wee, 2002) although many are sceptical about the influencing factors so far, because research methodologies do not seem solid enough. Indeed, many case studies have not produced conclusive results reinforcing the scepticism of the influence of land use on travel choice. Besides case studies and literature reviews, considerably less research was found on land use policy implications and recommendations. Furthermore, in spite of the extensive research on the land use factors influencing travel behaviour no general consensus has been reached on this matter. This is also the case for the research on the influence of transports or individual factors on travel behaviour.

In the bibliography relating travel behaviour to individual characteristics a wide range of study themes can be found. The research in this field can be broadly categorized as focussing on lifestyle and on lifecycle, as the main individual determinants of travel behaviour. Lifecycle refers to socio-

economic and demographic characteristics while lifestyle is generally considered as the aspect bringing differentiation to travel decision within similar lifecycle characteristics. Lifestyle research is mainly concentrated on motivational factors (of a psychological nature). Examples of motivational factors which can be found in this research field are, for instance, preferences (Scheiner & Kasper, 2002), value orientation (Scheiner & Kasper, 2002), need and desires, and symbolic affective motives (Steg et al., 2001), habits (Fujii & Kitamura, 2003), beliefs and attitudes (Fujii & Kitamura, 2003). Wen and Koppelman (2000) and Lyons et al. (2002) are only two among many other authors researching the influence of lifecycle characteristics on travel behaviour, such as age, gender, household size, etc. Case studies evaluating the influence of transports factors on travel behaviour are difficult to find. This research field seems to consider this influence as a matter of fact since it mostly concentrates on the formulation of policy measures. Within this research field, most studies evaluated attitudes towards and/or the effect of TDM measures or simply presented TDM measures and their categorization (for example, Marshal and Banister, 1997; Viegas, 2001). Although the influence of transport systems on travel behaviour is clear and therefore might be dispensed from further consideration, the lack of research on the main factors responsible for that influence is one of the main flaws within this research area, especially knowing the void this lack of understanding represents for policy making.

In spite of the amount of research centred on the factors influencing travel behaviour no consensus can be found in the literature indicating the need for further research.

In this context, the MOPUS project intends to have an effective contribution to arrive at a consensus on the factors influencing travel behaviour, being concerned with both the influence of urban structure factors (namely land use and transport system factors) and motivational factors related to the social, economic and cultural characteristics of the individual traveller.

4 Tasks

Task 1. Literature review

Expected results

- Carry out a comprehensive review of the literature;
- Maintain bibliographical search updated and disseminate new contributions;
- Keep the different members of the research team aware of the current scientific production in all relevant fields related to MOPUS.

Task description

Maintain our bibliographical database updated requires the establishment of a routine of weekly visits to our library and to web based search facilities. The first paper to be produced is expected to include a thorough revision of the literature.

Task 2. Methodological approach

Expected results

To arrive at a solid methodological proposal, based on extensive field work and desk research, and designed to address and put together the most relevant structural and behavioural factors that will be able to provide a satisfactory explanation of the mobility patterns in metropolitan areas.

Task description

The success of the MOPUS project depends very much on the initial effort to adjust and make compatible the Structural Accessibility Layer that is based on the analysis of structural factors and was applied to Oporto, and the Aalborg University methodology that emphasises the behavioural determinants of mobility patterns and was applied to Copenhagen. To combine these methodologies into one coherent methodology is the first challenge the team have to face. Likely adjustments are not only needed to ensure the internal coherence of the whole methodological package, but are also needed because although the statistical and cartographic databases (part already available) for the two metropolitan areas - Oporto and Copenhagen – are similar, they are not identical.

Task 3. Collection of data and field work

Expected results

Preparation of all raw databases (statistical, cartographic) to characterise the patterns of mobility in the two case studies areas, the metropolitan areas of Oporto and Copenhagen.

Matrix presentation of the raw results of the social survey and of questionnaires and travel diaries.

Task description

For the Oporto case study this task will involve:

- to prepare and carry out a social survey designed to characterize the mobility attitudes and behaviours of the resident population (metropolitan area of Oporto);
- to prepare, distribute and control the use of travel diaries in selected families;
- to prepare and carry out a series of interviews to selected families to understand the real motivations of travel patterns.

The choice of the social profile and of the residential location of these families will be based on a typology of area units characterised by contrasting values of our indicator of accessibility potential (already available).

For the Copenhagen case study this task will involve:

- the assembly of all the cartographic and statistical information needed to produce a map of the mobility potential for each and every area unit in which the whole metropolitan area is divided (the smaller statistical area unit).

It is important to emphasise that the tasks assigned to the Oporto case study have already been carried out for the Copenhagen case, and that the results are available (and indeed already published). Similarly, the tasks assigned to the Copenhagen case study have already been undertaken for the Oporto case.

Task 4. Qualitative, quantitative and geographic analysis

Expected results

This task is expected to produce a comprehensive matrix of results. Three types of analysis will be developed: quantitative analysis; qualitative analysis; geographic analysis.

Task description
This task involves:
- quantitative analysis - statistical and multivariate analysis will be used to find what are the most influential factors determining mobility patterns in the two study areas
- qualitative analysis - combining data from the social survey, the families´ questionnaires and the travel diaries (the Copenhagen case will be quite useful to provide a general orientation on the ways of exploring the data and information collected)
- geographical analysis - our GIS on the Metropolitan Area of Oporto will be expanded to include in a similar format the data from the metropolitan area of Copenhagen.

Task 5. Findings and conclusions
Expected results
The results of this task are expected to match the following objectives of MOPUS:
- to assess the influence of alternative urban structures of metropolitan areas on sustainable mobility, comparing, in particular, one monocentric and one polycentric structure;
- to provide a deeper understanding of the relationship between urban structure and travel behaviour;
- to assess the accessibility potential of urban structures;
- to typify the relationships between travel behaviour and potential accessibility;
- to develop social profile and area based targeted policies to enhance sustainable mobility patterns in the metropolitan areas of Oporto and Copenhagen;
- to recommend integrated land use and transport strategies tailored to the specific physical and functional characteristics of these two metropolitan areas;
- to promote and generalize the combined application of structural and behavioural methodological approaches in mobility studies.

This task involves an important synthesis effort given the large amount of data and information that is expected to be collected and analysed, and added to the information that is already available for the two case studies. As we emphasised before, previous studies of the two metropolitan areas (carried out from two complementary perspectives) constitute an essential input to this project. The preparation of the main findings and conclusions requires open discussions involving all the members of the team and the external consultant, considering first and separately the two case study areas and, in a subsequent stage, the confrontation of the two cases, finding out the main differences and commonalities.

Task 6. Reporting and dissemination
Expected results
As far as we can anticipate, the audience of this project is likely to come from the academic world. However we would also like to make an impact on local decision makers and practitioners in both

metropolitan areas. In the case of Portugal, and of the metropolitan area of Oporto, the Metropolitan Junta, the Municipal Authorities, the public transport companies and the new Metropolitan Transport Authority will surely be important end users of our findings and recommendations.

Task description

Two reports will be produced; the first by the end of the first year and the second and final with the end of the project. Of course this final report will be most important and, in practice, the basis of the book the team intends to publish. In addition, 3 papers will be prepared throughout the time period of this research.

Dissemination will involve the initial preparation of a website of the project and the organization of a final international conference.

5 Expected Results

MOPUS will be able to compare the mobility patterns of two important European metropolitan areas with contrasting internal structures — one typically monocentric (Copenhagen) and the other typically polycentric (Oporto). This exercise will be most important to support the formulation of planning and transport policies to guide metropolitan areas along a more sustainable path of development, and may come at a time of an important step forward in the establishment of the Portuguese Metropolitan Transport Authorities.

The project will:

- asses the influence of alternative urban structures of metropolitan areas on sustainable mobility, comparing, in particular, one monocentric and one polycentric structure;
- provide a deeper understanding of the relationship between urban structure and travel behaviour;
- assess the accessibility potential of urban structures;
- typify the relationships between travel behaviour and potential accessibility;
- develop social profile and area based targeted policies to enhance sustainable mobility patterns in the metropolitan areas of Oporto and Copenhagen;
- recommend integrated land use and transport strategies taylored to the specific physical and functional characteristics of these two metropolitan areas;
- promote and generalize the combined application of structural and behavioural methodological approaches in mobility studies.

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SUME, Sustainable Urban Metabolism for Europe

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The concept of urban metabolism helps to understand and analyze the way how societies – partly located in urban areas - use resources, energy and land, all elements of the environmental system, for maintaining and reproducing themselves. Urban systems are a specific form of organizing societies, namely a concentration of economic, reproductive and distributive functions in certain locations, while using and exchanging resources from much larger areas, especially in a global economy context. The way cities and urban areas are being built – in spa tial terms and also in technological terms – is gre atly influencing the quantities and qualities of resources being used in maintaining urban life. The quantities and the qualities of this exchange with the environmental system – the extraction of specific resource s and sources of energy as well as the return of waste and exhaust to the environmental system – is increasingly damaging. Future developmental trends, particularly at global scale, show that societal development is running a high risk, using up resources and unbalancing the environmental system, at least in some regions of the world. The research project SUME, Sustainable Urban Metabolism for Europe, is about how future urban systems can be designed in a way which is consistently less damaging to the environment than the current status. Urban development includes processes of growth in new areas, decay and abandonment and also restructuring and rehabilitation in parallel. In a historical perspective, the varying weight and speed of these alternate components of urban development is characterizing some of the differences between cities regarding land use, resource and energy consumption. The driving forces behind these dynamic processes are demographic change, the individual performance of urban areas in (global) economic competition, the speed and direction of applying technological innovations under various societal/political conditions. While the dynamics of urban development in these components have been studied and debated for a long time, the interrelation between urban development and urban metabolism in the sense of physical interaction with the environment is far less understood. It is the main challenge of this project to find a sound strategy to link the urban metabolism approach to urban development concepts in a way helpful to foster a more sustainable development path of urban areas in the future.

Keywords: Urban metabolism, sustainable development, urban development, urban systems.

1 Introduction

While demographic growth in European cities is rather moderate and mainly due to migration, the most significant factors effecting urban spatial growth are the growing number of smaller households and the increasing space consumption by households, business units and transportation infrastructures. Today these dynamics extend far beyond urban centres and heavily affect rural areas. While this drive for spatial expansion continues even in demographically stagnant areas, the environmental consequences and the potential economic and societal risks of such a growth pattern give reason to substantial concern. This is of particular relevance to countries, where in recent years a rapid urbanization coincided with a massive jump in economic and technological development, such as China or India.

Present patterns of resource and energy consumption are associated to three main factors, namely: the physical and technological qualities of buildings, the urban (spatial) structures – together forming the built environment - and the consumer lifestyles, greatly depending on the level of economic development. If these flows and consumption patterns can be transformed to quantitative levels and to qualities less damaging to the ecological system, the long-term sustainability of urban systems can be improved. In a global view, the challenge to make urban systems more sustainable

can be seen as absolutely vital.

SUME will analyse the potential to transform existing urban built environment (buildings and spatial structures) in order to significantly reduce the impact on resource/ energy consumption. Based on the urban metabolism approach, the flows of resources, energy and waste are being used to maintain the urban system. The built environment, in a systems logic the stocks of the urban system, is using a substantial portion of flows to be built and – on the other hand – in the way it is being built has a great impact on the quantities and the qualities of flows needed to maintain the urban system over time. The SUME approach will analyse the technological and spatial qualities of built urban systems (the stocks), and analyse the impacts of these “urban forms” on the qualities and quantities of resources needed and maintain them. Based on this analysis it will be shown what kind of urban forms and which built structures can be used in order to reduce resource and energy consumption in urban systems. The second question is setting the first question in a dynamic perspective, dealing with the ways to transform existing urban structures and create potential future structures. Depending on the varying rates of growth in urban systems, the rates of adding new and replacing existing buildings also differ widely. From a strategic point of view, it will be necessary to know, if these rates should be increased in order to reach improved urban forms and structures faster. Based on the theoretical and methodological framework of an industrial ecology approach focused on urban metabolism, the potential to transform the spatial fabric of European urban systems (and beyond) towards sustainability will be assessed. Connecting the approaches of urban metabolism and urban planning will address the future physical dimension of urban development, including structural changes in existing urban, peri-urban and interlinked rural areas.

A number of theoretical and empirical studies will be analysed in order to identify key issues for a future transformation strategy. Some explorative studies from different types of urban regions will contribute to the development of concrete models of future urban structures, which will – hopefully – demonstrate a significantly better performance in the use of natural resources in a wider sense. It will be essential to develop a better understanding of how urban structures should be rebuilt in order to develop new, “metabolic” strategies for ur ban planning, infrastructure development and transportation policies.

Based on such strategies to transform the existing urban system, it will be considered, how regulatory frameworks and incentives can guide actors and individual behaviour, contribute to the improving of technological standards in relevant aspects. Tools and instruments, influencing relevant flows and patterns of resource consumption will be examined. By including the experience of exploratory studies in various urban settings, implementation requirements for tools and instruments will also be checked.

SUME will thus enhance Europe’s competitiveness in a wider sense and in a sustainable way. It will create approaches and point to ways how future urban development can be de-coupled from negative environmental and social effects while allowing for economic development. The project´s findings will be disseminated to urban regions’ stakeholders, such as urban planners, infrastructure developers and social networks, and to policy makers, thus contributing to sustainable urban development throughout Europe. Since the whole design of the research project is oriented on producing innovative future urban development models, strategies and guidance for policy

implementation, a substantial support of the EU Thematic Strategies on the urban environment, sustainable use of resources and the prevention and recycling of waste will be prepared through the SUME project.

2 Objectives

The main objective of the SUME approach is to make the concept of urban metabolism truly operational in a planning and policy-making context. Each work-package has secondary objectives described as follow.

The main objectives of WP1 are: to identify and analyse urban development trends with relevance to the urban metabolism approach, to analyse and identify urban fabrics in relation to urban metabolism; to develop typologies of urban fabrics and urban development trends, to define urban development scenarios, to evaluate outcomes of scenarios, to demonstrate the developmental typology in relevant empirical settings (cases), to draw conceptual and methodological conclusions with respect to urban development trends seen from an urban metabolism viewpoint, to identify and describe research requirements in the metabolism field, and to show application potential in urban planning and urban development professions.

The overall objective of work package 2 is to establish links between urban planning and urban metabolism assessment at both a conceptual and an empirical level. This requires: screening of information and data, both quantitative and qualitative, from urban planning with regard to its possible use for an empirical description of the urban metabolism (including historical and scenario analysis); screening of the criteria that are regularly used in urban planning with respect to the representation of metabolic considerations in existing planning practices; identifying those resource flows that are relevant environmentally and can be addressed by urban planning; advancing the urban metabolism approach from a mere flows model to an integrated stocks and flows model, with a particular focus on the determination future resources flows through present urban planning decisions (housing, infrastructure etc.); developing a formal model with spatially explicit metabolic profiles for a hypothetical city which can be used in scenario analysis, including the simulation of alternative planning decisions; considering direct and indirect flows, as far as possible given the existing limitations with regard to the availability of data and suitable methods.

The main objective of WP3 is the assessment of different types of urban structures and their impact on urban metabolisms through innovative and integrated approaches. The definition of an evaluation framework will be explored in order to contribute with instruments/tools for analysing these urban structures. More specifically, this work package will cross the outputs of WP1 and WP2. The analysis of the dynamics of urban development in Europe, carried out in WP1, will provide typologies of urban fabrics and possible urban development scenarios. The debate around the urban metabolism concept, from WP2, will provide the criteria for the definition of the adequate methodological approach relating to urban fabrics. WP3 will, then, focus on the assessment of the typologies of urban fabrics through an urban metabolism perspective. Additionally, assessment will be applied to illustrative cases. We are also expected to arrive at a set of preferred models that should prove to offer the best metabolic performances. This WP will include important findings on how to evaluate different types of urban patterns and structures and which policies, instruments and

tools are most adequate to change our cities and metropolis in order to promote a more sustainable urban metabolism.

WP4 aims to provide a deeper understanding of the ways in which institutional, policy and behavioural contexts can help or hinder the optimisation of resource use in European urban areas. Based on such understanding, it aims to develop integrated policy options, implementation tools, and a transferability guide for implementing the concepts and frameworks that are developed in the project in order to optimize the use of resources for accommodating future urban development. The emphasis will be not only on the use of regulatory measures but also on mechanisms for mobilization and motivation of sustainable behavior. WP4 will therefore focus on the relevant actors including institutions and their strategies and behaviour.

3 State of the Art

One of the major opportunities for scientific innovation lies in the close cooperation of different fields of research, development and consulting, particularly if focused on a joint research objective.

In this case, the cooperation of the fields of societal metabolism, urban planning, infrastructure planning and policy studies is in itself challenging. Since research and development activities in this project will reach from basic research with science and engineering backgrounds (as in modeling of urban metabolisms), to qualitative methods (scenario-building), applied quantitative methods (impact assessment) to social science methods of evaluating policy impacts, the range of approaches to the theme is wide open. Thus, a substantial innovative quality will lie in the bridging of these approaches and finding answers to questions from different research fields. Keeping this challenge in mind, the work approach in this project will be interactive in a highly structured way, with a rhythm of inputs and outputs interrelated towards the building of a joint perspective, focusing on the common set of research questions as outlined in this proposal. A sequence of jointly designed and prepared Interface Workshops, with participants from all partners will therefore build the backbone of inter- and trans-disciplinary work from the beginning. A well designed synthesis phase in the final stage of the project shall deepen this jointly designed approach and highlight the future research and development efforts necessary in the various fields of research involved. This, it is hoped, will give a fruitful impulse and contribute to bridging the gaps in currently little related research fields.

Urban metabolism in urban development: a dynamic perspective

Urban growth dynamics are a well-known topic in urban and regional research, but at the same time the complexity of these tasks leads to a highly specialised research field and fragmented professional disciplines. However, some agree that the urban scope is transforming into a multi-centred form at metropolitan scale and that this is not just a matter of spatial form, but is also being reflected in social, economic and cultural processes (Salet & Mustered 2003). While this process is sometimes being featured as the transformation from a city to an urban region, today the effects go far beyond the urban and suburban scale.

There are various drivers for urbanizing dynamics: In some regions of the world, the pure demographic development is the decisive force for urban expansion. In the European context, currently urbanization and urban growth are rather driven by other factors than the increase of

population:

Economic reorganisation and the emergence of functional networks in the internationalization of “space of flows” (Castells 1999) lead to the proliferation of new polycentric spatial structures, with cities at their nodes. Tertiarisation and a demand-driven economy are raising the demand for office space. Moreover, in the specific case of cities of former Eastern Block countries, a “delayed suburbanisation” is taking place. Consequently, the ongoing space consumption has considerable impacts on the urban and suburban region as well as the rural hinterlands of European cities.

With regard to the physical aspect of this development, urbanizing trends in some European cases may be regarded as a process of spatial de-concentration from cities (population, businesses and amenities) into the surrounding rural areas. This either leads to a decentralized concentration and the emergence of a polycentric urban region or it takes a rather dispersed form as urban sprawl (Davoudi, 2003). In recent years European research has made considerable progress in observing and monitoring land use changes (i.e. CORINE, MOLAND, GEOLAND, TISSUE).

In the SUME research concept it will be asked, how these current spatial trends can be evaluated from a metabolic approach and what the future options for urban development from a metabolic perspective can be. These options will be dealt with from two main dimensions – one is dealing with the spatial form of future urban developments, especially with respect to transport needs and creating opportunities to find less resource intensive ways of exchanging people and goods in urban systems. The other option is referring to the way, cities are being built from a technological viewpoint, particularly considering the materials being used, the levels of energy consumption, and the levels of land consumption as a specific resource from the environmental system. With the SUME approach, there will be an effort to estimate the urban transformation potential with scenarios of the urban development for Europe, with particular emphasis on the effect these potential strategies will have on the environmental system, based on the metabolism approach.

Modelling urban metabolism in a spatially explicit way

Progress beyond the state of the art will be achieved by developing a model that has the following features:

It should assess relevant aspects of typical urban metabolic dynamics in a medium time perspective, app. 30 years back and forth.

It should exemplarily implement the non-linear interactions between physical stocks (infrastructure, buildings, etc.) and flows (energy and material used to reproduce and maintain the stocks). This is in itself a major innovation as all published urban metabolism studies are considering only flows.

It should be spatially explicit, i.e. go beyond the currently used black box models.

The model should be able to simulate the consequences of different urban planning options in terms of future metabolic requirements (based on typical metabolic rates, which have to be identified yet). In this context especially, the integration of an agent-based approach is of particular importance. Meso-scale urban spatial patterns can be simulated as to how they are also the result of processes concerning and the behaviour of micro-scale actors (Epstein and Axtell 1996; Axelrod 1997; Brown and Robinson 2006). For the proposed project it will be instrumental to recognize that urbane

planners are but one relevant actor determining the metabolism of a city. Thus other actors, such as households or firms will be included.

Results from analyses of a variety of processes such as land use (Berger 2004), material and energy flows, or time use can be integrated using this type of approach and effects of different urban planning strategies on infrastructure requirements, material and energy flows, settlement patterns, economic development and other relevant features of cities can be simulated. This supports the evaluation of future options and planning strategies.

Various software tools (e.g. Repast, NetLogo, Anylogic) exist that allow the simulation of non linear interactions and provide spatially explicit modelling features. In particular Anylogic supports agent based modeling as well as system dynamic modeling and has a variety of visualisation features integrated. The experience with Anylogic shows, that this tool is very flexible and can easily be adapted for different simulation settings and contexts.

To date, the issue of stocks in urban metabolism has hardly more than marginal attention. In a case study for the city of Vienna, metal stocks are mentioned as potential future resources and as sources of diffuse emissions. It is further suggested that changes in stocks might serve as an early warning for future (environmental) problems (Hendriks et al. 2000).

The most advanced attempt to develop a spatially explicit urban metabolism model that integrates the dynamic between stocks and flows as well can be found in Japan (Tanikawa 1999, 2005). This ongoing research uses GIS to integrate spatial information into the analyses of material flows for whole cities. Obviously this can be highly beneficial for the assessment of urban metabolism. It has to be noted though that the above quoted work is extremely data intensive, and by this also labour intensive. In addition such high-resolution GIS representations of the stocks and flows dynamics of a city require statistical data that are hardly available for European cities.

Developing methods to assess the impact of urban forms and structures on the use of resources and energy

As SUME's general methodological approach emphasises, the design of planning policies for more efficient urban metabolisms has to be supported on a thorough understanding of the nature, diversity and changing dynamics of Europe's urban and peri-urban territories, and on our capacity to forecast and explore the whole range of the potentials and limitations of future urban scenarios. A variety of assessment instruments, geared towards the evaluation of resource uses and environmental impact and operating at different and complementary spatial scales, is needed.

Throughout the last decade, assessment theory and practice has clearly been at the centre of the planning debate (see, for instance, Khakee 1998, 2003; Faludi, 2000, 2006; Voogd, 2001; Lichfield, 2001, 2003; Alexander 2006a, 2006b). However, these debate did not always include matters related to the overall environmental efficiency of cities, as the urban metabolism school points out. And yet we are condemned to prepare a sustainable future for Europe, based on an ecologically balanced environment, on a competitive economy and on a just and cohesive society.

One of the first tasks included in this WP is the critical review of the main evaluation methodologies developed since the emergence of Cost-Benefit Analysis back in the 1950s. We have to stress that this critical review will be strictly concerned with the search for relevant assessment

principles and ideas that, in a later stage of this project, may prove useful in the design process of our own methodological approach. The Planning Balance Sheet Analysis (Lichfield, 1956) and the Community Impact Evaluation (Lichfield, 1988, 1996), the Goals- Achievement Matrix (Hill, 1968), the Multicriteria Analysis (Voogd, 1983; Nijkamp et al, 1990), the Environmental Impact Assessment/EIA (Glasson & al., 2004), and the Strategic Environmental Assessment/SEA (Therivel et al, 1992), are some of the most important methodologies that will be revisited and debated. In addition to these eight ex-ante and somehow utilitarian methodologies (Alexander, 2006c), other approaches, namely the Policy-Plan/Programme Implementation-Process (Alexander and Faludi, 1989) and the Plan Implementation Methodology (Laurian et al, 2004; Berke 2006, and also Brody et al, 2006a, 2006b), should be discussed. These approaches have an important role in bridging the gap between evaluation theory and practice. Nevertheless, some of these approaches tend to ignore considerations related to equity and sustainability (Lichfield et al., 1975; Lichfield, 1996; Alexander, 2006a; Moroni, 2006). In contrast, the more recent SEA is an instrument of impact evaluation, geared towards the evaluation of policies, plans and programmes. It works with strategies and not on specific development proposals, operating on larger temporal and geographical scales, with growing uncertainty levels and, thus, requiring greater methodological flexibility (Partidário, 2003).

Potentials and limitations will be identified and, in particular, new areas of cross fertilization with the industrial ecology perspective will be explored. Under this perspective, an innovative methodological approach – the metabolic impact analysis – will be developed, tested and applied to a number of illustrative cases. The foundation principles of this approach will be supplied by the work carried out by our WP2 colleagues on the urban metabolism concept.

Other influential principles will be derived from recently developed assessment methodologies such as the Sustainability Impact Assessment (see Kirkpatrick, et. al., 1999), the Ecological Footprint Analysis, based on the pioneering working of Rees (1992) and Wackernagel, et. al. (1996) and the Low Carbon City approach currently developed by COST C23 (2005) as part of a technical and scientific cooperation action funded by the EU (see also Frame & Vale, 2006).

Present spatial trends and future development scenarios of the main European urban structures, are the evaluation objects of SUME. The challenge for this WP is to develop an innovative evaluation methodology that can truly understand and appraise these scenarios, bearing in mind the operationalization of the concept of urban metabolism.

Understanding the challenge and transforming urban planning policies and urban development strategies

There is an increasing political, public and professional concerns about how best to accommodate new development: its scale, location and consequences for sustainable urban metabolism.

The concern about emerging urban structures (including both expanding and shrinking cities) has grown substantially in the light of increasing evidence on the impact of development on environment and climate change (Breheny, et al, 1993; Owens & Cope, 1992). Influencing urban structures and promoting more sustainable forms of behaviour will require more than single policy instruments. Integrated policy packages, comprising a mix of regulatory, pricing and technological measures will be necessary to achieve change. WP4 will examine the relationships between policies

in order to determine how policies can be combined most effectively so that synergies are maximised and conflicts are minimised.

Parallel to the rising concerns about decoupling urban growth from wasteful use of energy and resources, new forms of institutional relationships are emerging (Grande 1996; Kohler-Koch 1996). Power to shape urban structure is now more diffused, with a large number of stakeholders (including public, private, NGO's, local organizations, interest groups, etc) involved in decision-making processes (Mathur et al., 2003; CEC, 2001). The diversity of institutional structures and relationships mean that same policy (or combination of policies) implemented in different regions or countries with differing institutional conditions might result in very different outcomes due to factors such as the division of responsibilities, the role of the private sector in policy implementation or mechanisms for dealing with cross-cutting issues. WP4 will assess how institutional conditions (not just the policies themselves) can affect the implementation and delivery of policies and the achievement sustainable urban metabolism.

The strict enforcement of laws and regulations for the implementation of policy programmes is steadily giving place to participation procedures and bargaining processes among major stakeholders (Hibbard & Lurie, 2000). Decision-making processes related to the capacity and responsibility to guide the European cities along a more sustainable path has to adapt to the fall of the so called blueprint planning paradigms. The European comparative studies concerning the planning of metropolitan areas (Salet et al., 2003; Kübler & Heinelt, 2005), or the debate around strategic spatial planning and the local integration of public policies (like for example Albrechts et al., 2003; Vigar et al., 2000; Healey et al., 1997; Healey, 2004), show the importance of actors' behaviour and inter-institutional cooperation networks for the achievement of strategic development goals. The design and assessment of development scenarios as alternative futures assumes a particular importance within a collaborative framework (Healey, 1997). Hence, for policies to be effective, they need to be acceptable by key actors (including individuals).

The challenge therefore is to identify how to increase the acceptability of policies through the right balance of incentives (pull measures/carrots) and regulation (push measure/sticks).

4. Methodology and description of workplan

The SUME approach and associated work plan is ranging from the analysis of trends in urban development with respect to impacts on resource use, energy consumption, land consumption and waste/exhaust to advanced modelling of urban metabolisms, impact analysis and alternative models of cities to the formulation of (sustainable) urban development strategies and policies. In order to organise this e extensive research and development effort, SUME is organised along 7 work packages (WP):

- WP 1 Scenarios of urban development: Dynamics of Urban development in Europe
- WP 2 Urban metabolism and resources
- WP 3 Impact of urban forms and structures on resource use
- WP 4 Transforming urban planning policies and strategies
- WP 5 Synthesis and outlook

- WP 6 Dissemination
- WP 7 Project management

WPs 1 to 5 contain research and innovation activities, while dissemination activities are carried out through a special work package running over all 3 years of the project as WP 7, the project management.

In terms of developing the bulk of methodological and empirical innovations, the inter-disciplinary cooperation between the main work packages 1 to 4 has to be secured from the very beginning (see below). WP 5, Synthesis and Outlook, in the last phase of the project, is designed to bring together the results of the individual WPs with the objective of a joint and coherent presentation and discussion with stakeholders and policy makers in a so-called Dialogue Conference (administered within WP 6). Integrating the results from this conference, a research and development outlook will be elaborated in a joint way, with the collaboration of all partners.

WP 1, Dynamics of urban development in Europe, shall provide an insight to the mid-and longterm developmental trends of (predominantly) European cities and their urbanized regions. One output to the other WPs is an *urban form typology*, which is derived from spatial observation and trend analysis, and which is supposed to serves as a structuring element in the other WPs. This typology shall reflect a number of hypotheses about a potential impact of urban forms on the use and flow of resources. The second output shall be an estimate of the urban restructuring rate, based on developmental scenarios which consider different rates of growth (of population, economy etc.) The urban restructuring rate, in the context of this project, can also be called *urban metabolic rate*, meaning the rate of exchange of the existing urban built structures (the stocks in metabolism terminology) over time. The main question here is, at what rate can existing stocks be replaced by more modern, ecology oriented structures under given development scenario assumptions. WP 2, using these projected rates will tackle the question, whether a fast or a rather slow rate of rebuilding our cities is more helpful from a resource optimization viewpoint by a modelling approach. The result of this investigation will be, in turn, used as an input to WP 1 in order to estimate the effects of differing transformation typologies in urban contexts in Europe.

WP 2, Urban metabolism and resources, shall apply the metabolism approach to the urban development context, meaning that space and time will have to be introduced in the modelling. Therefore, it will be most important to *advance* the metabolism concept from a flow to an *integrated stocks and flows-concept*. This means, it is necessary to observe the flows of material and energy being used to feed the urban metabolism, but it is not sufficient. In the long-term perspective, which is appropriate here in the context of building and rebuilding urban structures, it is also essential to look at different qualities of the stocks and their change over time. Different qualities of stocks can be i) the urban form/spatial structures and ii) the material and energetic qualities of the built structures. Changing and modernizing the stocks in spatial and technological terms will be – from an urban development perspective – the way to a future reduction of resource use. From an urban metabolism perspective, it will be also important to analyze, if the resource use for rebuilding and restructuring our cities will be efficient in terms of the resource saved afterwards (or: if the effort to rebuild fast is so high that it surpasses the later saving of resources, using the logic of an cost-benefit-approach applied to the use of resources).

From this perspective, a *typology of urban metabolic profiles* can be developed, which reflect different models of rebuilding/reshaping cities(urban regions, neighbourhoods etc.) from this long-run estimation of effects on resource use.

WP 3, Impact assessment on and of spatial structures, shall show in concrete analyses, how urban form (using the urban form typology derived in WP 1) influences the flow of resources and energy in our urban systems. In analysing the impact of urban form, spatial patterns of movement will have to be developed and the impact on the ways of transporting people and goods will have to be concluded (impact of urban forms on densities and on the modal split).

Following this approach, the impact of various urban forms on the flow of (material, energy) can be demonstrated (including illustrative cases), leading to a *"Metabolic impact analysis"* as an innovation in impact assessment methodologies. Derived from this empirical basis, in a next step methods of optimizing urban forms for existing and for newly built urban structures shall be developed, attempting to show, how metabolically improved cities will have to be built (m*odels of resource optimal urban forms and for the restructuring of existing urban areas).*

WP 4, Urban planning policies and strategies: Shaping actors' behaviour, shall primarily deal with the full understanding of who is currently shaping urban areas, and with what set of interests and incentives as a background. This shall explain, why the future trends of urban development, particularly with respect to the *urban form typology* derived in WP 1, are being produced and shaping urban development in a way which can be described as far from metabolically sound. It shall also deal with the question, if the existing incentive structures for the actors' behaviour tend to prevail in a mid- to long-term perspective and what could bring about changes. One way of finding out is testing the models for alternative, *resource optimal urban form models* derived from WP 3, from the actors' perspective of interests in the given incentive structure. Based on the this analysis, two strategies shall be developed: i) Strategies to influence the set of incentives and rules guiding actors' behaviour and ii) Communication strategies to clearly show to various actors which urban forms shall be achieved, and why.

6 Project deliverables

The major project deliverables are the following:

- Exemplary studies and WP1 conclusions: This report will include the description of identified urban fabrics and development trends and the main results of the urban development scenarios. Furthermore the report will outline the knowledge gained through the exemplary studies of the urban typology in empirical cases.
- Second generation model with an integrated agent based model and research results: After identifying the urban metabolic types, the conceptual and empirical links between metabolic and planning approaches to urban areas, the stocks and related resource flows that are relevant environmentally and can be addressed by urban planning this report outlines the urban metabolism model for a hypothetical city focusing on dynamics between stocks and flows in a spatially explicit way and combining this with agent-based modelling.
- Report on models for metabolically optimal urban forms and restructuring: This report summarises the research results in the field of evaluation methodologies in planning relating to urban form,

focusing on the flows of people, energy and materials, the identified impact of urban form typology and describes the developed metabolic impact analysis. As such, this report is also expected to include an innovative contribution to the set of existing methodologies developed so far for sustainability impact assessment.

- Testing and validation stage: Results of testing the transferability guide, report on success factors for implementing policy packages, policy tools and evaluation frameworks: This report gives a summary about the relevant actors and institutions and relevant strategies and policies. It furthermore describes the identified integrated strategies and policy tools and the potential for new institutional frameworks for new urban development policies to bring about the future metabolically optimal urban forms and urban restructuring strategies.
- Synopsis and synthesis report: This deliverable will outline the combined and integrated research results of WP1 to 4 and will be analysed with regard to future challenges and new strategies and tools for urban development and main policy fields and strategies in order to reduce environmental effects of urban metabolism.

7 Expected Results

Urban development includes processes of growth in new areas, decay and abandonment and also restructuring and rehabilitation in parallel. The weight and speed of these alternate components of urban development is varying strongly between different cities and countries, leading to different patterns of land use, resource and energy consumption.

The SUME project will analyze the potential to transform existing urban built environments (buildings and spatial structures) in order to significantly reduce resource/energy consumption, taking these differences into account. From a strategic point of view, it will be necessary to know whether existing rates of transforming urban structures should be increased in order to improve urban form and to reduce resource use.

The results will provide essential inputs for environmental and spatial policy making, for urban development policies and for transportation policies at both, national and local levels. It will be useful for scientific and practical application.

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Part 2. Planning and Environmental Assessment

Analysing the city

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One of our current projects focuses on the different forms of analysis and prescription in planning, and on the possible advantages of their combined utilization. In recent years we have been exploring three different approaches – a morphogenetic analysis close to the theoretical and methodological proposals of the International Seminar on Urban Form, the syntactical analysis proposed in the end of the 1970s in the University College London, and finally, the Structural Accessibility Layer recently developed in our research centre. This paper describes the origins, developments and main characteristics of these three approaches. In addition it explores the relationships between the first and the second approaches using Oporto as a living laboratory. In particular, it focuses on the link between the concept of 'morphological period' and the range of values for 'integration', both at global and local scales. Finally, our study on the relationships between the second and the third approaches is presented, highlighting the relationships between 'global integration' and 'comparative accessibility'.

Keywords: integrated forms of analysis, urban morphology, urban morphogenesis, space syntax, accessibility models.

1 Introduction

Throughout the last decades the main lines of research being developed within planning theory have somehow been drifting from the fundamental issues of planning practice. In addition the channels of communication between planning and some related fields of knowledge have been weakening. It is our strong believe that planning practice needs new methods of analysis and design of the city that could be integrated in existing or proposed planning frameworks. This paper explores the potential utilization of three methods. The first and the second methods came from the field of urban morphology. The third comes from the interplay between land use and transports planning.

The following section describes the origins, developments, and the main characteristics of these methods. The paper continues with the case study result of these methods for Oporto. Finally, a brief discussion is made on the relationship between the first and second approaches and between the second and third approaches.

2 Different forms of territorial analysis

2.1 Morphological analysis and the International Seminar on Urban Form (ISUF)

The main purpose of the morphogenetic tradition is the reconstruction of the historical development of the physical configurations of urban areas. A large number of different sources of information are generally used, especially the surviving physical fabric and old maps and plans (Whitehand, 1992). Morphogenetic analysis and the study of urban form, in general, have found in ISUF (established in the beginning of the 1990s) a privileged platform for debate.

ISUF gathers a curious balance in terms of schools and traditions. On the one hand, there has been an increasing presence of researchers from new countries in its annual conferences, and of scientific papers on national morphological traditions in its journal, 'Urban Morphology'. On the other hand, there is a clear predominance of its seminal traditions, such as the British historical-

geographical school grounded on the work of Conzen, being mainly developed by the Urban Morphology Research Group/UMRG, and the Italian school of urban morphology and building typology founded by Muratori, being mainly developed by the *Centro Internationale per lo Studio dei Processi Urbani e Territoriali*/CISPUT. For additional information on the former two traditions see Larkham (2006) and Whitehand (2001, 2007) and on the latter see Cataldi (2003) and Cataldi et al. (2002).

A major theoretical aspect of this approach is Conzen's division of the townscape in three main parts: the town plan, the building fabric, and the land use and building utilization (Conzen, 1960). He defines town plan as the topographical arrangement of an urban built-up area in all its man-made features. The town plan contains three distinct complexes of plan elements: streets and their arrangement in a street system; plots and their aggregation in street-blocks; and the block-plans of buildings.

Another important theoretical issue, mainly explored by Conzen, is the conceptualization of historical development. One of these concepts is the morphological region, defined by Conzen (1960), as an area of homogenous urban form in terms of plan type, building type and land use, becoming distinguishable from the surrounding areas. Kropf (1993) links this concept of morphological region with the idea of urban tissue, developed by the Italian school, and proposes the concept of levels of resolution. According to the latter, the physical form of a city can be divided in a number of levels, each forming the basis for analysis to prescription. These levels can range from the whole municipal territory to the different parts of a building.

Another key concept proposed by the German *émigré* geographer is the fringe belt, corresponding to a zone originating from the temporary stationary fringe of a town and composed of a characteristic mixture of land-use units initially seeking peripheral location. When residential urban growth restarts, this area becomes surrounded, but assumes a number of characteristics that are different from the involving urban tissues.

A third fundamental concept is the morphological period, corresponding to the influence exerted by a time period on the urban forms of a particular territory. This idea can be linked to the concept of typological process, developed by the Italian school, in which new building types are viewed as products of a process of learning from the adaptations of previous building types (Whitehand, 2001).

The burgage cycle is another concept proposed by Conzen (1960) and it corresponds to the progressive filling-in with buildings of the backland of burgages terminating in the clearing of buildings and a period of urban fallow prior to the initiation of a redevelopment cycle. Finally, Conzen defines the morphological frame as the set of urban form pre-existences that stand for and that condition, at least in an initial stage, the process of urban development.

2.2 Syntactical analysis

Space Syntax research began in the 1970s in the Unit for Architectural Studies under the coordination of Bill Hillier. Its main purpose in this period was to understand the influence of architectural design on the existing social problems in many housing estates that were being built in the United Kingdom.

Besides an interesting set of papers published during the first years of this research programme – still in the 1970s – two books must be highlighted, The social logic of space (Hillier and Hanson, 1984) and Space is the machine (Hillier, 1996). The first proposes a new theory focused on space as a dimension of social life. Hillier and Hanson (1984) build a conceptual model where the relationships between space and society are analyzed, bearing in mind the social dimension of space patterns, and the spatial dimension of social patterns. These authors propose a method to analyze these space patterns and particularly the articulation between local and global scales. This theoretical and methodological framework is designed to be applied to open urban spaces and to architectural spaces. The second book, Space is the machine, synthesizes the development of this theory throughout the 1980s and the beginning of the 1990s, highlighting its specific features, particularly the configurational and analytical dimensions. This theoretical development corresponded to a wider research on the functional and spatial nature of city and buildings, to the production of software exploring the graphic dimension of space syntax's analytical tools, and to a large number of practical applications within architecture and urban design.

The focus on space and the relationships between space and movement are two fundamental aspects of the space syntax approach. Spatial configuration is also a key concept in this approach, meaning the relationships between two space considering a third one, or more generally, the relationships between space within a system considering all the other spaces in that same system.

The way that spatial relationships within a building or an urban area are represented is another distinctive element of space syntax. This representation is translated into an axial map which is constituted by the least set of axial lines that covers the whole system, in a way that any convex space is crossed by one of those lines (Hillier and Hanson, 1984). The axial line corresponds to the longest line that can be drawn through an arbitrary point in the spatial configuration. A number of topological measures can be extracted from the map to quantify the characteristics of the spatial configuration. Global integration measures the relative depth of each axial line to all other lines of the system. Local integration measures the accessibility up to three steps away. Connectivity measures the degree of intersection or one step possibilities of each axial line. Global intelligibility, expresses the degree of linear correlation between connectivity and global integration, and is defined as the degree to which what we can see and experience from the spaces that make up (or are connected in) the system and what we cannot see - the integration of each space into the system as a whole. Local intelligibility is calculated by the degree of linear correlation between connectivity and local integration. Synergy, expresses the degree of linear correlation between local and global integration, and somehow intends to reduce the influence of the system size. This selection of space syntax measures will be applied in Oporto case study.

2.3 Structural Accessibility Layer

The Structural Accessibility Layer (SAL), proposed by Silva (2008) and Silva and Pinho (2009a), is based on a measure of comparative accessibility by transport mode. On the one hand, SAL analyses the constraints of an urban structure on the sustainability of potential mobility patterns. On the other hand, it supports the identification of policy actions enhancing conditions for sustainable mobility patterns. Comparative accessibility by mode has a central role in these capabilities by providing a

measure of the potential use of each transport mode, within certain land use and transport conditions. Therefore, this measure presents an interesting appraisal of urban structure constraints for mobility to be sustainable.

SAL is a geographical representation of comparative accessibility levels by types of transport modes to different types of travel generating opportunities. This definition highlights three fundamental aspects of this instrument: i) the production of geographically represented (GIS based) results; ii) the use of an accessibility measure, looking at land use and transport conditions simultaneously – the diversity of activity index; and finally, iii) the use of a comparative accessibility measure, comparing accessibility values by transport mode and defining a measure of sustainability of potential mobility enabled by land use and transport conditions – the accessibility clusters.

The geographical representation of the results of comparative accessibility measures is fundamental to provide a global view of the territory under analysis and of variations of accessibility conditions throughout the study region. The use of an accessibility-based instrument is fundamental to reveal the link between urban structure and the potential mobility patterns. The use of comparative values of accessibility (by transport mode) is fundamental to measure the potential of urban structure to enable sustainable travel behaviour.

The SAL uses two main accessibility measures: the diversity of activity index and the accessibility clusters (Silva, 2008, and Silva and Pinho 2009a). The diversity of activity index assesses the accessibility level by each transport mode considering both level of service, availability and price of each transport service, and density and diversity of activities. This index counts the number of activity types that one can reach within those considered to be most relevant for travel demand generation. The accessibility clusters use the results of this index to develop the comparative analysis of accessibilities by different transport modes, grouping land use and transport conditions favouring the use of the same transport mode. This measure provides a representation of the sustainability of potential travel behaviour according to mode choice constrained by urban structure. The authors argue that SAL provides a synthesising measure of the conditions given by the land use and transport system for potential mobility to be sustainable and works as a framework for thought for the development of integrated land use and transport policies.

3 Oporto case study

This section describes the application of the three methods presented in the previous section to the Oporto municipal territory.

3.1 Morphogenetic analysis

The definition of the last two centuries as the timeframe for this study on the evolution of the city was due to the availability of cartographic material and to the low rates of urban growth prior to 1800s. The first known representation of Oporto is the *Planta Redonda* from George Balck, made in 1813. Table 1 shows all the cartographic surveys available for Oporto. This table reveals that the preparation of the town plans is not evenly distributed over time. Long time periods appear between the maps of 1865 and 1892, and between the maps of 1903 and 1932. Another limitation of this research was the lack of information on the peripheral areas of the municipal territory in the maps of

the beginning of the nineteenth century. For this reason these areas are not represented in the maps between 1813 and 1865. The lack of information on the urban plot in some of the original cartography made it impossible to include in our analysis.

Table 1. Oporto town plans: 1813-2005

Oporto town plans
1813 *Planta Redonda* - George Balck
1824 *Plano da Cidade do Porto* - José Francisco de Paiva
1833 *Oporto* - W. B. Clarke
1839 *Planta Topográfica da C. do Porto* - Joaquim da Costa Lima
1865 *Planta da Cidade do Porto* - Frederico Perry Vidal
1892 *Planta Topográfica da C. do Porto* – Telles Ferreira
1903 *Planta da Cidade do Porto* - STCMP
1932 *Planta Topográfica da Cidade do Porto* - STCMP
1937 *Planta Topográfica da Cidade do Porto* - STCMP
1948 *Carta Militar de Portugal* - IGE
1960 *Planta Topográfica da Cidade do Porto* - STCMP
1978 *Levantamento Aerofotogramétrico* - DGPU
1992 *Cartografia Digital* - STCMP
1997 *Carta Militar de Portugal* - IGE
2005 *Planta da Situação Existente* - STCMP

This morphogenetic analysis of Oporto was already described in three previously published papers. Oliveira and Pinho (2006) identified and characterized the different periods of urban development in Oporto. Oliveira and Pinho (2008) critically reviewed the most influential planning policies in the city since the second half of the nineteenth century. Finally, Pinho and Oliveira (2009) evaluated the use of cartographic redrawing, in the analysis of a particular city during a long period of time. Accordingly, the next paragraphs provide only a synthesis of the procedures and the main results of this analysis.

The work in our GIS Laboratory started with the preparation of an updated and rigorous computer-made representation of Oporto. After some initial work that included the erasing of all unnecessary layers of information, the most recent map of our set was ready to generate all the previous maps, by successive subtractions of all physical elements that were not built in the time period between two consecutive maps. Each re-drawn map was the framework for redrawing the previous. In this process, it was necessary to introduce a set of detailed adjustments for a precise overlapping of each pair of maps. Making all the successive representations strictly compatible, we were able to construct a model, permanently updatable and open to different kinds of analysis.

The analysis of the fifteen maps of Oporto (see Figure 1) suggested the existence of three morphological periods over the last two centuries: a monarchic period (1813-1865), a late-monarchic and dictatorial period (1892-1960), and a democratic period (1978-2005) – for a description of the main characteristics of these morphological periods see Oliveira and Pinho (2006). The analysis also made evident the importance of some singular axis in the evolution of Oporto urban layout: *Rua do Almada*, supporting the initial stages of urban expansion outside the medieval walls; *Avenida da Boavista* and *Rua da Constituição*, guiding the Northern and Western urban expansions in the second morphological period; and the *Avenida Marechal Gomes da Costa* and *Avenida Antunes Guimarães*, structuring the western part of the city in a complementary way to *Avenida da Boavista*, throughout the second half of the second morphological period. Finally, this analysis has demonstrated that the dominant urban forms in Oporto are much more influenced by the relationships

between the private initiative and the development control mechanisms in the short term, than by long term design proposals included in local planning documents. Within eight municipal plans, the only exception to this situation seems to be the Plano *Regulador do Porto* prepared in the beginning of the 1950s.

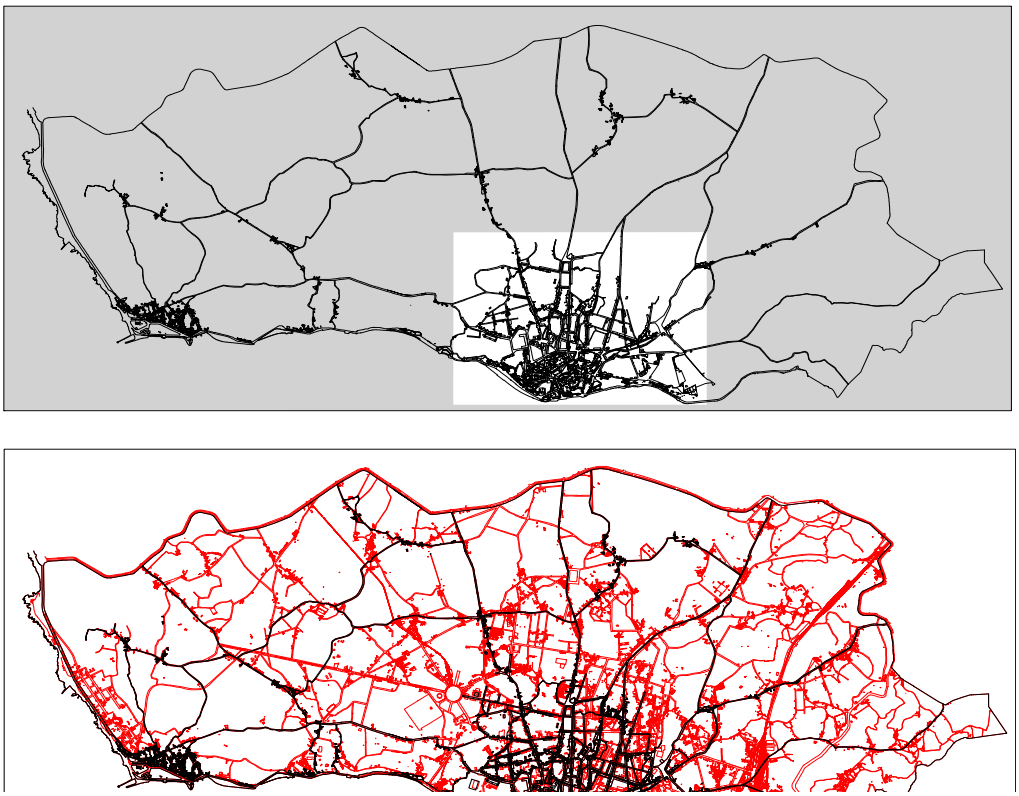

Figure 1. Morphogenetic analysis – Oporto case study: 1813, 1892, 2003

3.2 Axial analysis

Our analysis of the axial map of Oporto throughout its historical process of development comprises the following measures: global (radius n) and local (radius 3) integration, connectivity, global and local intelligibility, and synergy. Figure 2 shows the evolution of the urban layout of Oporto from the historical town of 1813 until 2005. Table 2 provides a synthesis of the metric and axial parameters of this historical process. Because of the restrictions of a conference paper we chose to focus only on three of these maps, 1813, 1892, and 2005.

Oporto axial system of 1813 is constituted by 477 lines with an average length of 155m. It presents an average global integration of 0,867. The main integrator of the system is Calçada dos Clérigos / Rua de Santo António (1,391), an East-West axe that separates two different types of urban tissues of the city, the 'historical areas' in the South, and the 'areas of continuous building frontages and largely replete plots' in the North (for a characterization of these tissues see Oliveira, 2006). Calçada dos Clérigos (see Figure 2 for the street location) is linked to five lines presenting the other highest values for integration – longer lines in the North (1267m and 767m), and shorter lines in the South. Within the interstices of a main structure of quasi-radial lines (red and orange lines) green and blue lines are found. The analysis of integration radius 3 shows that some of these green areas, particularly in the West, and in the South along the Douro River, have as a local focus (yellow lines). The average connectivity of the system is 3,790 and the most connected line is Rua do Almada (13), an emblematic street of a successful planning intervention carried out in the second half of the eighteenth century. The local structure of the 1813 Oporto system, described by the synergy, has a value of 0,456 that is a reasonable correlation. Regarding intelligibility, the system holds two different performances: it has a value of 0,195 for global intelligibility, implying an unintelligible system, and a value of 0,705 for local intelligibility, implying an intelligible system at the local scale.

Table 2. Oporto metric and axial parameters: 1813-2005

Map	Number of Lines	Line Length	Global Integration	Local Integration	Connectivity	Global Intelligibility	Local Intelligibility	Synergy
1813	477	154,356	0,867	1,703	3,790	0,195	0,705	0,456
1824	486	155,378	0,875	1,710	3,814	0,209	0,710	0,466
1833	491	155,896	0,886	1,712	3,825	0,216	0,708	0,478
1839	503	164,521	0,917	1,737	3,869	0,253	0,691	0,539
1865	542	165,241	0,898	1,730	3,875	0,249	0,689	0,520
1892	2248	179,608	0,555	1,562	3,382	0,095	0,628	0,300
1903	2286	182,204	0,585	1,593	3,441	0,109	0,588	0,352
1932	2379	186,849	0,630	1,642	3,542	0,122	0,571	0,392
1937	2494	185,060	0,639	1,657	3,572	0,106	0,565	0,360
1948	2645	183,068	0,636	1,673	3,602	0,092	0,567	0,323
1960	2978	177,974	0,652	1,699	3,632	0,086	0,551	0,308
1978	3505	172,424	0,702	1,704	3,597	0,076	0,529	0,310
1992	3728	171,642	0,715	1,720	3,610	0,073	0,511	0,317
1997	4065	169,539	0,713	1,712	3,577	0,071	0,512	0,302
2005	4287	168,983	0,744	1,725	3,599	0,076	0,510	0,322

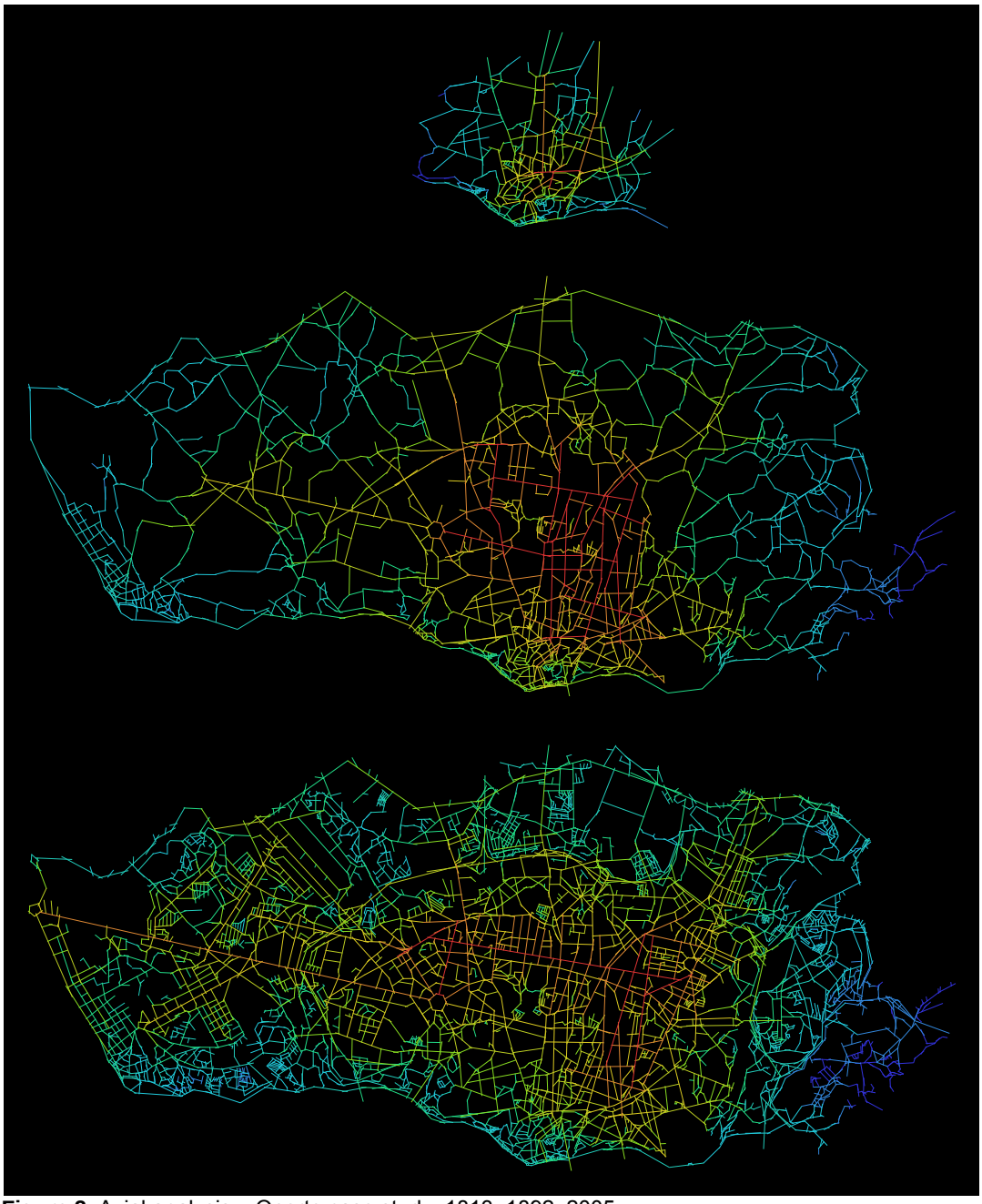

Figure 2. Axial analysis – Oporto case study: 1813, 1892, 2005

Our historical review of the evolution of the urban structure of Oporto focuses on the 1892 map which was, as referred to before, the first map to represent the whole municipal territory. The process of urban expansion – as well as the integration core – seems to be oriented to the West and to the North. While the number of, and the length of axial lines has increased (particularly the former) all the other syntactic measures under analysis have decreased. Decreases in global integration (from 0,898 to 0,555) and intelligibility (from 0,249 to 0,085) are particularly significant. Rua da Constituição at North of the historical kernel is the main integrator of the system (0,878). The Eastern area of

Campanhã emerges as the most segregated part of the city including the deepest lines of the system with integration below 0,3. Av. da Boavista, the longest axe of the system, located at Northwest of the integration core, has the highest local integration (3,455). Far from the city centre and facing the Atlantic Ocean, Foz emerges as a blue area in terms of global integration, but as a yellow (the main lines) area in terms of local integration. Av. da Boavista is the most connected line of the system (22), a situation that will remain until the end of the period under analysis.

Oporto axial map of 2005 is constituted by 4287 axial lines (14,7% below the average European city – see Hillier, 2002). It has always been increasing since 1813, when the axial map was composed by 477 lines. The evolution of the average length of an axial line throughout the period under analysis can be divided in two different parts, an increase from 154,3 in 1813 to 186,8 in 1932, and a subsequent decrease until 168,9m in 2005. Global integration in the 2005 map is 0,744 (18,9% below the average European city). It has suffered several variations throughout the period under analysis, the most expressive in 1892 when it decreased from 0,898 to 0,555, due to the consideration, for the first time, of the whole municipal territory. Connectivity in the 2005 map is 3,599 (21,9% below the average European city). As in the case of global integration, connectivity suffered several variations between 1813 and 2005, although with a more reduced expression than the former. Local integration in the 2005 map is 1,725 (23,5% below the average European city). The evolution of local integration has fewer variations than the former measures – increasing from 1,703 in 1813 to 1,737 in 1839, decreasing until 1,562 in 1892, and increasing until 1,725 in the end of the period. All the second level measures suffered several fluctuations throughout the period under analysis and the 2005 Oporto system presents very poor correlation between global integration and connectivity (0,076), poor correlation between global and local integration (0,322), and reasonable correlation between local integration and connectivity (0,510). Finally, it should be mentioned that for all these measures Oporto is closer to UK rather than to European cities.

3.3 Structural Accessibility Layer

In the absence of land use and transport data required to develop a long term implementation of SAL to Oporto, this study was developed only for 2007. A more detailed analysis of the implementation of SAL to Greater Oporto (including 5 further municipalities) is presented in Silva (2008) and Silva and Pinho (2009b). The results of this implementation enable a discussion of current accessibility conditions provided by Oporto's urban structure.

For the development of diversity of activity index maps we considered the following 18 activity types as the main travel generating activities: work, infant schools, elementary schools, high schools, Universities, parks, restaurants, cinema, theatres, sport, others leisure activities, shopping for food, shopping for other items, pharmacies, clinics and hospitals, public administration offices, postal offices, banks, and other activities. Accessibility was limited by travel time. Two travel time limits were used for each transport mode, defining 6 travel time limits in total. For activities considered to be accessible with longer travel times (such as shopping for non-food goods and work activities) we used 20, 45 and 30 minutes travel time limit for non-motorized mode, public transport and the car. For activities considered to be only accessible for short travel times (such as pharmacies and parks) we used 10, 25 and 15 minutes, respectively.

The following maps represent small-scale variations of accessibility conditions by walking, public transport and the car. Figure presents both the results of the diversity of activity index and a more aggregate analysis of these values for each transport mode. The aggregate analysis map groups different level of accessibility into three classes: class A - high accessibility (DivAct=]0.95;1]); class B – medium accessibility (DivAct=]0.80;0.95]); and class C – low accessibility (DivAct=[0;0.80])[19].

These maps show a clear homogeneity of accessibility conditions for public transport and the car. The car provides accessibility to all activities considered to generate travel, for the entire municipality. Public transport provides the same accessibility level as the car to all Oporto with exception of a few neighbourhoods (around 2% of the study area holding less than 1% of its inhabitants) with no accessibility by this transport mode. These areas are not served by the current public transport system and are, therefore, unable to access any activity by this mode. In this case study, availability of public transport is synonymous of maximum accessibility to activities by this mode. In average, Oporto offers an accessibility level of 0.99 by public transport (weighted average by population) to its inhabitants although we must bear in mind that 1% are, in theory, unable to use this transport mode to pursue every day activities.

Table 3. Accessibility classes for each transport mode by area and by population

	Analysis by Area (% of 40km^2)			Analysis by Population (% of 263.131 inhabitants)		
	NM	PT	CAR	NM	PT	CAR
A	42,6%	97,6%	100%	49,8%	99,1%	100%
DivAct=1	*25,4%*	*97,6%*	*100%*	*33,8%*	*99,1%*	*100%*
B	42,3%	0,0%	0%	43,3%	0,0%	0%
C	15,1%	2,4%	0%	6,9%	0,9%	0%
DivAct=0	*0,0%*	*2,4%*	*0%*	*0,0%*	*0,9%*	*0%*

Accessibility levels by non-motorized modes are far less homogeneous. These levels range from 0.60 to 1 (with an average of 0.94 – and therefore accessibility class B) showing a clear concentric effect around the historical centre of the city. Walking accessibility to all activities is mainly found in an inner area around the historical centre. These accessibility conditions are provided by 1/4th of the municipality to around 1/3rd of its population. The second accessibility level ring stretches along one of the main roads of the backbone road structure of Oporto, Av. da Boavista. Local Accessibility levels seem to drop faster to the north and east of the historical centre. This is also visible in the non-motorized accessibility class map with an almost circular area around the historical centre providing high accessibility levels. This accessibility class can also be found in some areas around Av. da Boavista and along one of the main motorways to the north (A29) involving the industrial area of Oporto. The remaining western side of the municipality offers mainly medium accessibility level, while the eastern side offers both medium and low accessibility level. In the eastern side, higher accessibility classes are found on one of the major entrance and exits roads of Oporto (Rua Fernão de Magalhães) and near the train lines.

[19] The choice for high values dividing high and medium accessibility – 0.95 – and medium and low accessibility – 0.80 – takes into consideration the already good accessibility conditions by all transport modes and especially the exceptionally good conditions provided by the car and public transport.

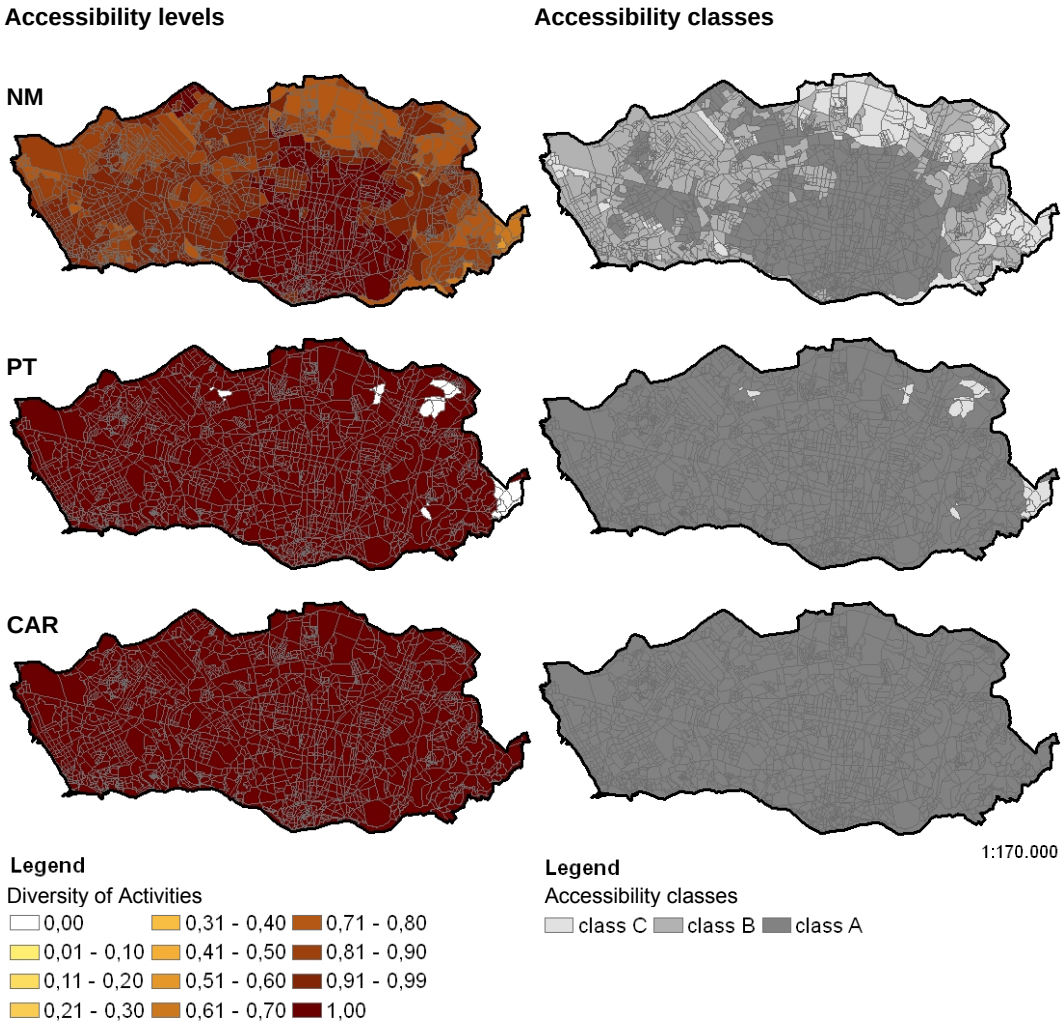

Figure 3. Diversity of activities accessible by three transport modes and by accessibility classes

Figure 4 represents the results of comparative accessibility (accessibility clusters). Result of the homogeneity of Oporto's accessibility levels by public transport and the car only 6 out of 27[20] accessibility categories are found. Categories 7, 14 and 15 represent high accessibility by public transport and the car, and high, medium and low walking accessibility, respectively. Categories 9, 17 and 19 represent high accessibility by the car, low accessibility (in this case, no accessibility) by public transport, and high, medium and low walking accessibility, respectively. Although six categories can be found, Oporto offers mainly accessibility conditions of category 7 (high accessibility by all modes) and 14 (high accessibility by public transport and the car and medium walking accessibility). More than 90% of its inhabitants live within these conditions.

[20] The SAL defines 27 accessibility categories as a result of the comparison of accessibility levels by transport mode divided into 3 accessibility classes (3*3*3=27). Accessibility categories define all combinations of accessibility conditions (classes) by all three transport modes.This case study presents 3 classes for non-motorized accessibility, 2 for public transport and 1 for the car (3*2*1=6).

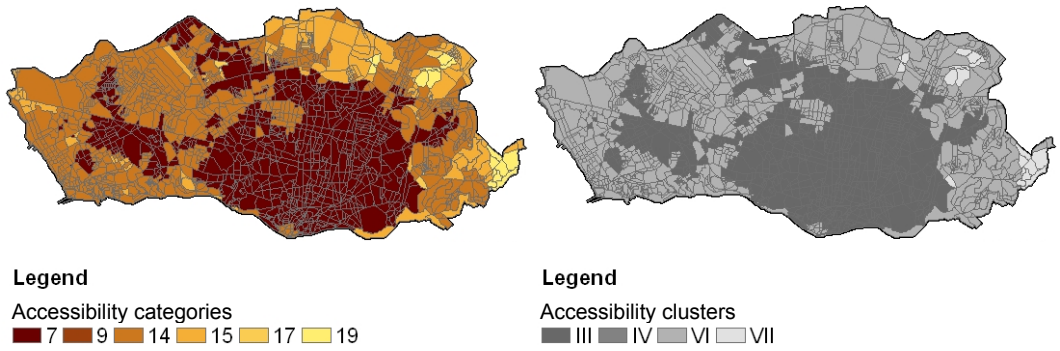

Figure 4. Accessibility categories and clusters (synthesizing maps)

Similarly, Oporto present two main accessibility clusters: cluster III, land use and transport conditions favouring the use of all transport modes; and, cluster VI, land use and transport conditions favouring the use of public transport and the car. Within these areas (99% of Oporto) the public transport and the car have, in theory, the same competitiveness since both provide access to all activity types. Only 25% of the study area offers the same conditions also for walking accessibility. In the remaining area in cluster III (43% of Oporto), although accessibility is high for all three transport modes, and the vast majority of activities is equally accessible by each of them, some activities, such as cinemas or theatres and, in fewer cases, postal offices, are still not accessible by foot. This creates lower competitiveness of walking in comparison with other modes, at least for these activities.

In summary, it is fair to say that, within the municipality, public transport is able to compete with the private car. Although short distance accessibility (walking) is generally quite good, it has still lower competitiveness when compared to hard modes.

Table 4. Categories and clusters by number of sub-areas, area and population

		Sub-areas	%	Area km^2	%	Population	%
category	7	963	46,7%	17	42,6%	131039	49,8%
	9	1	0,0%	0	0,0%	4	0,0%
	14	904	43,8%	17	42,0%	113449	43,1%
	15	170	8,2%	5	13,0%	16330	6,2%
	17	4	0,2%	0	0,3%	380	0,1%
	19	22	1,1%	1	2,0%	1929	0,7%
Total		2064	100%	40	100%	263131	100%
cluster	III	963	46,7%	17	42,6%	131039	49,8%
	IV	1	0,0%	0	0,0%	4	0,0%
	VI	1074	52,0%	22	55,1%	129779	49,3%
	VII	26	1,3%	1	2,3%	2309	0,9%
Total		2064	100%	40	100%	263131	100%

The accessibility cluster map, clearly shows travel choices (regarding mode) which are not made available by the urban structure. For every activity not accessible at walking distance the propensity to use another mode increases. As mode choice is clearly related to habit, these may discourage the use of soft modes for other activities at walking distance.

4 Comparison of results

4.1 Comparing the use of morphogenetic analysis and axial analysis

The results from the application of space syntax methods in the analysis of Oporto have, on the one hand, reinforced the main conclusions of our previous study under ISUF framework, and on the other hand, made evident some aspects that have not emerged in the morphogenetic analysis.

One key issue in our previous analysis was the definition of three morphological periods comprised between 1813 and 2005. Tables 5 and 6 make the link between morphological periods and integration measures evident. The maps included in the first morphological period have a global integration comprised between 0,8 and 1,0 (showing that this syntactic measure is unique for each morphological period), and a local integration comprised between 1,70 and 1,75. The maps included in the second morphological period hold a global integration comprised between 0,5 and 0,7, and a local integration comprised between 1,55 and 1,70. Finally, the maps included in the third morphological period have a global integration comprised between 0,7 and 0,8, and a local integration comprised between 1,70 and 1,75. Despite some similarities between the definition of the morphological periods and the values for connectivity, it was not possible to establish such a direct link as in the case of integration.

Table 5. Global integration and morphological periods

Global Integration	Maps	Morphological Periods
0,5-0,6	1892, 1903	2nd Morphological Period
0,6-0,7	1932, 1937, 1948, 1960	
0,7-0,8	1978, 1992, 1997, 2005	3rd Morphological Period
0,8-0,9	1813, 1824, 1833, 1865	1st Morphological Period
0,9-1,0	1839	

Table 6. Local integration and morphological periods

Local Integration	Maps	Morphological Periods
1,55-1,60	1892, 1903	2nd Morphological Period
1,60-1,65	1932	
1,65-1,70	1937, 1948, 1960	
1,70-1,75	1813, 1824, 1833, 1839, 1865	1st Morphological Period
	1978, 1992, 1997, 2005	3rd Morphological Period

Another important feature of our previous study was the identification of the most important axes for the overall structure of the city. As we can see in Table 7 (including an additional axial measure of first level, control) syntactic analysis agreed on the importance of: *Rua do Almada* (the longest axial line between 1813 and 1833; the line with the highest connectivity between 1813 and 1865, the highest control between 1813 and 1833, and the highest local integration between 1813 and 1865); *Rua da Boavista* (the longest line in 1839 and 1865) and *Av. da Boavista* (the longest line between 1892 and 2005; the line with the highest connectivity and control between 1892 and 2005, and with the highest local integration between 1892 and 1960); and *Rua da Constituição* (the line with the highest global integration in 1892, 1903 and between 1937 and 2005, and with the highest local integration between 1978 and 2005). Besides these streets, axial analysis has also highlighted the importance of other axes that have been somehow devaluated in our previous analysis, *Calçada dos Clérigos/Rua de Santo António*, *Rua de Santa Catarina*, and *Rua Fernandes Tomás*.

Table 7. Oporto fundamental axes: 1813-2005

Map	Number of lines	Line length (Maximum)	Integration (Maximum)	Connectivity (Maximum)	Control (Maximum)	Local Integration (Maximum)
1813	477	1267,080 ALM	1,391 CLE	13 ALM	3,418 ALM	2,957 ALM
1824	486	1267,080 ALM	1,402 CLE	13 ALM	3,418 ALM	2,954 ALM
1833	491	1267,080 ALM	1,410 CLE	13 ALM	3,368 ALM	2,963 ALM
1839	503	1369,070 BOA	1,471 CLE	13 ALM	3,287 FER	3,011 ALM
1865	542	1369,070 BOA	1,455 CLE	13 ALM+FER	3,621 FER	3,006 ALM
1892	2248	2830,930 aBOA	0,878 CON	22 aBOA	6,750 aBOA	3,455 aBOA
1903	2286	5021,930 aBOA	0,919 CON	30 aBOA	9,333 aBOA	3,785 aBOA
1932	2379	4961,380 aBOA	0,979 SAN	32 aBOA	11,060 aBOA	3,861 aBOA
1937	2494	4961,380 aBOA	1,018 CON	32 aBOA	10,893 aBOA	3,839 aBOA
1948	2645	4961,380 aBOA	1,018 CON	32 aBOA	10,824 aBOA	3,846 aBOA
1960	2978	4961,380 aBOA	1,033 CON	37 aBOA	13,779 aBOA	3,924 aBOA
1978	3505	4961,380 aBOA	1,194 CON	39 aBOA	13,834 aBOA	4,117 CON
1992	3728	4961,380 aBOA	1,210 CON	44 aBOA	16,163 aBOA	4,208 CON
1997	4065	4961,380 aBOA	1,193 CON	45 aBOA	16,780 aBOA	4,227 CON
2005	4287	4961,380 aBOA	1,259 CON	46 aBOA	16,847 aBOA	4,221 CON

ALM – Rua do Almada; BOA – Rua da Boavista; aBOA – Avenida da Boavista; CLE – Calçada dos Clérigos, Rua de Santo António; CON – Rua da Constituição; SAN – Rua de Santa Catarina; FER – Rua Fernandes Tomás

4.2 Comparing the use of axial analysis and SAL

The second comparison introduced by this research analyses the results of one long established method, the axial analysis, and of the recently developed SAL. Comparison of results of these two methods used only two of the maps produced by the SAL: the diversity of activity index map for non-motorized modes and the cluster map. Public transport and car accessibility maps were excluded from the comparative analysis due to their homogeneity at this analysis scale[21].

A first analysis of maps form both methods reveal some interesting similarities between accessibility cluster and global integration. Both maps highlight a central area of Oporto suggesting a relationship between high global integration and high accessibility level by all transport modes, or at least between high global integration and high walking accessibility. In addition to the central area both maps show a strong axis to the West centred on the “Avenida da Boavista” and producing a longitudinal area of high global integration and high accessibility levels by all transport modes. Surrounding this major road high accessibility levels can be found in several areas where the global integration level is strong. Another similarity can be found at the opposite level with low global integration level of peripheral axis generally corresponding to lower walking accessibility. The lowest values for both measures are found in exactly the same area of Oporto, to the east. Nevertheless, some results are somehow less coincident such as a strong accessibility axis to the northwest (near A29 and Oporto’s Industrial Area) which presents lower global integration level than another axis to the north on the eastern side (along “Avenida Fernão de Magalhães”) where global integration is stronger than on the north-western axis.

These results suggest the existence of a relationship between the urban layout, the land uses and the transport system. Although these axial maps do not include land use characteristics disregarding the influence of travel generators, some of its measures seem to be strongly related to these characteristics (though indirectly through the close relationship between urban fabric, land use and transport infrastructure, which has clearly moulded they way they have co-evolved).

[21] It is important to point out that the SAL was defined for the metropolitan or regional scale and not for municipal scale. This considerably limits variability of analysis results.

The cluster and walking accessibility map form the SAL and the global integration map form space syntax show the most relevant similarities within the compared measures. There seems to be no direct relationship between connectivity or control form axial analysis and any accessibility measure used by the SAL, at least at the current analysis scale.

This research for connections between axial analysis and comparative accessibility analysis is still taking its first steps with a number of features yet to be explored. The first is clearly the comparison of these methods at metropolitan our regional aiming to shed light on the relationship between all elements that condition urban form and metabolism. One further step leads us beyond this view, towards the understanding on how these methods may be used taking advantage of the complementary knowledge they produce on the city.

5 Conclusions and further research

Throughout the last decades of the twentieth century planning has been losing its capacity to influence the process of city building. The reasons for this have been discussed elsewhere and include both internal (the exclusive focus of planning theory and research on the issues of method, discourse, and communication, to name a few) and external factors to this field of knowledge (such as the weakening of the welfare state, the rising of neoliberal ideologies, and the increasing complexity and uncertainty of the urban development process). This paper is part of a wider research project that aims to provide a framework for analysis and design of the city, including both ISUF and Space Syntax morphological techniques, and the SAL method. The first goal of the paper was the exploration of a complementary utilization of morphogenetic and syntactic analysis in the study of Oporto municipal territory. Particularly evident was the identification of a strong link between the concept of morphological period and the measures of global and local integration. The second goal of the paper was the exploration of the similarities and differences between syntactic analysis and the SAL approach. In Oporto case study similar results were found between the measure of global integration and comparative accessibility. A more effective analysis and a subsequent comparison with Space Syntax measures require the application of the two methods at a metropolitan scale. This will be the scope of our future research.

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Revision of the Land Use Law: what consequences for land rent?

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In this article some considerations are made concerning the revision of the land use law (that is currently being undertaken), in line with its articulation with the basis of the Policy of Territorial Ordinance, and with the juridical regime of territorial management tools, in order to point out some key issues in territorial planning goals concerning: the need to provide land for the different kinds of uses at acceptable prices (ensuring the right of urban property), the encouragement of the private initiative of promoters, builders and sellers, and the monitoring and control of surplus-values generated by planning decisions (thus preventing speculative processes). Within this scope, an analysis of the concept of land rent is carried on, and the consequences of the different kinds of public interventions on property values are analysed, in terms of the surplus-values they generate. Next is presented a methodology to compute land rent and surplus values that is applied, as a case study, to the office market of Oporto city (Portugal). This methodology considers the different variables that intervene in land and real estate price formation, the inter-relations between property values, the licensed land uses, and the behaviours of the different agents involved in property markets. Some concluding reflections are made on how the revision of the land use law can lead to the appropriate provision of land, considering its social function, the control of its price levels, and the stimulus to territorial development within an increasingly uncertain environment.

Keywords: land rent, surplus values, land use law, office markets, decision-support systems.

1 Introduction

The main goal pursued in the research reported in this article consists in the analysis of how the revision of the land use law shall contribute to fulfil some of the core territorial development goals, in what concerns: (1) the provision of land for the different kinds of uses at acceptable prices (ensuring the right of urban property), (2) the encouragement of the private initiative of promoters, builders and sellers, and (3) the monitoring and control of surplus-values generated by planning decisions (thus preventing speculative processes). The following steps are pursued in order to reach this main goal: (1) brief analysis and reflection concerning the relations among the Constitution of the Portuguese Republic, the land use law, the base law of the policy of territorial ordinance and urbanism, and the juridical regime of the territorial management tools, (2) display of the concept of land rent and factors that condition it, (3) assessment of the consequences of different types of public interventions on land property values, in what concerns the surplus values they engender, (4) proposal of a model for the computation of land rents and surplus-values applied, as a case study, to Oporto's office market and, finally, (5) reflections concerning how the revision of the land use law should enhanced the attainment of the land social function, the control of its price levels, and the attainment of territorial development targets.

2 Theoretical review

In this section will be pursued a brief analysis of: the relation between the territorial planning goals and the urbanistic legislation; the concept of land rent and the factors that condition it; the

consequences of public interventions on property values (in terms of the surplus-values they engender); and the behaviour of the agents that intervene in the property markets.

2.1 Relations between planning goals and the urbanistic legal framework

According to the Portuguese Constitution, the urban real estate property should satisfy private as well as public specific interests (Monteiro, 2008), such as salubrity, security and buildings´ aesthetic, and the general social interest. But the Portuguese urbanistic legislation hasn't yet dealt with the question of the urban real estate property in the most convenient way, even considering its highly importance to planning concerns (Monteiro, 2008). Additionally, the proper territorial planning system doesn't respond suitably to how the private property shall accomplish its social function, both at the level of plans and at the operational level, despite the existence of some studies and of some partial territorial databases, and of an emergent cadastral structure (Campos, 2009; Pardal, 2006b). One of the goals of the land use law, that is currently in force and that dates from 1976, consisted in the resolution of the housing problem, and in preventing real estate speculation. However, whereas the currently available housing almost doubles needs, after three decades had elapsed, the speculation problem still remains unsolved, and even worsened along time.

Other outstanding planning goal in the land and real estate property field refers to the need to enhance the private initiative of promoters, builders and sellers, in search for a balanced sustained economic development.

The increase in property values may depend on two distinct simultaneous or alternative sources: (1) decisions and interventions of the territorial planning system, that are independent of landowners´ investment or worth, and (2) profits that accrue from trade goals and from the market, as well as from benefits pursued by property owners (Pardal et al, 1996). An excessive greediness in development conversion from rural into urban land uses, and in land uses´ intensification has turned up in Portugal for the last years. These processes have been favoured by incoherencies in the legal urbanistic base, and in its deficient articulation with the planning tools, and by excessive allowance of public administration. The consequences have turned up, through the waste away of the urban centres, the sprawl of the urban peripheries, and development of speculative processes. The planning system has failed in the segmentation assessment of land and real estate markets, and has settled land use classifications that are marginal to the market functioning rationale (Pardal, 2006a), taking the existing uses as a starting point, instead of adopting a proactive and strategically oriented attitude. This kind of behaviours of the public administration engenders distrust of the market agents, that don't willingly conform to the contents of plans (Pardal, 2006a). The land use law shall be able to impose some restrictions on the obsession for development, which translate concerns for a socially-guided land use policy, rehabilitation issues, and control over urban sprawl, land provision and price levels. In order to prevent and control speculation, the territorial planning shall monitor, regulate, manage and control surplus-values, and their taxation shall enhance planning goals, instead of bounding them.

Surplus values correspond to the increase in property values that result from planning decisions, such as changes from agricultural to urban land uses, settlement of urban perimeters, division of land property, expansion of the building capabilities, and expansion of the number of

autonomous land plots that result either from administrative decisions or from public works (Pardal et al, 1996). Surplus values have currently been appropriated by private agents that, mostly, didn't even contribute for them.

Control over surplus-values may be undertaken by the proper state or by the autarchies, either through taxation devices, or through a proper land use policy, and respective urbanistic management. If the processes of production of development land are under the responsibility of public organisms, then public administration manages to entirely detain the surplus values. It additionally avoids conflict behaviours, settles the rules for urban development, and balances land market functioning (Pardal et al, 1996). But if urban land production is granted to private agents, then the public administration looses a core tool to regulate the availability of land plots in the market, and to control urban sprawl, and, in the utmost, it will be able to collect and revert on its own behalf only a small slice of the surplus values. In the case of urban allotments carried out by private agents, the surplus-values assemble with the costs of infrastructures, and with the profits and losses of promoters, builders and sellers, and under these circumstances it becomes almost impossible to clearly retain the surplus values engendered by planning decisions. The return of the surplus values on behalf of the state, that is in charge of its more just and equitable redistribution is one of the outstanding challenges faced by the new land use law.

Despite the successive taxation reforms in the Portuguese fiscal system during the last decades, the taxation of surplus-values still continues to be collected by the tax on income (Pardal et al, 1996). The main change in the taxation of surplus-values has occurred at the level of the municipal tax on real estate (I.M.I.): what enter in the computation of the surplus-values are the property values appraised according to the I.M.I.'s parameters. Despite the use of clear and objective parameters, it is not easy the identification and distinction of the increase in worth that results from municipal interventions, and the one that results from the private initiatives of promoters, builders and sellers (Pardal et al., 1996). This structural change has deep effects in the private property status. The current philosophy underlying the real estate municipal tax raises a twofold concern (Pardal, 2006a): (1) the collected values resemble a rent payment (what foreshadows a feudalization profile in the property regime of real estate), and (2) the landlords become double-taxed: by the municipal tax on real estate, and by the income tax. These incoherence and incongruence between the fiscal and the urbanistic framework imply disfunctionalities in the rental market, and thus hinder and strongly condition the pursuit of the goals of a balanced land use policy.

Within this framework, it is all-important that the urbanistic legislation, and particularly the new land use law shall (Monteiro, 2008): (1) articulate the contents of the urban property rights with the territorial planning management tools (through a proper insertion of the private property law on the urbanistic legislation), (2) adjust the property structure and its object to the needs of urban life and to socially-oriented land uses (namely through the reinforcement of the paradigm of horizontal property on contrast to the paradigm of vertical property, and through the progressive self-sufficiency of building rights from the content of private property rights).

The new land use law must, thus, respond to two main goals: to control the urban sprawl and consequent speculative processes, and to contribute to solve the problem of monitoring, control and recovery of the surplus-values engendered by planning interventions. In order to control speculative

behaviours, two appraisal tools should be carefully developed and applied (Pardal, 2006a): the market evaluation code, that is made up by the appraisal techniques currently used by real estate appraisers, and the official valuation code, that should allow for a critical evaluation of market values, through their comparison with the normal and reasonable real estate values within the framework of a land use policy that respects the social function of real estate property (Pardal, 2006a).

2.2 Analysis of the concept of land rent and of the underlying factors

Land and real estate prices exhibit an outstanding cause-and-effect relation (Clark, 1995; Granelle, 1970; Thoman et al., 1968; LeFeber, 1958). The cost of land enters real estate prices because of the heterogeneous characteristics of the different plots of land, the competition for land uses, the planning regulations, and firms´ and families´ location choices (LaFountain, 2005; Needham, 1981; Dunn, 1954). The retention strategies that landowners frequently adopt, accrue to land production costs, due to the absolute and monopoly rents they engender (Harvey, 1985). But the prices of real estate assets exert influence the prices of land plots as well, especially due to competition for land uses (George, 1879; Smith, 1843; Ricardo, 1817).

Land costs can, thus, be split into two parcels: the transference cost (that corresponds to the capitalized income that results from land's productive use), and the economic rent. The transference cost is a part of real estate costs and such, it enters into their prices. The economic rent, by its turn, is given by the difference between the price of land and its transference cost Chacholíades, 1986). Land economic rent includes, thus, a surplus rent (in relation to the transference cost), and an additional profit margin, but it is very difficult – theoretically and empirically - the objective distinction between rent and profit. Planning shall assume an outstanding role in the regulation of land profit generation, considering the social function of land, and the need to stimulate the initiatives and investments performed by promoters, builders and sellers (Rebelo, 2009; Pardal, 2006a).

The identification of the contributions of public and private interventions on land increased values requires the split of any land plot into two components: the territorial-based value, and the value that results from the investment of landowners. The former depends on plot's location, dimension and authorized use, results from social and territorial dynamics, and doesn't depend on landowner's intervention, what means that it can be controlled by territorial plans and by other land policy tools. The latter is ruled by the market. Under the current economic and territorial framework, taxes should exclusively fall upon the territorial-based value, within an informed and enlighten land use policy, and through the application of appropriate landmarks.

2.3 Behaviours of agents in property markets

As land price depends on its expected future uses (in order to fulfil accommodation, industry, trade and services´ space requirements, Aydalot, 1985), the production, allocation and prices of urban land depend on a complex set of inter-related decisions taken by different economic agents - landowners, promoters/developers/builders, real estate mediators, final buyers or tenants, credit institutions and public authorities. In their search for profit goals, landowners often resource to differentiation and retention strategies. Promoters and builders provide real estate final products: their profit margins are modelled by market rules (that point out suitable prices), by the urban regulations, and by the principles of the land use policy. Real estate agents (namely consultants and other real estate

professionals) join buyers and sellers together. They assess outstanding data on real estate characteristics, location and availability, thus encouraging transactions in property markets. Final consumers search for spaces that satisfy their needs, concern with quality and price issues, and sometimes are interested in real estate investment and trade. The main responsibilities of credit institutions, by their turn, consist in regulating cash flows within the property markets. Finally, the role of local authorities in land use management and control mainly expresses through provision of housing (settled on different public programs), zoning regulations, laws, taxes, control on land use changes, and decisions on investments in infrastructures, equipments and public spaces.

However, considering the main imperfections in property markets - few participants in market transactions, lack of transparency, and some monopolistic characteristics -, part of the surplus values engendered by development nourish speculative processes, escape authorities, and fail to be used on behalf of society in general.

3 Methodology for the computation of economic rents and of surplus values

In order to respond to the main goals settled for this research, urban planning shall intervene on property laws, and/or develop property appraisal tools that fit locals, uses and intensities of use, in order to support the provision of land for different functional needs at acceptable prices, encourage the private investments of promoters, builders and sellers, and monitor and control surplus-values. In line with these concerns, this article proposes a methodology for the computation of surplus-values, so that planning interventions on taxation, and on monitoring and control of the distribution of surplus-values becomes reinforced and more efficient (Figure 1). This methodology is applied, as a case study, to the office market in Oporto city (Portugal).

This methodology is applied to the development of an integrated and interactive model, through the following steps: (1) implementation of a management information system for on-going monitoring purposes, and (2) development of a methodology to compute surplus values of land aimed at office uses, based on a hedonic model of market prices and on average development costs.

4 Application of the methodology to Oporto office market

4.1 Development of a management information system

The main office areas in Oporto city are located in the Boavista district, the Constituição/Marquês district and the old downtown centre (characterised by a remarkable stock of heritage buildings) (Figure 2).

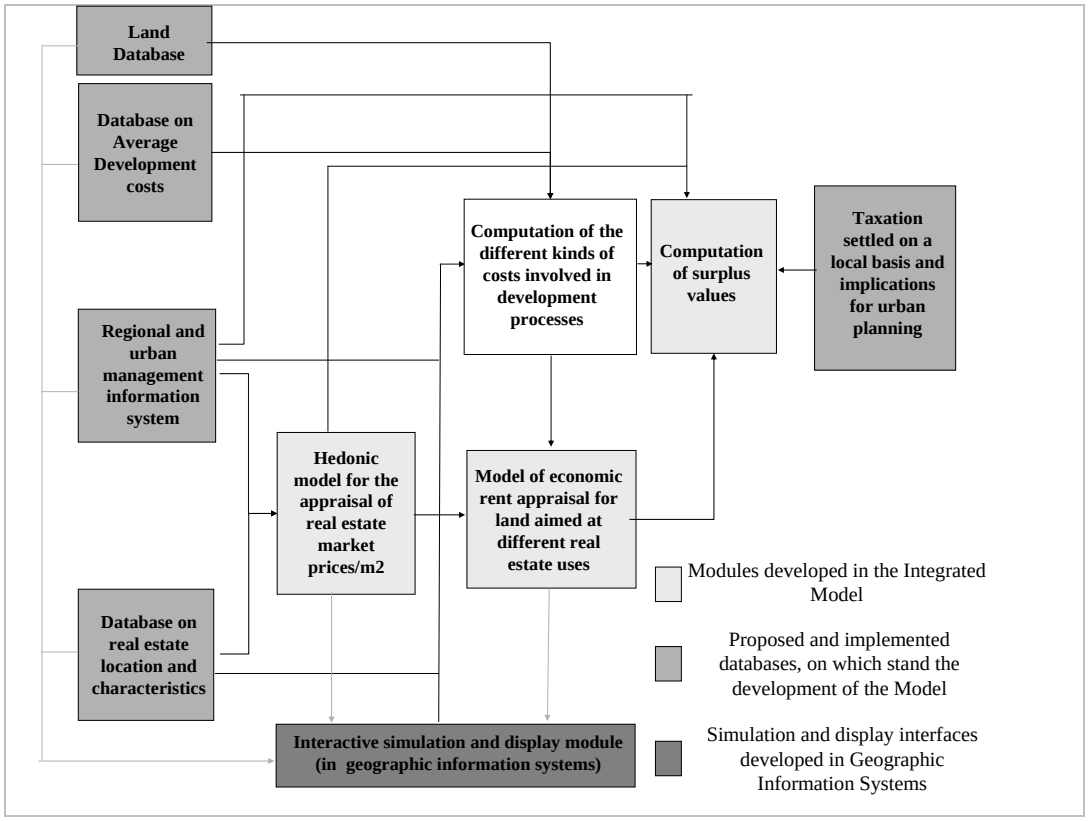

Figure 1. Integrated and interactive model to support municipal decisions concerning property markets

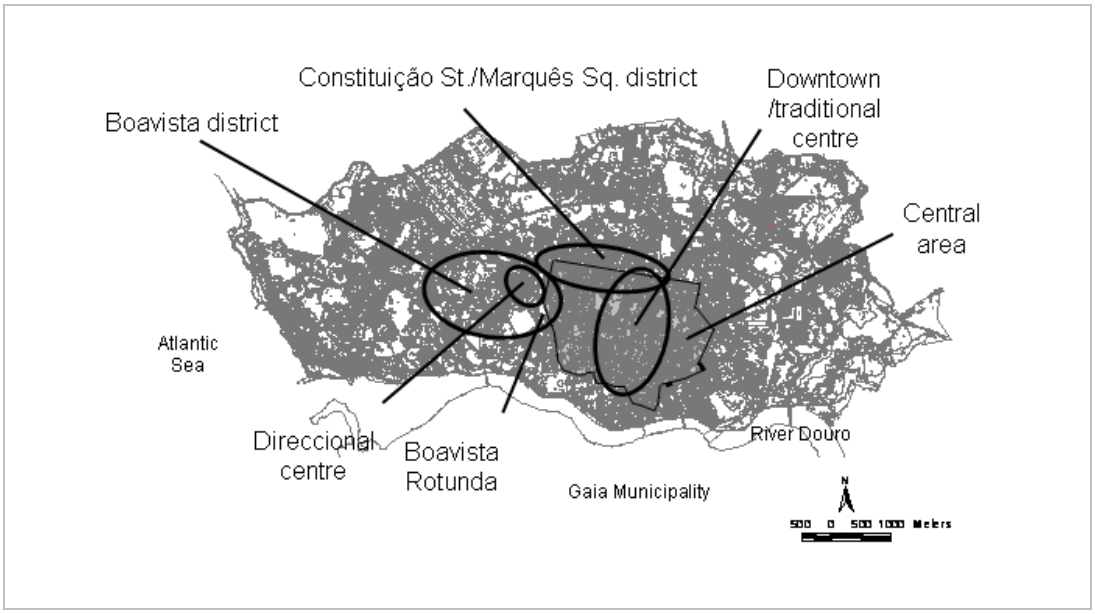

Figure 2. Main office areas in Oporto city

A management information system was developed and implemented for Oporto city. It is made of databases on (1) land parcels, (2) regional and urban indicators, (3) average development costs, and (4) real estate location and characteristics.

The database on land parcels consists in a set of variables concerning their main characteristics and their uses (enabled by territorial plans and other land use policy tools). It includes the following variables: plot's dimension, geo-morphological characteristics, absolute and relative location (in relation to the main centre and sub-centres); current or anticipated property division, licensed use, real or anticipated taxes, and surplus values that result from infrastructures, equipments, public services and other undertakings.

The database on regional and urban indicators is made up by variables that exert influences on offices demand, supply and prices. Some of these result from market operation, and others depend on regional and local authorities (Rebelo, 2009) The systematized variables are: spatial/geo-referenced location of offices; planning regulations (including zoning regulations and land use coefficients); location indexes of different kinds of office activities (that show relative spatial concentration in relation to the overall territory); weighted distance to urban centres and sub-centres; inertia exhibited by offices that remain in the same location (or trend to change to a new location); public investments in communications and transports, culture, sports and leisure time; public health utilities, environment; education; housing; economic development and tourism; civil protection; social action and urban (re)qualification; number or density of inhabitants in each block; and date.

The database on average development costs include: land and land-related costs, development costs, building costs, management, administrative and marketing costs, financial charges, and property taxes: The costs of the land plots/m^2 of building area are computed as the economic capitalized return from land use (they represent land transference costs). They are considered to equal the prices of the housing construction plots sold in public auctions, which approach the prices of land for social uses. Land costs for office uses correspond to those prices weighted according to the average percentage of office prices over housing corresponding prices. Land acquisition costs also include other parcels that are expressed as percentage of the land acquisition cost/m^2: transfer tax (10%), stamp duty (0.4%), property registration costs (0.5%), notarized costs (0.5%) and lawyer honoraries (0.5%). Development costs represent the costs of participation in public investments and land infrastructures, and are computed according to the municipal tax for urban infrastructures. The building costs include: construction costs properly so-called (approached by the selling prices/m^2 of common housing, annually published as a decree in the government diary); costs with equipments (including heating systems, lifts and special foundations); and building honoraries. This category of costs also include different contingent costs (that usually represent about 5% of total costs), and the building inflation. Management, administrative and marketing costs were assumed to amount to 0.8% of total construction costs/m^2, and a 20% added value rate was supposed to fall upon those costs. A 6.2% rate of annual capital cost, and 50% of borrowed capital for land acquisition purposes, and 50% of borrowed capital for commercialization purposes were also considered (commercialization costs were assumed to represent 0.5% of total building costs). Finally the municipal tax on property was applied, considering office uses.

The database on real estate location and characteristics uses a set of variables that represent the characteristics, location, morphology and typology of buildings and real estate units, and respective kinds of uses.

4.2 Methodology for surplus values computation

According to the methodology proposed in this article, the computation of surplus values requires the previous computation of land economic rent.

The land economic rent/m^2 is reckoned by the difference/m^2 between the expected income and a set of anticipated costs (land; development; technical building; management, administrative and marketing; and financial costs), property taxes and a normal profit rate expressed as a multiple of those overall costs (Rebelo, 2003, 2009). The selling price/m^2 of offices (according to their functional uses, characteristics and location) is anticipated by a hedonic regression model that expresses it as a function of the indicators systematized in the urban management information system (Rebelo, 2009). As new and updated information feeds the management information system, the on-going hedonic model is adjusted. As each building site is assigned a certain licensed area or volume (according to planning regulations and restrictions), the total expected income is computed by the product among the licensed building area and the office selling price/m^2 anticipated by the hedonic model.

The difference between the land market value and respective patrimonial value (computed according to the municipal tax on property) gives, then, the surplus-values of land for office uses (Rebelo, 2009). The land market values are computed by the sum of the land rent with land economic rent. According to the municipal tax on property (DL nº 287/2003, that is the official valuation code), the tributary patrimonial-value of building land is given by the sum of the value of the building implantation surface with the value of land adjacent to construction (articles 38º, 40º, 41º, 42º and 45º). The implantation surface of buildings (already considering location characteristics) varies between 15% and 45% of the building costs. The tributary patrimonial-value of urban buildings targeted to housing, trade, industry and services is computed as the product among territorial base-value of the property, the gross construction area plus the area that exceeds the implantation one; the affectation coefficient; the location coefficient; the comfort and quality coefficient; and the ancientness coefficient.

The developed hedonic model explains about 67.8% of variance, and expresses office prices/m^2 exclusively as a function of urbanistic variables (Rebelo, 2009). Thus, according to the proposed methodology, the surplus values only accrue from land territorial-based value, thus their taxation remains neutral in face of landowner's investments and initiatives.

The integrated and interactive model presented in this article is able to embody new and updated information. Its simulation and display interfaces additionally allows for the on-going monitoring and control of factors that influence property prices, the simulation of alternative scenarios to support decisions of local authorities, and the provision of a cartographic display of engendered surplus-values. This methodology and model are supposed to support urban policy decisions concerning the management of property and location of activities (in its economic, financial and cartographic aspects). It further allows the computation and display of land economic rent and surplus values, and the analysis of changes that accrue from variations in planning variables. Due to its structure and flexibility, this model easily adjusts to other urban realities, and to other property markets.

4.3 Results

The hedonic model developed in this case study expresses offices selling prices/m^2 as a function of the following urbanistic variables: offices´ spatial location; urban planning regulations (zoning restrictions and land use coefficients); location indexes of different office activities; weighted distance to the most recent planned business centre (*Boavista* Rotunda); temporal inertia of office activities (or tendency they exhibit to remain in the same locations); different types of public investments; number of employees in the upper tertiary sector; and date.

An excerpt from the database on the different kinds of costs involved in office development processes in Oporto city is presented in next table (Table 1).

The land economic rent and surplus-values of land aimed at office uses, according to respective characteristics and location, obtained from the application of the integrated and interactive model are outlined in next table (Table 2).

Using the module of cartographic visualization leads to the distribution of surplus values presented Figure 3.

Table 1. Different kinds of costs/m^2 involved in office development processes in land acquisition and office building, according to their location in Oporto city (excerpt from the database) Unit:Euros

Adress	Zone in Oporto city	Land acquisition costs/m^2									Building costs/m^2			Management, administrative and marketing costs/m^2	Financial costs/m^2			Municipal tax on property/m^2	Total costs/m^2
		Land cost/m^2 of office buildings	Municipal transfer tax	Stamp duty	Property registration costs	Notarized costs	Lawyer honoraries (0,5%)	VAT on lawyer honoraries	Development costs	Total land costs/m^2	Average office building costs (ans specialised works)	Average costs of building garages/m^2 of office buildings	Total office building costs/m^2		Financial costs of land acquisition/m^2	Financial costs of commercialization/m^2	Total financial costs/m^2		
646 RUA PROF CORREIA ARAUJO R	Antas	211,5	21,2	0,8	1,1	1,1	1,1	0,2	31,5	268,4	415,0	43,8	458,8	3,7	8,3	0,1	8,4	0,770	740,0
94 ALAMEDA ECA QUEIROS AL	Antas	211,5	21,2	0,8	1,1	1,1	1,1	0,2	31,5	268,4	415,0	43,8	458,8	3,7	8,3	0,1	8,4	0,770	740,0
130 ALAMEDA ECA QUEIROS AL	Antas	211,5	21,2	0,8	1,1	1,1	1,1	0,2	31,5	268,4	415,0	43,8	458,8	3,7	8,3	0,1	8,4	0,770	740,0
194 ALAMEDA ECA QUEIROS AL	Antas	211,5	21,2	0,8	1,1	1,1	1,1	0,2	31,5	268,4	415,0	43,8	458,8	3,7	8,3	0,1	8,4	0,770	740,0
256 ALAMEDA ECA QUEIROS AL	Antas	211,5	21,2	0,8	1,1	1,1	1,1	0,2	31,5	268,4	415,0	43,8	458,8	3,7	8,3	0,1	8,4	0,770	740,0
191 PRACA PEDRA VERDE PC	Aldoar/Antunes Guimarães/Vilarinh	205,0	20,5	0,8	1,0	1,0	1,0	0,2	31,5	261,1	415,0	43,8	458,8	3,7	8,1	0,1	8,2	0,770	732,5
216 PRACA PEDRA VERDE PC	Aldoar/Antunes Guimarães/Vilarinh	205,0	20,5	0,8	1,0	1,0	1,0	0,2	31,5	261,1	415,0	43,8	458,8	3,7	8,1	0,1	8,2	0,770	732,5
250 RUA SOEIRO MENDES R	Aldoar/Antunes Guimarães/Vilarinh	205,0	20,5	0,8	1,0	1,0	1,0	0,2	31,5	261,1	415,0	43,8	458,8	3,7	8,1	0,1	8,2	0,770	732,5
305 PRACA PEDRA VERDE PC	Aldoar/Antunes Guimarães/Vilarinh	205,0	20,5	0,8	1,0	1,0	1,0	0,2	31,5	261,1	415,0	43,8	458,8	3,7	8,1	0,1	8,2	0,770	732,5
280 RUA EUGENIO CASTRO R	Boavista/Rotunda	290,0	29,0	1,2	1,5	1,5	1,5	0,2	31,5	356,3	415,0	43,8	458,8	3,7	11,0	0,1	11,1	0,770	830,6
300 RUA EUGENIO CASTRO R	Boavista/Rotunda	290,0	29,0	1,2	1,5	1,5	1,5	0,2	31,5	356,3	415,0	43,8	458,8	3,7	11,0	0,1	11,1	0,770	830,6
352 RUA EUGENIO CASTRO R	Boavista/Rotunda	290,0	29,0	1,2	1,5	1,5	1,5	0,2	31,5	356,3	415,0	43,8	458,8	3,7	11,0	0,1	11,1	0,770	830,6
370 RUA EUGENIO CASTRO R	Boavista/Rotunda	290,0	29,0	1,2	1,5	1,5	1,5	0,2	31,5	356,3	415,0	43,8	458,8	3,7	11,0	0,1	11,1	0,770	830,6
686 RUA TENENTE VALADIM R	Boavista/Rotunda	290,0	29,0	1,2	1,5	1,5	1,5	0,2	31,5	356,3	415,0	43,8	458,8	3,7	11,0	0,1	11,1	0,770	830,6
174 CAMPO MARTIRES PATRIA CPO	Gonçalo Cristóvão/Baixa	281,5	28,2	1,1	1,4	1,4	1,4	0,2	31,5	346,8	415,0	43,8	458,8	3,7	10,7	0,1	10,8	0,770	820,8
46 CAMPO MARTIRES PATRIA CPO	Gonçalo Cristóvão/Baixa	281,5	28,2	1,1	1,4	1,4	1,4	0,2	31,5	346,8	415,0	43,8	458,8	3,7	10,7	0,1	10,8	0,770	820,8
9 LARGO ADRO LG	Gonçalo Cristóvão/Baixa	281,5	28,2	1,1	1,4	1,4	1,4	0,2	31,5	346,8	415,0	43,8	458,8	3,7	10,7	0,1	10,8	0,770	820,8
48 LARGO FONTINHA LG	Gonçalo Cristóvão/Baixa	281,5	28,2	1,1	1,4	1,4	1,4	0,2	31,5	346,8	415,0	43,8	458,8	3,7	10,7	0,1	10,8	0,770	820,8
26 LARGO PROF ABEL SALAZAR LG	Gonçalo Cristóvão/Baixa	281,5	28,2	1,1	1,4	1,4	1,4	0,2	31,5	346,8	415,0	43,8	458,8	3,7	10,7	0,1	10,8	0,770	820,8
54 PRACA FLORES PC	Gonçalo Cristóvão/Baixa	281,5	28,2	1,1	1,4	1,4	1,4	0,2	31,5	346,8	415,0	43,8	458,8	3,7	10,7	0,1	10,8	0,8	820,8
95 RUA JOAO BAPTISTA LAVANHA R	Foz/Gomes da Costa	241,5	24,2	1,0	1,2	1,2	1,2	0,2	31,5	302,0	415,0	43,8	458,8	3,7	9,4	0,1	9,4	0,8	774,6
67 RUA INFANTE SANTO R	Foz/Gomes da Costa	241,5	24,2	1,0	1,2	1,2	1,2	0,2	31,5	302,0	415,0	43,8	458,8	3,7	9,4	0,1	9,4	0,770	774,6
399 RUA ALEGRIA R	Marquês/Constituição	226,0	22,6	0,9	1,1	1,1	1,1	0,2	31,5	284,6	415,0	43,8	458,8	3,7	8,8	0,1	8,9	0,770	756,7
582 RUA ALEGRIA R	Marquês/Constituição	226,0	22,6	0,9	1,1	1,1	1,1	0,2	31,5	284,6	415,0	43,8	458,8	3,7	8,8	0,1	8,9	0,770	756,7
7742 ESTRADA CIRCUNVALACAO EST	Bonfim/Campo 24 Agosto	226,0	22,6	0,9	1,1	1,1	1,1	0,2	31,5	284,6	415,0	43,8	458,8	3,7	8,8	0,1	8,9	0,770	756,7
7762 ESTRADA CIRCUNVALACAO EST	Bonfim/Campo 24 Agosto	226,0	22,6	0,9	1,1	1,1	1,1	0,2	31,5	284,6	415,0	43,8	458,8	3,7	8,8	0,1	8,9	0,770	756,7
11 LARGO JOSE MOREIRA SILVA LG	Bonfim/Campo 24 Agosto	226,0	22,6	0,9	1,1	1,1	1,1	0,2	31,5	284,6	415,0	43,8	458,8	3,7	8,8	0,1	8,9	0,770	756,7
116 PRACA MARQUES POMBAL PC	Marquês/Constituição	226,0	22,6	0,9	1,1	1,1	1,1	0,2	31,5	284,6	415,0	43,8	458,8	3,7	8,8	0,1	8,9	0,770	756,7

Table 2. Estimate of economic land rent and surplus values of land aimed at office uses in Oporto city (excerpt from the database)

Unit:Euros

Address	Zone in Oporto city	Land use coefficient	Average number of floors	Anticipated office selling prices/m_2	60% of income/m^2	Land, development, building, management, administrative, marketing, and financial costs, property taxes/m^2, and normal profit rate/m^2	Economic land rent/m^2 [1]	Land rent/m^2 [2]	Land market value/m^2 [3]=[1]+[2]	Land patrimonial value/m^2 [4]	Surplus-values [3]-[4]
203 RUA GUEDES AZEVEDO R	Gonçalo Cristóvão/Baixa	5	1,85	1554,3	1726,9	543,4	1183,6	281,5	1465,1	645,2	819,9
227 RUA PINTO BESSA R	Corujeira/S. Roque da Lameir	5	1,85	1260,8	1400,9	515,4	885,5	173,5	1059,0	745	314,0
242 RUA S BRAS R	Gonçalo Cristóvão/Baixa	5	1,85	1504,2	1671,3	543,4	1128,0	281,5	1409,5	649	760,5
2533 FERNAO MAGALHAES AVE	Paranhos/Costa Cabral	5	1,85	935,3	1039,2	511,7	527,5	159,0	686,5	758,4	-71,9
35 RUA LIMA JUNIOR R	Paranhos/Costa Cabral	5	1,85	1284,0	1426,7	511,7	915,0	159,0	1074,0	756,2	317,8
411 RUA CASTELOS R	Ramalde/Monte dos Burgos	5	1,85	1362,1	1513,5	513,0	1000,5	290,0	1290,5	753,8	536,7
433 RUA NOSSA SENHORA FATIMA R	Boavista/Rotunda	5	1,85	1436,0	1595,6	545,6	1050,0	290,0	1340,0	637,4	702,6
49 RUA FORMOSA R	Bonfim/Campo 24 Agosto	5	1,85	1429,5	1588,3	528,9	1059,4	226,0	1285,4	659,5	625,9
55 RUA DR RICARDO JORGE R	Gonçalo Cristóvão/Baixa	5	1,85	1377,0	1530,0	543,4	986,6	281,5	1268,1	659,2	608,9
57 RUA FLORES R	Gonçalo Cristóvão/Baixa	5	1,85	858,0	953,3	543,4	409,9	281,5	691,4	653,1	38,3
393 RUA ALEGRIA R	Marquês/Constituição	5	1,85	1472,4	1636,0	529,0	1106,9	226,0	1332,9	696,5	636,4
1395 RUA CONSTITUICAO R	Marquês/Constituição	5	1,85	1304,9	1449,9	529,0	920,9	226,0	1146,9	694,3	452,6
455 COMBATENTES GRANDE GUERRA AVE	Antas	5	1,85	1160,3	1289,2	525,3	764,0	211,5	975,5	705,8	269,7
8 RUA BRAS CUBAS R	Antas	5	1,85	1052,4	1169,3	525,3	644,0	211,5	855,5	705,1	150,4

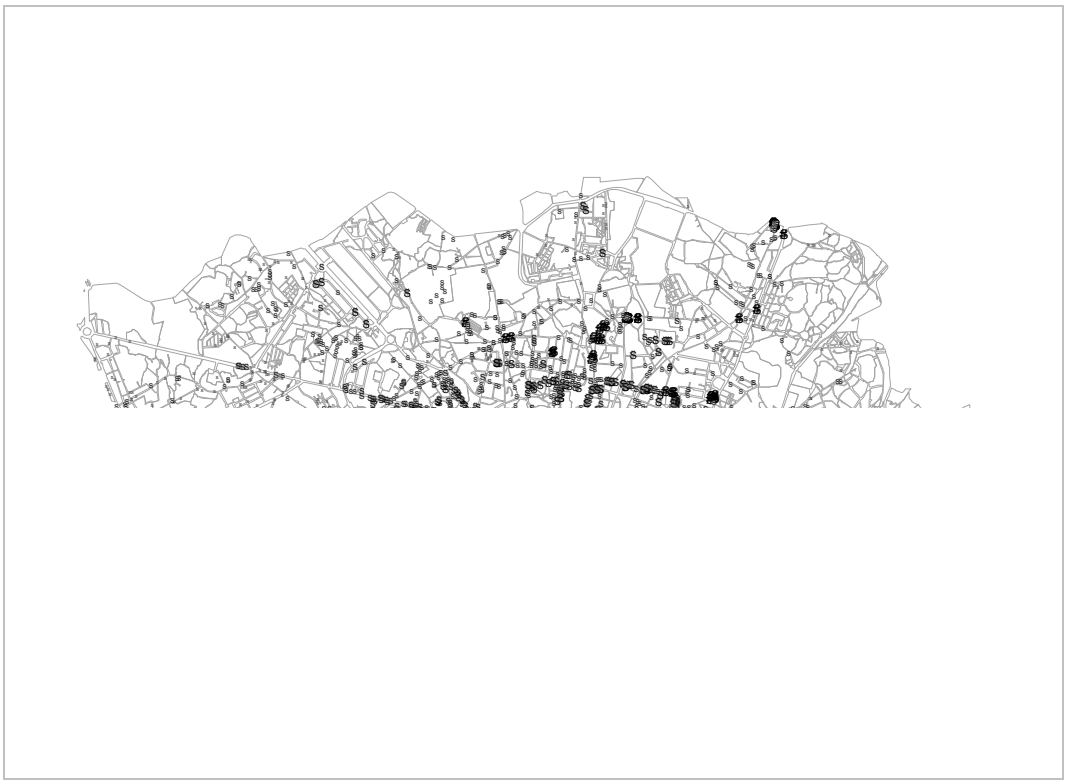

Figure 3. Expected distribution of surplus values of land aimed at office uses in Oporto city (according to the proposed methodology)

5 Conclusions and recommendations

The methodology and model for the appraisal and quantification of surplus-values proposed in this article allow the definition of planning and fiscal policies that embodies economic, social and functional locally-intrinsic characteristics. As such it supports the analysis of the impacts exerted by administrative decisions and public investments concerning land uses and intensities of use.

All participants in development processes should be encouraged to introduce respective added values in the productive chain, thus reaching acceptable profit margins, since they respect the market rules, the urbanistic regulations, and the principles of a just social land use (Pardal, 2006a, b; Clark, 1995; Correia, 1993). Considering that surplus-values are generated by administrative decisions of municipalities – that are the entities in charge with land changes of use and intensities of use, and that assume responsibilities to regulate property markets – they should (in each case) involve landowners and promoters, builders and sellers into a negotiation process, in order to find a balanced share of surplus-values among these different property agents (Pardal, 2006a). Otherwise the development processes risk to be blocked either by supply or by demand.

Within the scope of the pursued analysis, and of the methodology proposed in this research, the new land use law should: warrant the availability of land for the different kinds of uses, at acceptable prices, and respecting the private property rights; encourage the free initiative of promoters, builders and sellers; and monitor and control the surplus-values engendered by planning decisions, preventing speculative processes.

In order to enhance the private initiative of promoters, builders and sellers, preventing the excessive greediness in development processes, the new land use law should support a more effective and efficient implementation of the planning strategic priorities and guidelines, namely through: (1) control of real estate prices (in its different functional segments), (2) restrictions to uncontrolled urban sprawl, (3) bet in the urban rehabilitation, thus helping to brake property speculation. Besides, a better consciousness by planning and municipal powers and a more appropriate urbanistic legislation should clearly identify and segment more efficiently the different types of property demand, in order to design better responses, ensuring citizens rights and the accomplishment of the planning goals.

One of the great challenges the new land use law faces consists in pointing out how to fight speculation and, in some outstanding cases, bribery. Thus it may play a core role in the resolution of the surplus-values problem. This new law shall define clear rules concerning the possibilities and conditions of land use that will reinforce control of real estate prices by public administration, together with the provision of land for the different kinds of uses, according to a land use policy that accounts for the land social function, and that ensures the property rights. The clear distinction – even if based on a settled criterion - between the accrued property worth that arises from planning decisions, and the one that arises from owner's initiative and investment should allow a more just taxation of surplus-values, that better shapes local realities, and that ensures that: surplus-values are applied on behalf of population; real estate values become under control; and speculation is prevented and/or controlled. Within this scope, it would be much interesting to consider a new agent (similarly to what happens in the current recently approved Spanish land use law) – the development agent – charged to intermediate public administration, landowners, and promoters/builders/sellers interests whenever development processes are unchained in certain land plots. He may successfully assume a mediation role in the negotiation of surplus-values among the different parts.

Another measure that should guide property market operation aimed at strategic planning priorities consists in the possible aggravation of the fiscal burden on land plots located within the

urban perimeters that are at a standstill during a time period higher than the one considered normal and reasonable. The same rational is applicable to vacant and degraded properties.

The new land use law shall contain clauses that: ensure a higher transparency; and implies an accrued participation of citizens in the working up of municipal urbanistic plans. This deeper participation of citizens in planning decisions, founded on the new land use law, and on a better integrated urbanistic juridical basis, will certainly reinforce the engagement and conformation of private initiatives with the effective content of plans, within the strict accomplishment of legislation.

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Notes

[1] The useful demand searches for spaces to develop a certain social function, whereas the speculative demand invests in property generally without social concerns.

[2] Tax on the income of singular people I.R.S., or tax on the income of collective people I.R.C.

[3] It was empirically computed by the product between the average licensed number of floors, considering an average height of 2.7 meters, according to the general regulation of urban edifications R.G.E.U. (Regulamento Geral das Edificações Urbanas), and the selling price/m^2 anticipated by the hedonic model.

[4] That depends on the kind of use: trade, services, housing, social housing, warehouses and industrial activities, and parking.

[5] That considers accessibilities, nearness of social equipments, public transportation services, and location in expensive real estate areas.

[6] For trade, industry and services purposes, this coefficient is positively weighted by the location in trade centres or in building offices, by the existence of central heating, the building quality and the existence of lifts or rolling stairs, and negatively weighted by the inexistence of sanitary installations, water and electricity nets, sewerage system, paved streets, lifts in buildings with more than three floors and low maintenance conditions.

[7] That translates the influence of building age on prices.

[8] The collected information refers to year 2000.

Periurban Spatial Dynamics

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This study describes the evolution of the open space systems of five case studies from the urban fringe of Oporto Metropolitan Area, during fifty years of urban growth. It uses the cartographic redrawing technique to recreate their public space grids at four different moments and space syntax to explore the configurational evolution of their spatial systems. Besides the confirmation of Space Syntax as a particularly relevant tool for the analysis and planning of suburban areas, the study conclusions include the clarification of the configurational differences between rural and urban grids, the evidence of different suburban growth patterns and the demonstration of a strong relation between such patterns and the evolution of the syntactic intelligibility of these systems.

Keywords: periurban, morphology, space syntax, intelligibility.

1 Introduction

Geographically, the urban fringe can be defined as the area in which suburban growth is taking place by the transformation of rural in urban soil, and where the two land uses are mixed together to form a transition zone between town and country (Johnson, 1974). This transition zone has always existed and is accepted as a permanent feature of the urban phenomenon itself (Thomas, 1974). The historical nature of the urban fringe is well known to urban morphology. The morphological imprint that urban fringes leave on the urban tissue was first identified by Conzen (1960) and later developed by Whitehand (1974, 2001) under the designation of “fringe belts”. Cities appear to growth spasmodically, with cycles of acceleration and deceleration. In each deceleration cycle, the urban fringe attracts “land consuming” uses (as public institutions or industry) which with more difficulty would find affordable space in the dense central areas. In the next acceleration cycle, urban growth (mostly residential) resumes beyond this area, leaving behind a “belt” with specific morphological characteristics: low density, sparse urbanization pattern with large spatial voids (public and private), great variety of plot sizes and shapes and a sparse road system.

The nature of the urban fringe has changed considerably over time. In the pre-industrial city it was inhabited by less-advantaged social groups and presented an almost concentric pattern around the urban core. In industrial times, as the central city became congested and polluted, and because of the introduction of mass transport, the urban fringe grew exponentially developing a star-like pattern, driven by public transports operating along main radials that fingered out from the central built-up area. In the second half of the 20th century, largely as a result of the impact of road transport and private car ownership, it grew even more, now in a diffuse and pulverized pattern, with new expansions no longer tied to areas already built-up. These new developments are not necessarily located on main roads leading outwards from a city, but can lie in formerly less accessible area “interdigitated” between the main lines of movement (Johnson, 1974).

Today’s urban fringes are very complex territories, attracting more (and more diversified) population, showing new patterns of metropolitan movement (no longer dependent on the central

city), with new functions and new urban forms. The model under which urban conglomerations could be seen as a spectrum from a totally urban zone (the city center) to a totally rural one (the countryside that would surround it), no longer applies to the new "urban-rural compound" of the city-region. The new peripheral areas, now called "periurban", are much more independent than the former suburbs, but they are not as multifunctional as the traditional city centres. They are neither urban in terms of density and multi-functionality, nor rural in terms of agriculture, seclusion and tradition (Borsdorf, 2004). Still, it is at the outskirts of the contemporary city that we can explore and understand the nature of the new urban phenomena; it is there that they attain their maximum expression. As the periphery is taking more often the role of a centre in the life of many people around the globe, the interest in analyzing its spatial and physical dimensions becomes a legitimate and important endeavor (Stanilov, 2004). Yet, as we shall see, it remains largely unexplored.

2 Objectives

This study will describe the morphological evolution of five suburban and periurban settings of Oporto metropolitan area, during fifty years of urban growth. The primary objective of the work is the identification of differences or similarities, and trends or regularities between the studied areas, in order to elucidate their formation processes and specific spatial and physical characteristics. Hence, this research is ultimately exploratory. The set of theories and analytical techniques known as space syntax will be the main research tools, so spatial systems and their configurational proprieties will be the main research objects. However, the work also aims at exploring the relation between visible morphological characteristics (as shape and geometric form) and configuration (that is, non-visible and simultaneous topological relations). Since the relation between spatial configuration and urban functioning is now well established (Hillier and Vaughan, 2007), the objective of this exercise is to try to find causal relations between dominant geometries of urban grids and their configurational outcome, so that it would be possible to infer and produce planning and design prescriptions for periurban areas.

3 Literature Review

The relative lack of studies analyzing the physical and spatial patterns of periurban areas can be explained with the relative young age of those environments. Also, the extremely dynamic rates of their formation and the scale of the new periurban extensions present a challenge for the analysis of their form (Stanilov, 2004). The present section will review the literature on the subject of periurban and suburban morphology. We will begin by looking at the International Seminar on Urban Form (ISUF) approach, important to the knowledge of the visual and apparent morphological characteristics of urban tissues and their growth dynamics. Next, we will review the Space syntax literature on the subject, in search of their underlying structural characteristics.

The ISUF was established in the beginning of the 1990s. Although the product of different schools of thought that evolved separately, namely the Italian Typologist School and the English Morphogenetic School, the ISUF's approach as acquired coherence as an interdisciplinary theoretical field (Moudon, 1997). As far as urban change is concerned, Whitehand (1992, 2001) resumes some of the main findings of this approach:

-The notion that the different elements that make up the urban landscape (streets, plots, buildings and their related open spaces) change at different speeds. A spectrum of susceptibility to change can be recognized, with “perennial” structures whose transformation entails a large capital investment changing rarely (like streets and plots), and “volatile” structures whose transformation involves a relatively small capital investment undergoing quite frequent changes (like buildings and their uses).

-The notion that the way in which forms are created on the ground, particularly during the process in which rural land is converted to urban use (which is the basic suburbanization process), acts as a long-term constrain on subsequent change. Plot boundaries, and especially streets, exert a powerful long-term influence.

The ISUF’s line of morphological analysis (and for that matter, also space syntax’s) has been mostly concerned with the historical urban fabric. Nevertheless, some studies elaborating on the subject of suburban form can be pointed out.

Anne Vernez Moudon (1998) in “The changing morphology of suburban neighborhoods”, questions the claim by other authors that the shift from historic urban fabric to modern periurban fabric makes the analysis of its morphology not only difficult, but even uninformative. The author advocates that not only do the techniques used on historic towns apply directly to the new environments, but they also yield information which corroborates the processes documented earlier in historic towns. She uses several morphological studies from others to illustrate this.

Albert Levy (1999) in “Urban morphology and the problem of the modern urban fabric: some questions for research”, explains the general morphological changes that have undergone contemporary urban fabrics. According to the author, a dramatic shift as occurred from a dense, closed fabric, characteristic of the central city and inner suburbs, to a periurban fabric which is open and fragmented, with autonomous and atomized elements which do not relate to each other. Looking at the traditional relations between the elements of urban form, the author concludes that what has happened is a profound subversion of these relations: constructed space no longer corresponds to the plot, the plot has lost its structuring role of the street system, and streets have been transformed into mere transportation infrastructures.

Jaqueline Tatom (2004) in “Making a metropolitan landscape: Lyons 1812-1994”, analyzes two Lyon suburbs diachronically, using GIS software to superimpose cartographies from different periods. She concludes that, notwithstanding the apparent radical transformations, the original rural landscape structure has largely persisted, that is, change takes place within the structural continuity of rural parcels.

From these examples, and regarding the objectives of this research, we can extract the following conclusions:

- First, that although very different from the traditional urban tissue, periurban tissues obey to the same general rules of transformation.

- Second, that some morphological elements of the original rural landscape, namely the street and parcel systems, act as long-time constraints to the future form of the city.

-Third, that these elements (especially the street system) are also the most resistant to transformation.

Space syntax approach to urban form is mainly concerned with the relation between the structural organization of urban space and the social structures that inhabit it. Unlike ISUF, this line of morphological analysis ignores the information contained in the built forms and addresses only the form of the open space system defined by them. The form of space is a less obvious object of analysis than the built form, and almost absent from morphological studies prior to the introduction of syntactic analysis techniques. This is because we cannot analyze the form of urban space without looking at its most fundamental properties: continuity and global form. In this sense, urban spatial analysis raises a problem which is anterior to the analysis itself: that of space representation (Hillier et al, 1987). To cope with this problem, Space syntax researchers developed several kinds of original spatial representations, which have in common the fact of being easily translatable into graphs, in which vertices represent individual spaces and edges represent relations of adjacency between spaces. The graph represents all the relations between all spaces in the system, thus internalizing its global and continuous nature. Space syntax calls this set of simultaneous relations between spaces "configuration", and argues that cities are "strongly relational systems", that is, systems in which the complex of relations amongst elements is more important than the intrinsic properties of elements in how they function (Hillier, 1999). One can then easily analyze the graph using centrality measures from graph theory and network analysis (as degree, betweenness or closeness centrality) or others proposed by Space syntax (as control, restricted radius centrality and angular analysis), in order to investigate the relative importance of each space in the system. Because this is a quantitative method, its results are easy to compare to other results from quantitative analysis of human behavior, as urban movement (which is the most common use of urban space). Strong correlations between syntactic measures and urban movement rates have been found showing that, other things being equal, it's the form of space (or more properly, its configuration) the main determinant of the distribution of movement flows inside an urban grid (Hillier, 1993). Following this kind of analysis, Space syntax was able to establish causal relations between urban form and human behavior, which gave rise to a morphological theoretical framework of urban functioning, rooted on empirical evidence.

Bill Hillier (1996) argues that cities can be seen as "movement economies". According to this author, the functional formatting of the urban object is determined by the movement patterns within it, which in turn are determined by the grid configuration. Spaces travelled many times in each origin-destination trip (because they are more globally accessible) "profit" with the by-product of that movement (i.e. being travelled), attracting movement seeking uses, like tertiary uses. These functions then, acting as destinations, attract even more movement, creating a multiplier effect which is responsible for the emergence of dense and highly multi-functional urban areas. Other uses that do not gain directly from movement, like residential use, tend to locate themselves in the less accessible interstices between the most integrated spaces. Thus, one can say that, in spite of their obvious differences, cities are shaped by the same dual process, in which each side of the duality explores the relation between space and movement in a different way. On the one hand, there is a micro-economic driven process that structures space in order to make it globally accessible, i.e. to optimize its reach from all other spaces and so maximize movement and co-presence; this tends to be invariant across cultures, as trade and exchange are. On the other hand, there is a residential space

process, which uses space to restrain and structure movement in the image of a residential culture of some kind. This dual process leads to the emergence of the also dual structure of urban grids: a foreground network of highly accessible spaces linking centers at all scales, and a more segregated background network of primarily residential space in which the foreground network is embedded (Hillier and Vaughan, 2007).

The Space syntax approach as brought very important results to the knowledge of how cities work spatially but, as ISUF, it has been concerned mostly with the historical city. There are a few examples of the application of the method to suburban or periurban areas.

Toker, Baran and Mull (2005) in "(Sub) Urban Evolution: a cross-temporal analysis of spatial configuration in an American town (1989-2002)", explore diachronically the configuration of a rapid growing, predominantly suburbanized town, Cary, in North Carolina. In this case, the results show that suburban growth leads to the progressive segregation of central areas, as global integration values become "flattened" and attraction inequalities diluted. Also, the system intelligibility drops continuously.

Adriana Nogueira (2003) in "Analysis of high sub-centrality of peripheral areas at the global urban context", also a diachronical study, analyses the evolution of Aracaju, Brazil. As in Cary, suburban growth leads to a general decay of global integration and intelligibility measures. Besides, the study shows how the fragmented pattern that the system as acquired reinforces the segregation of its peripheral areas.

Ruth and Nick Dalton (2005) in "Spatial Signature of Sprawl: or the proportion and distribution of linear network circuits", propose a way of measuring the "urbanity" of a given system, by looking at the nature and number of its axial graph cycles. The authors discuss several algorithms for computing that analysis. The technique is applied to several urban and suburban settings, showing how cycle length distribution can serve to distinguish urban and suburban grids. Also, it is stressed the importance that a seldom used syntactic measure, known as "axial ringiness", can have in such differentiation. These conclusions are particularly relevant to the present work, therefore we shall return to them later.

We can then summarize the results of syntactic research on suburbanization as follows:

- First, there seems to be a real advantage in diachronical modeling in order to understand the configurational effects of the suburbanization process.

- Second, that this process apparently leads to the progressive segregation of central areas, and to the dilution of former attractions inequalities.

- Third, that suburbanization also seems to lead to a general decrease in the systems intelligibility.

- Fourth, that there seems to be a configurational differentiation between urban and suburban areas, suggesting that there could be some kind of "signature" of urban and peripheral spatial conditions.

4 Methodology

This study aims at not only investigating the spatial nature of periurban areas but also the characteristics and effects of their formation processes. So, a diachronical approach is necessary.

The Oporto Metropolitan Area was elected as the main object territory. Five study zones were defined, according to the criteria explained below. The public space systems of these areas were recreated in four different historical moments using the cartographic redrawing method, as described by Pinho and Oliveira (2009). Then, the axial maps for each case study in each of the four periods were drawn. These two sets were then analyzed according to their apparent characteristics (redrawn maps) and configuration (axial maps). Comparative analysis between case studies was then carried out, in order to extract further conclusions.

4.1 Study areas

The sub-municipal territorial scale was chosen as the scope of the work. The five more rapidly growing parishes in the last fifty years of the five municipalities around Oporto (Matosinhos, Maia, Valongo, Gondomar and Vila Nova de Gaia) were elected as study areas. They are Custoias, Vermoim, Ermesinde, Rio Tinto and Mafamude. For simplicity reasons, from now on we will call them A, B, C, D and E. Obviously, the administrative borders of the different parishes are very different, as well as their areas. Besides, a buffer zone would be needed around each one, in order to minimize the "edge effect" that is known to occur in configurational analysis. Therefore, a circular area with a three kilometer radius (30 minutes on foot) was defined around each parish, with center on the centroids of the planar shapes defined by the parishes' administrative limits. With this procedure, differences between parishes' areas were eliminated, as well as guaranteed a buffer zone around each one (Figure 1).

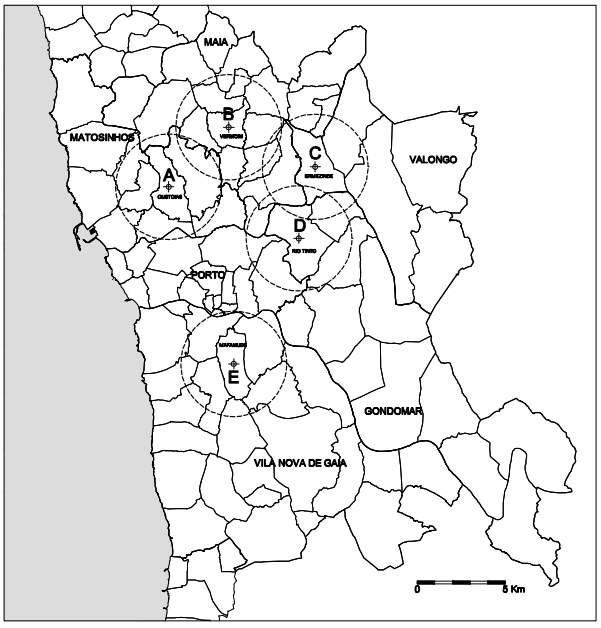

Figure 1. Study areas location on the Oporto Metropolitan Area

4.2 Cartographic redrawing

The cartographic redrawing technique is used to recreate the past form of the city, starting from today's rigorous digital cartographies and their superimposing on GIS software, with older digitalized

maps. This process makes clear the differences between the two geographical moments, and allows the introduction of that information in the current digital map. It is then possible, by successive editions, to create several temporal versions of that map, integrating the differences recorded with the former cartographic elements, that is, the permanence or absence of built structures (buildings, streets, etc). Pinho and Oliveira (2009) describe in detail this technique and point out several outputs of the method, as the overall and simultaneous vision of the urban form evolution, and the rigorous identification and characterization of urban-expansion areas.

Cartographic redrawing was conducted only for the public space network, object of the subsequent configuracional analysis. Table 1 resumes the cartographic sources and their issuing dates. The time span between the first and the last analysis periods is fifty years, and the mean variation between the three first periods is 24 years. The difference between the third and the fourth periods, corresponding to the current digital maps, is only 4 years. However, as transformations in this last period proved to be important, this information was also included.

Table 1. Cartographic sources and issuing date

period	CUSTOIAS	VERMOIM	ERMESINDE	RIO TINTO	MAFAMUDE	Source
1st	1948	1948	1948	1947	1948	Portuguese Military Map (IGE) Scale 1:25 000
2nd	1974	1975	1974	1974	1974	Portuguese Military Map (IGE) Scale 1:25 000
3rd	1996	1996	1996	1997	1997	Portuguese Military Map (IGE) Scale 1:25 000
4th	2000	1999	2000	2000	2001	Municipal digital cartographies

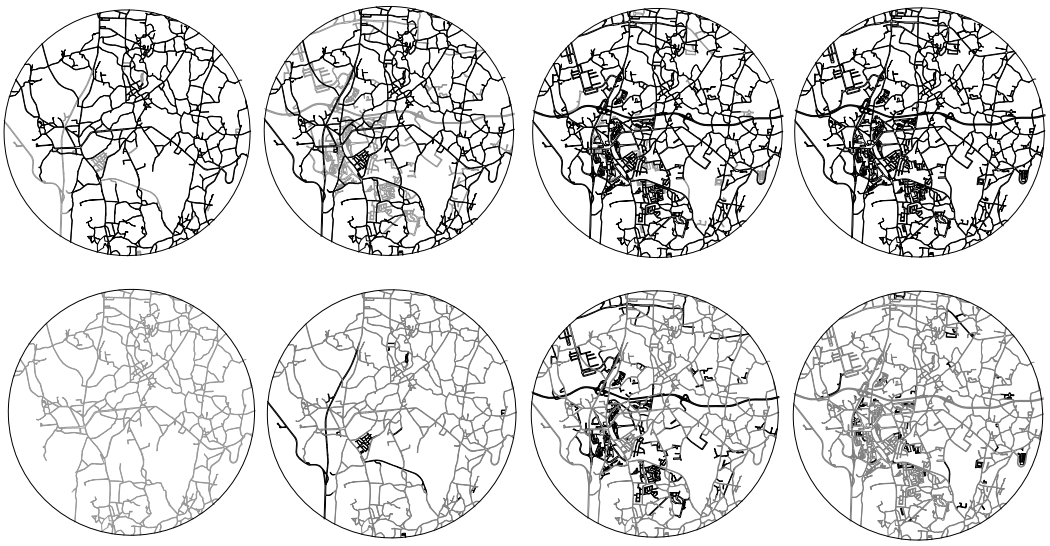

Figure 2. Example of the cartographic redrawing produced for each case study

Two types of map were produced for each study area and period, each one with different representation objectives. One highlights the grid current state in each period, showing in black the actual structures, and in light gray those which will appear in the next period. The other one highlights the urban-expansion areas that emerged between that period and the previous, showing them in red and in light grey the already existing grid (Figure 2).

Besides serving as a base for producing the axial maps, these elements have their own analytic importance. As already mentioned, this study aims at comparing the visible properties of the systems with their configurational properties. Their reading and interpretation was conducted under three analytical criteria: grid characterization, growth pattern and form of urban-expansion areas, as summarized in Figure 3.

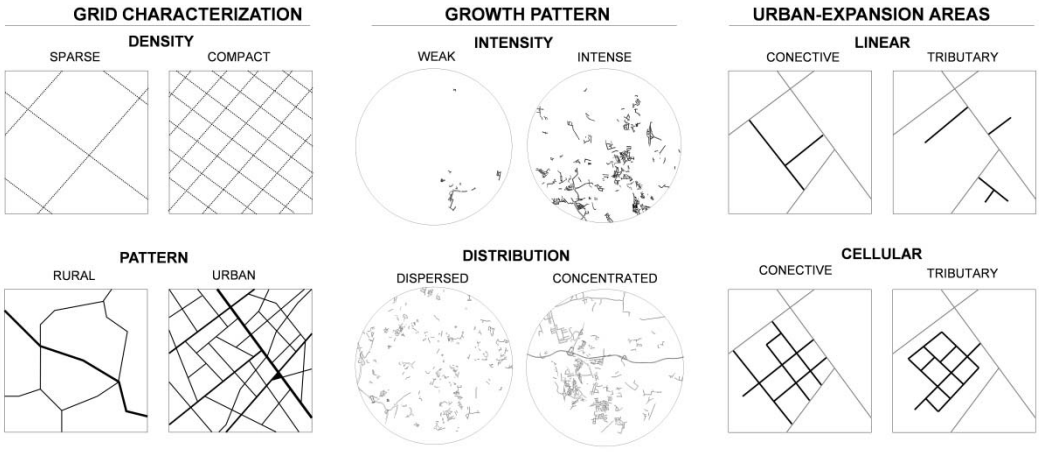

Figure 3. Classification system for grid characteristics, growth patterns and form of urban-expansion areas

For grid characterization we mean its density (sparse or compact) and its type (rural or urban). Since all case studies have the same area, grid density is simply expressed by the number of spatial islands (that is, non-public space islands) in the system. The difference between rural and urban grids, though not quantified, is characterized by the size and shape of their spatial islands. Rural if composed by large and irregular (non-polygonal) spatial islands, hence with low road density; urban if composed by small, regular spatial islands, with high road density. For growth pattern we mean the intensity of growth (from null to intense) and its distribution (dispersed or concentrated). These attributes were identified visually, comparing all the elements of analysis.

The form of urban-expansion areas was classified under a typology created for this purpose, regarding their topological configuration and growth pattern. We have divided them into two large groups: linear and cellular. Linear if based in the creation of linear spaces (streets), cellular if containing new spatial islands. These two large groups where then classified as connective or tributary, regarding to their relation with the existing grid. Connective if dividing existing spatial islands, that is, connecting existing streets and creating new circuits in the graph; tributary if only expanding the perimeter of existing islands without creating new circuits in the graph (except their own, in the cellular cases). From the topological point of view, the scale or size of these expansions is not very important, although very large interventions should obviously have a larger configurational impact. What is really important is the new connections that they create, or not, in the axial graph.

4.3 Configurational analysis

Configurational analysis was carried out on “DepthMap 7” software, provided by the Space Syntax Laboratory, University College London. Axial maps were drawn for each case study and each period of analysis. Global and local integration (closeness centrality) were the first attributes investigated, according to the evolution of their patterns and integration cores. These are two kinds of graphic representation that make the values distribution clear in visual terms. The first one represents this distribution as a chromatic scale on the axial lines; the other one highlights the lines with the highest values (in this case the 10% highest) (Figure 4). Global integration values reflect the degree of accessibility, or centrality, of each space to all other spaces in the system. Spaces well integrated are spaces with high propensity for “to-movement”, that is, spaces that have a greater potential to act as destinations, simply because they are topologically nearer to all locations in the system. We can also make this measure at a restricted radius: calculating the integration value for each space, but only up to a certain topological distance (or changes in direction, that is, moves from one axial line to other). This allows us to investigate the centrality of each space regarding only its vicinity, that is, the accessibility structure of the system at a local scale. Both global and local integration measures reflect the movement patterns at global and local scales. It is commonly found that somewhere between 60% and 80% of the differences in movement flows along axial lines can be accounted for in terms of the configuration of the grid itself (Hillier and Vaughan 2007). Thus, it is now acquired that well globally integrated spaces constitute normally the main active centre of an urban agglomeration, and well locally integrated spaces its main local centres.

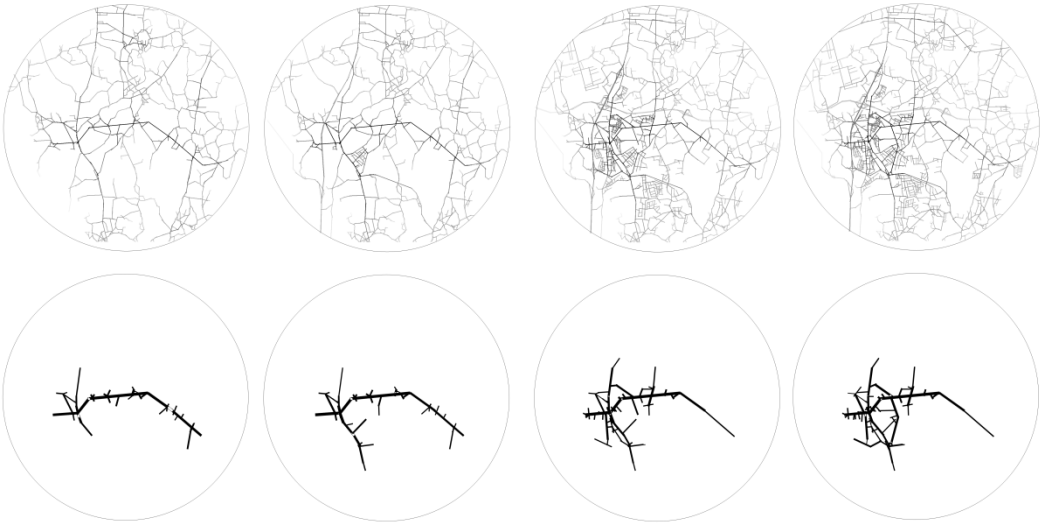

Figure 4. Example of the evolution of global integration patterns and cores

The spatial structures of the study areas, that is, the relation between their parts and the wholes, were investigated next. The scattergram between global and local integration values is the tool for this kind of analysis. Space syntax calls the relation between global and local properties of space intelligibility, and argues that a system’s intelligibility can be quantified as the correlation between both. Let us remember that global integration is a product of the form of the system as a

whole. Therefore, the global importance of a space is an information that is not available locally to an observer. However, as we have seen, it is part of a structural organization that dictates urban functioning through its movement patterns. Knowledge of this structure is therefore essential to understand the city, in order to navigate it or simply to grasp its global nature. That is why cities are said to be intelligible when the global structure reflects the local one, that is, when global integration correlates strongly with local integration (or with connectivity, also a local property). Although theoretical, this concept has been tested in several situations in cognitive experiments with convincing results. Penn (2001) resume these findings. This correlation can also be regarded as a measure of the interface between scales of movement. Such an interface seems essential for the movement economy to work. It has been found that the local active parts of cities, the urban areas that we normally identify as possessing a particular character and activity, show a stronger and steeper correlation than the rest of the system. In addition, the reciprocity between the intelligibility scattergram and the axial map (the possibility to see which line in map corresponds to which point in the scattergram, and vice-versa) allows the study of the role of the parts in the global configuration of the system. The diachronical use of this method also allows studying the evolution of the scatter pattern, in order to understand the evolving value distribution and the emergence or decay of local parts. We have used this method both ways: first looking at the evolution of the scattergram and intelligibility value over the four analysis periods; then, probing in detail the first and last period's scattergrams and axial maps, in order to understand the evolution of the overall spatial structure (Figure 5).

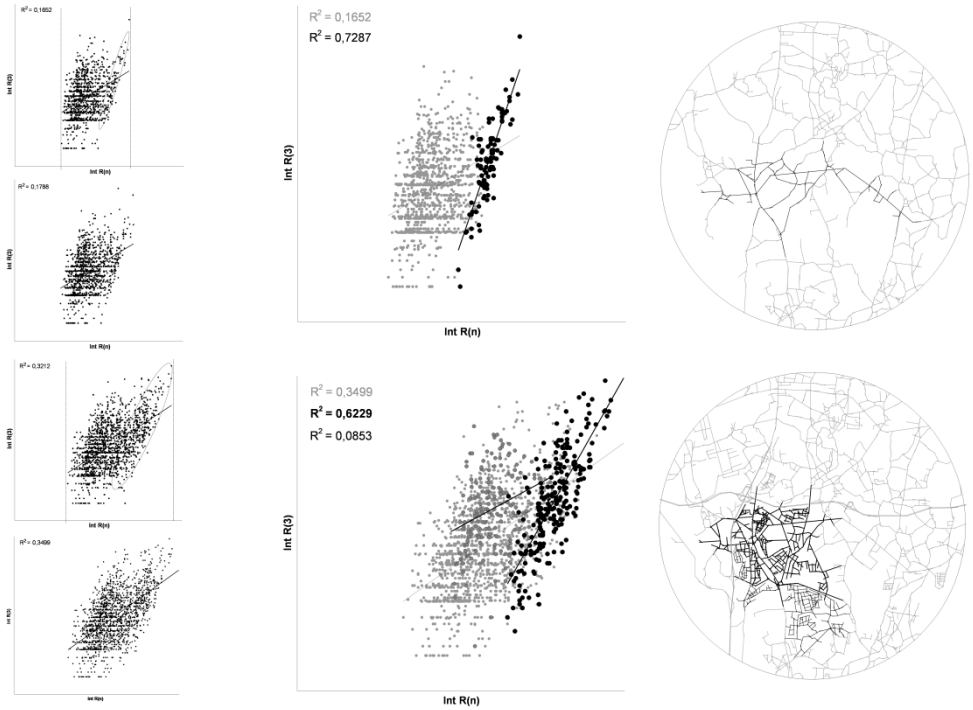

Figure 5. Example of the evolution of spatial structures

At last, the mean values of nine syntactic variables, enunciated in “The Social Logic of Space” (Hillier and Hanson 1984) and considered relevant for the purposes of this study, were quantified for each case study in all analysis periods. It is expected that the evolution of its values may capture some of the morphological specificities of the urban grids. They are as follows:

a) Grid compacity – simply the number of axial lines in the system, since the area of study zones is always the same. Similar to grid density, exposed before.

b) Mean connectivity – the connectivity of an axial line is the number of other lines that it intersects. As a node in the graph, it is simply the degree of that node. The mean value of the system reflects its level of interdependency, that is, if it is made of interconnected or more disconnected parts.

c) Mean global integration – the mean value of all axial lines. Reflects the permeability of the system as a whole, that is, if its spaces are more or less accessible to all others.

d) Mean local integration – the same as b) but at the local level.

e) Mean axial length – the mean of the lengths of all axial lines. Reflects the grid’s linearity degree.

f) Grid axiality – value that compares the actual grid with an orthogonal one with the same number of spaces (axial lines). It is given by the expression:

$$\text{Grd Ax} = [(\sqrt{i} \times 2) + 2] / L$$

where **i** is the number of spatial islands and **L** the number of axial lines. The value varies between 1 and 0, with higher values meaning a greater approximation to an orthogonal grid.

g) Axial ringiness – value that expresses the number of spatial rings in the system, or circuits in the graph, as a proportion of the maximum possible planar circuits for that number of spaces. This can be calculated by:

$$\text{Ax Rng} = (2L - 5) / i$$

where **i** is the number of spatial islands (obviously the number of islands and the number of rings is the same) and L the number of axial lines in the system. It expresses the amount of space that is invested in creating circuits in the graph or less connective structures. As mentioned before, this is a key variable when considering the differences between urban and suburban grids. Urban grids tend to have a much higher axial ringiness, for their circuits are much shorter, that is, composed by less axial lines. On the contrary, irregular and less connective suburban grids tend to have bigger circuits, formed by more axial lines (Dalton and Dalton, 2005).

h) Intelligibility – as explained above, the value of Pearson’s correlation coefficient (r^2) between connectivity and global integration values.

i) Synergy – so-called to distinguish it from intelligibility, but also the correlation (r^2) between global and local properties of space, in this case between global and local integration. Strong correlation also means synergy between movement scales.

5 Findings

In this section we will summarize and discuss the research findings. Non-numeric information, that is, the product of the visual evaluation of analysis elements (like grid characteristics and configurational structures) will be organized in diagrams and summary tables. Numeric information (like urban-expansion areas and syntactic variables quantification) will be presented on charts, showing the evolution of their values over time.

5.1 Summary

We will begin by reviewing the cartographic redrawing results, resumed in table 2. In the first analysis period, the study areas show uniformly sparse and rural grids. The only exceptions are case studies D and E, which by this time already possess zones with urban characteristics, explainable by their early urbanization, product of the closeness and strong relation with the central city (especially case study E). All study areas are crossed by radial roads, linking northern and southern towns to Oporto. Along the study, It has become explicit the known role that this kind of structure has on suburban growth. Not only are they the main growth inductors, but also it is on their intersections with other local important roads that the areas with a more intense growth rate are located.

The way grid type has evolved showed a less uniform pattern. It has been found that case studies B and C, and to a certain degree also A, evolved from uniformly rural grids, to grids characterized by a dense and urban central condensation and a sparse and still rural surrounding area. In these cases, distinction between urban and rural components is very clear. Case studies D and E show a very different evolution pattern. They have less sparse initial grids which become dense earlier, because of their closeness to the central city. Also, and what is perhaps more important, they evolve to a kind of hybrid grid, with no clear distinction between rural and urban components.

As for the growth patterns, all case studies showed an intensity peak on the third analysis period, corresponding to the strong urban expansion that Portuguese cities suffered during the 80s and 90s. The distribution of urban-expansion areas, however, varies considerably between case studies. It is possible to define two groups, one in which urban growth is concentrated (case studies A, B and C), especially during the third period (the most intense), and another in which it is almost always dispersed (case studies D and E).

As we have seen on section 3, street lay-out has great resistance to change. We have found that in all case studies grid growth happens by addition of new structures, not by transformation or erasure of older ones. In this way, a great deal of the former rural landscape structure is kept, notwithstanding the apparent great level of transformation. The rural road structure acts as the background over which urban expansions appear. In case studies A, B and C, these new expansions manage to integrate, or to assimilate, the older structures in a new urban grid pattern, marked by greater linearity and much smaller spatial islands. However, in case studies D and E, the dispersed pattern of small and localized grid expansions is not able to alter the general sinuous and labyrinthine character of the previous rural grid. Urban-expansion areas were classified accordingly to the typology already explained, after what they were counted and their values transformed in percentages of the total number of expansions in each period for each case study. This operation

allows comparing the contribution of each type of expansion to grid growth, in each moment, independently of the growth intensity differences between analysis periods or case studies. Note that higher or lower values don't mean more or less growth intensity, but a higher or lower contribution of each type to the total growth in each period.

Table 2. Grid type and growth pattern evolution

		GRID CHARACTERIZATION		GROWTH PATTERN	
		DENSITY	PATTERN	INTENSITY	DISTRIBUTION
CUSTOIAS (A)	1P	sparse	rural		
	2P	sparse	rural	nill at north weak at south	dispersed
	3P	sparse at north dense at south	rural at north urban at south	weak at north intense at south	concentrated
	4P	sparse at north dense at south	rural at north urban at south	nill at north weak at south	concentrated
VERMOIM (B)	1P	sparse	rural		
	2P	sparse	rural	week	dispersed
	3P	dense central area sparse surronding area	urban central area rural surronding area	intense	concentrated
	4P	dense central area sparse surronding area	urban central area rural surronding area	mild	concentrated
ERMESINDE (C)	1P	sparse	rural		
	2P	sparse	urban central area rural surronding area	intense	concentrated
	3P	dense central area sparse surronding area	urban central area rural surronding area	intense	concentrated
	4P	dense central area sparse surronding area	urban central area rural surronding area	mild	concentrated
RIO TINTO (D)	1P	sparse	rural, with dispersed urban fragments		
	2P	dense	rural, with dispersed urban fragments	mild	dispersed
	3P	dense	mix	intense	dispersed
	4P	dense	mix	week	dispersed
MAFAMUDE (E)	1P	sparse	urban central area rural surronding area		
	2P	dense	urban central area rural surronding area	mild	concentrated
	3P	dense	mix	intense	dispersed
	4P	dense	mix	week	dispersed

The evolution of these values is expressed on the charts in figure 6. From their reading, one can immediately point out the prevalence of linear expansions over cellular. This is an obvious result, given the much smaller scale (hence minor capital investment) of linear expansions. Less obvious is the difference between the first three charts (case studies A, B and C) and the last two (case studies D and E). In the first group, connective expansions (linear and cellular) are always prevalent over tributary ones. In case study C, during the last period, connective cellular expansions even overweight linear tributary ones. However, in the second group, between the second and third periods (corresponding to the growth peak), this trend is inverted: tributary expansions overweight the connective ones. Thus, one can say that case studies A, B and C have a permanent connective grid construction, but case studies D and F, during the period with most intense growth rate, have a predominately tributary grid construction. As we shall see, this fact will be determinant to the evolution of their configurational characteristics.

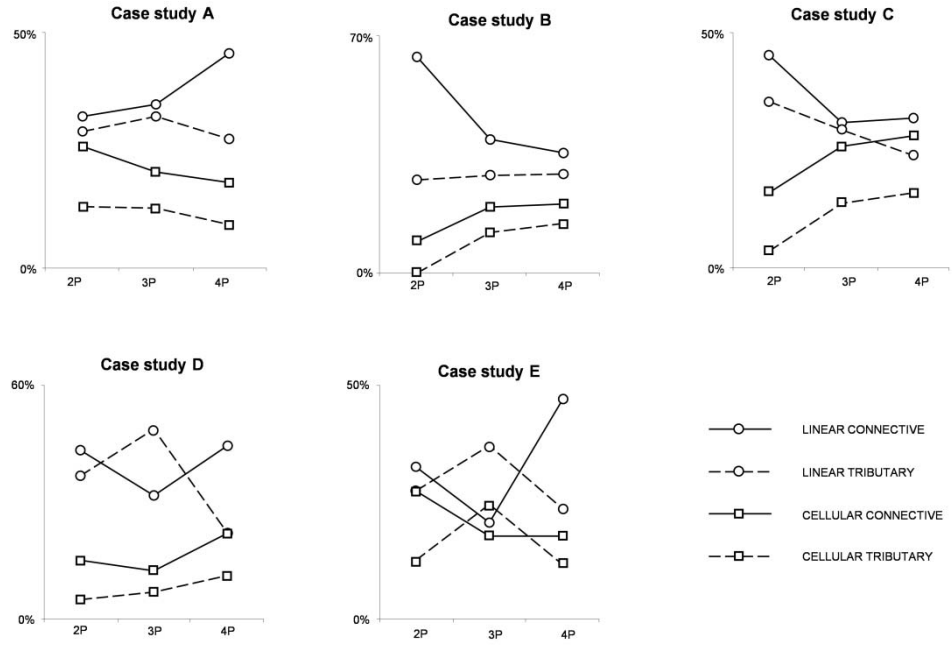

Figure 6. Evolution of urban-expansion areas types

Table 3, which summarizes the results from the observation of global integration patterns, crosses three observation criteria (configurational pattern, dominant spaces and form of the integration cores), with all case studies and analysis periods. For configurational pattern we mean the general distribution of integration values and, if any, attraction inequalities (that is, areas clearly more integrated). Dominant spaces are those composing the integration core in each period, thus the main movement attractors. Form of the integration core is the geometrical shape that these spaces create, which informs about the way they relate to the overall grid.

Table 3. Global integration patterns evolution

		GLOBAL INTEGRATION PATTERNS		
		CONFIGURATIONAL PATTERN	**DOMINANT SPACES**	**FORM OF INTEGRATION CORE**
CUSTOIAS (A)	1P	- Int(R) mean =0,553 Mean depth=26 - Rural grid without attraction inequalities outside integration core	- Radial road (Oporto/Póvoa). - Intersection with local roads.	- Unitary, peripheric.
	2P	- Int(R) med =0,579 Mean depth=25 - Values increase on southern half	- No significant variation	- Unitary, peripheric.
	3P	- Int(R) mean =0,682 Mean depth=22 - Intensification of previous pattern	- Spaces mentioned before - Integration core increases in size	- Unitary, peripheric, complex (reticulated)
	4P	- Int(R) mean =0,693 Mean depth=22 - Intensification of previous pattern	- Spaces mentioned before - Integration core increases in size	- Unitary, peripheric, complex (reticulated)
VERMOIM (B)	1P	- Int(R) mean =0,677 Mean depth=19 - Rural grid without attraction inequalities outside integration core	- Radial road (Oporto/Braga). - Intersection with local road.	- Unitary, central
	2P	- Int(R) mean =0,689 Mean depth=19 - No significant variation	- Spaces mentioned before	- Unitary, central
	3P	- Int(R) med =0,848 Mean depth=16 - Significant increase of values in central area	- Emergence of cluster of well integrated spaces arround intersection mentioned before	- Unitary, central, complex ("deformed wheel")
	4P	- Int(R) med =0,924 Mean depth=15 - Intensification of previous pattern	- Spaces mentioned before	- Unitary, central, complex ("deformed wheel")
ERMESINDE (C)	1P	- Int(R) mean =0,639 Mean depth=20 - Rural grid without attraction inequalities outside integration core	- Radial roads (Oporto / Guimarães). - Intersection with local roads - Train station area	- Fragmented, central
	2P	- Int(R) mean =0,687 Mean depth=18 - Intensification of previous pattern	- Spaces mentioned before	- Fragmented, central
	3P	- Int(R) mean =0,776 Mean depth=17 - Intensification of previous pattern	- Spaces mentioned before - Emergence of more well integrated spaces around same area	- Unitary, central
	4P	- Int(R) med =0,862 Mean depth=16 - Intensification of previous pattern	- Intensifiction of previous pattern	-Unitary, central, complex ("deformed wheel")
RIO TINTO (D)	1P	- Int(R) mean =0,641 Mean depth=21 - Rural grid without attraction inequalities outside integration core	- Peripheral zones (Radial roads and their intersection with others)	- Fragmented, peripheric
	2P	- Int(R) med =0,698 Mean depth=20 - No significant variation	- Dilution of previous pattern	- Fragmented, peripheric
	3P	- Int(R) mean =0,802 Mean depth=19 - General increase in integration values, though without creation of new attraction inequalities.	- Dilution of previous pattern	- Fragmented, peripheric
	4P	- Int(R) mean =0,824 Mean depth=18 - Structuring interventions cause deep changes in central zone	- Emergence of new and extended cluster of well integrated spaces in central area	- Fragmented, peripheric - New fragment in central area
MAFAMUDE '(E)	1P	- Int(R) mean =0,724 Mean depth=20 - Rural grid without attraction inequalities outside integration core	- Radial road (Oporto/Lisbon) - Cluster of well integrated spaces with urban structure.	- Unitary, central, complex ("deformed wheel")
	2P	- Int(R) mean =0,844 Mean depth=17 - Dilution of attraction inequalities	- Dilution of previous pattern	- Integration core retraction - Unitary, central, complex (reticulated)
	3P	- Int(R) mean =0,918 Mean depth=17 - Intensification of previous pattern	- New well integrated areas appear outside previous integration core	- Integration core fragmentatio - Fragmented, dispersed
	4P	- Int(R) mean =0,890 Mean depth=17 - No significant variation	- No significant variation	- Fragmented, dispersed

The initial rural grids have shown integration patterns characterized by general segregation (low integration values), meaning low movement permeability and low accessibility. Also, attraction inequalities are almost absent out of the integration core, which in every case is deep and confined to a few spaces (thus less accessible). This pattern is very pronounced in case studies A, B and C, and less in case studies D and E.

In all cases, grid growth leads to an increase in mean global integration values. Nevertheless, the evolution from the initial general pattern is different between case studies: A, B and C show an initial well integrated (though restricted) area, that increases in size and complexity with time; case studies D and E, although at first with more clear and diversified attraction inequalities, suffer a general "flattening" of their global integration values. Former well integrated areas stagnate or dilute despite their overall intense growth rates.

In all cases, sections of the radial roads (usually their intersections with other local important routes) have shown high global integration values. In case studies A and B (and to a less extent also in C), these spaces constitute the initial centers around which most urban-expansions aggregate, intensifying the grid and giving rise to complex and highly integrated areas. In case study D, however, dominant spaces of the same kind are very peripheral (near the study area limits) and the subsequent dispersed growth leads to their decay. Only in the last analysis period, as a result of localized linear expansions with great impact, case study D is endowed with a well integrated central area. As for case study E, the dominant spaces that initially formed a cohesive pattern, become fragmented later. Disruptions in the grid caused by the appearance of Oporto-Lisbon motorway lead to the decay of former integrated areas, and the dispersed growth pattern to the emergence of new isolated centers.

Integration cores correspond to these dominant spaces and their evolution reflects the stated above. Case studies A, B and C, start with simple and restricted cores that evolve to central, larger and more complex shapes, like Hillier's (1989, 2001, 2007) "deformed wheel" cores. In case study D, the integration core is always fragmented and non-central. Only in the last period it acquires a central reticulated fragment. Case study's E initial integration core (complex and unitary) looses parts and ends up fragmented, as a result of the grid disruptions already mentioned.

Local integration (radius 3) patterns were analyzed in the same way. In all case studies the mean local integration values increase with time. The initial rural grids show a more differentiated structure at the local scale. Several small clusters of well integrated lines, corresponding to old rural hamlets, appear dispersed in all study areas. However, as the grids growth, these spaces loose importance. The radial roads also show well integrated segments at the local level. In case studies A, B and C, grid expansion areas (especially cellular connective type) produce new local integration *focci*, that coalesce in a pattern more or less similar to that of global integration. In case study D and E, regardless of the very intense growth and besides some dilution of former inequalities, grid expansions are not able to create significant changes to the initial pattern.

The analysis of spatial structures revealed more specificities and regularities among case studies (Figure 7). Initially, the rural grids show a very poor correlation between global and local integration values. Adding to this initial low intelligibility, the general global segregation pattern expresses in the scattergrams as the concentration of values in the left side of the horizontal axis.

Also, we found that the local integration values of the initial rural grids (vertical axis) followed a very marked stratified distribution, that is, a variation in steps rather than gradual. This was interpreted as a particular spatial characteristic of rural grids that we will explore later on.

In all case studies, the initial scatter patterns showed that spaces with higher global integration values (corresponding to the global integration cores) stand out of the main cloud, following their own regression line. This means that the initial integration cores are spatially very different from the otherwise rural grids, and much more intelligible. Note that only in case study E these spaces correspond to an already urban grid. In all others, it is more a pre-urban zone, a kind of coalescence point, around which urban growth maximizes.

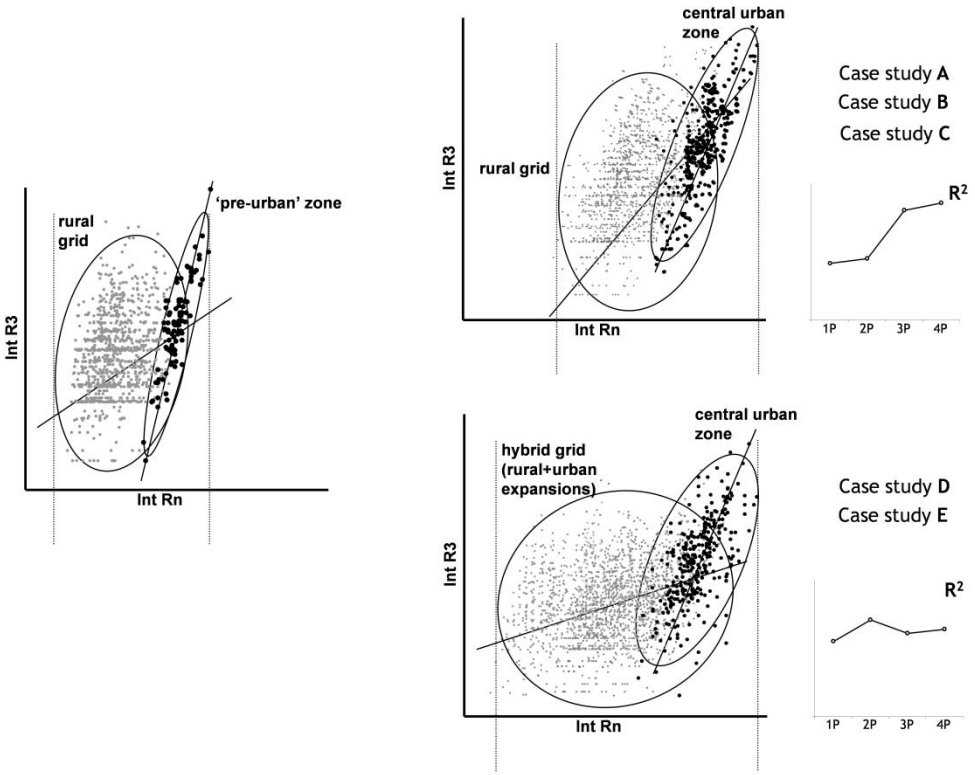

Figure 7. Evolution of spatial structures

Although with the same initial conditions, the spatial structures of the several case studies have different evolutions. In case studies A, B and C, we observed a progressive dilution of the stratified pattern of local integration values, the growth of the well correlated point cluster and the general increase in global integration values and intelligibility (correlation coefficient). The stratified pattern dilution happens not only because the local integration values change (the rural grid is configurationally transformed), but also because new spaces (urban expansions) with better distributed local integration values appear between the strata. Case studies D and E also suffer this effect and a general increase in global integration values, although their scatter patterns show more internal cleavages. However, and this is an unexpected difference, their correlation coefficients (though increasing at first) decrease considerably between the second and third analysis periods,

that is, they become less intelligible. Case study E shows a slight increase in the last period, but without attaining the previous maximum.

Let us now look at the evolution of the values of the syntactic variables (Figure 8), starting with compacity, which reflects the grid density and its growth rate. All case studies reveal an increase along time, with a clear acceleration between the second and third analysis periods. This corroborates previous results. Although there are differences between case studies (with compacity decreasing with increasing distance from the central city) growth rate for all cases is the same. Mean connectivity shows a different evolution. In case studies A, B and C, mean connectivity values follow grid growth rate. In contrast, case studies D and E suffer a steady mean connectivity increase, although under the same growth rate, because their predominantly tributary expansions increase the overall grid connectivity only marginally. This also reinforces previous results about the prevalence between urban-expansion area types.

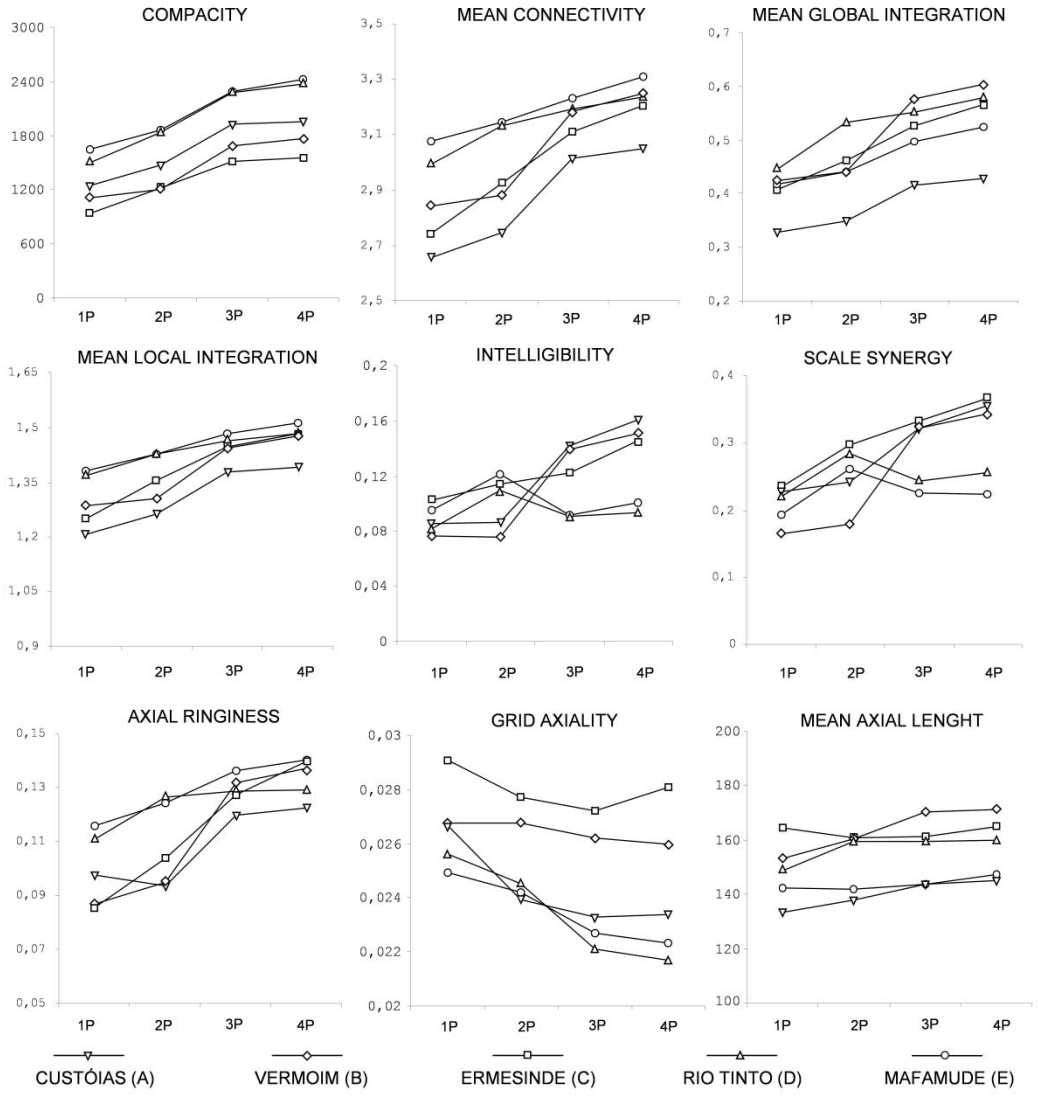

Figure 8. Values of syntactic variables

Mean global integration follows a continuous increase in all cases, although with differences between them. Case studies A and B have an increase pattern similar to growth rate, case studies C and E a steady increase and case study D almost stagnates after the second analysis period. Mean local integration, however, follows the evolution of mean connectivity values. This is to be expected, because at local radius the most connective spaces tend always to be more integrated.

Mean axial length, reflecting grid's linearity degree (not its orthogonality) shows little variations along time, meaning that grid growth is driven by interventions constituted by spaces with small linear development. Grid axiality (or grid's deformation degree when compared to an orthogonal grid with the same number of spaces), reveals how case studies B and C, starting from comparatively less deformed grids, are able to maintain the same deformation level along time. Case studies A, D and E, however, suffer a constant deformation increase. Axial ringiness, already identified by Dalton and Dalton (2005) as a possible indicator for suburban sprawl, reveals great differences between case studies. Although always increasing, it follows closely the pattern identified for connectivity and local integration. Finally, the last two variables, scale synergy and intelligibility, show a remarkable evolution. Again, the division of the case studies in two groups is evident: A, B and C have a continuous increase, but D and E suffer a strong decrease from the second to the third analysis periods. This result indicates that there are profound differences between grid growth processes, in what concerns the production of intelligible urban systems.

5.2 Discussion

The time span considered in this work – fifty years of suburban growth – was enough to make clear the profound transformations that these territories have undergone. The observation of these transformations has shown that in spite of their uniformly amorphous appearance, periurban areas are differentiable by their spatial qualities. Also, their formation processes are not equal, neither their configurational outcome. In discussing these results, we will begin by defining the initial morphological characteristics of the studied grids. As we saw in section 3, these conditions are determinant of urban morphogenetic processes. Next, we will discuss the several kinds of urban growth identified and their configurational outcome. Finally, we will propose a simplified model of the intrinsic spatial dynamics operating in the studied areas.

5.2.1 Initial morphological conditions: the rural grid

The conversion of rural land in urban use is the basic suburbanization process. In this process, existing built structures, like streets, act as long-term constraints on the form of the future urban areas. Thus, the first output of this research should be the spatial characterization of rural street systems, which are the original spatial matrix over which urban growth develops. Rural grids were morphologically defined as sparse and composed by large and irregular spatial islands. Topologically, this kind of grid produces long circuits in the axial graph, most of the nodes having degree 2 or 3, and just a few with a higher degree. Figure 9 shows how we can highlight the rural grid, by selecting only the lines with connectivity less or equal to 3. Other lines with superior connectivity happen to be those making the radial roads or other more linear road structures.

This is exactly the contrary of what happens in urban grids, has shown in Dalton and Dalton (2005). According to these authors, urban grids can be characterized by a high number of small circuits, with prevalence of lengths of 4 and 5. Circuits larger than that are rare in urban settings. On the contrary, in suburban settings, the authors have found that this distribution disappears, giving place to a greater distribution of longer circuits. On their study the authors analyzed and compared urban and suburban American settings. Here, we propose that the same principle can be used to distinguish rural and urban grids. Although different from American "sprawl" suburbia, were circuits with 50 nodes (and higher) are usual, one can say that rural grids differ from the urban ones by the same broad principle. The configurational result of these basic characteristics is a space system marked by low connectivity, low intelligibility and generally segregated (low global and local integration values). Also they are spatially undifferentiated, that is, with very few attraction inequalities. A syntactic interpretation of these characteristics is that rural grids are not created to spatialize any kind of social phenomena (as are urban grids). They are simply dictated by the structure of the rural parcels, and the need to access them. Space function is marginal, of mere access and circulation. As we shall see, if used as the main urban distribution network, and not properly transformed by the right type of urban growth, this kind of grid can drag with it spatial inertias difficult to overcome.

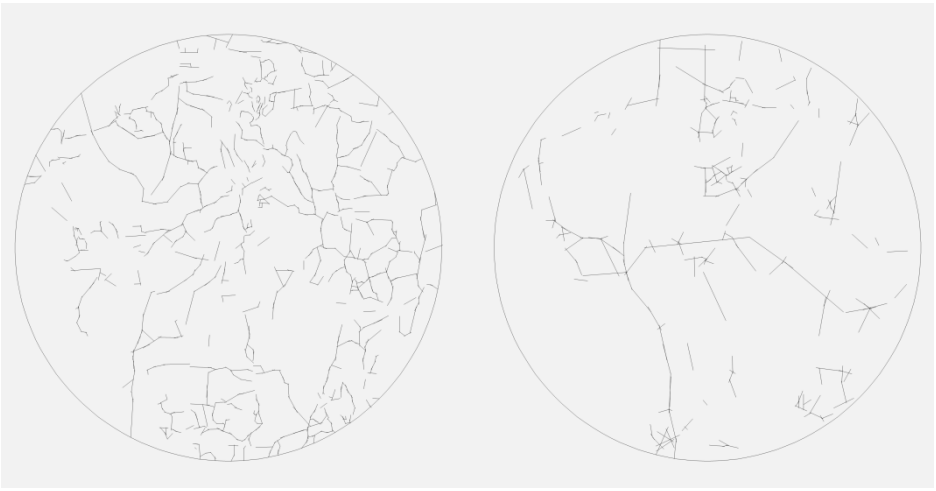

Figure 9. Case study B, first period (1948). On the left lines with connectivity ≤ 3, on the right > 3

5.2.2 Types, forms and configurational consequences of suburban growth

The observed urban growth is not isotropic, nor in space nor in time. First, its intensity varies along time, with periods of intense growth and others of more moderate intensity. Secondly, it shows differences in spatial distribution: in some case studies it is mainly dispersed, in others concentrated. This also happens between different periods in the same case study. We have seen that concentrated growth gave rise to clearly defined urban areas (case studies A, B and C), and that dispersed growth lead to hybrid grids, without clear distinction between urban and rural components (case studies D and E). The configurational outcomes of these two types of urban growth were also different. Concentrated systems were able to create well integrated and more intelligible urban

centers, while dispersed ones became more spatially undifferentiated with time, and above all, less intelligible (Figure 10).

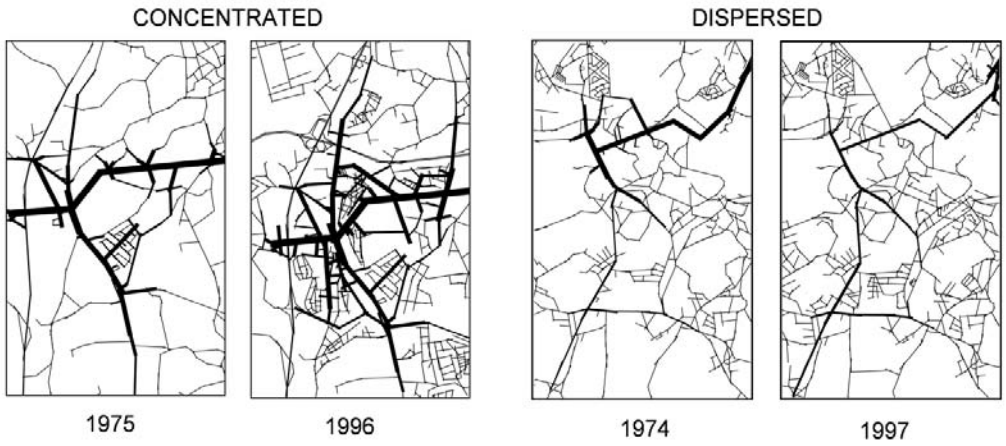

Figure 10. Configurational effects of concentrated and dispersed urban growth: intensification and dilution of attractions inequalities

Configurational analysis brought other insights into the spatial dynamics operating in the urban fringe. It has become clear how singular interventions on the spatial systems can have profound configurational consequences in their development, both positive and negative (Figure 11). As a negative effect, we could point out the urban barrier effect observed in case study E, caused by the construction of the Oporto/Lisbon motorway. This infrastructure has created disruptions in the previous grid, leading to the decay of former well integrated areas and to the division of the study area in two separated parts, with different accessibility levels. It is important to stress that this is not a local effect. Introduction of urban barriers, like the one observed, can cause spatial imbalances even at considerable distances from where the fracture is created. Also, this effect is not an inevitable consequence of this kind of infrastructures. Case study B has several roads of this kind, without showing the same effect, because grid continuity is maintained almost intact. What seems critical is the way disruptions are created (or not) in the grid, which is a subject easily assessable by configurational analysis.

Positive configurational changes were also stated, which we could call “spatial correction effects”. In case studies A, C and D, small scale linear interventions, still connecting strategic points, were able to change considerably their integration patterns and cores. These can be mere grid linearization operations (reducing its axial description) or more extended interventions, connecting separated parts of the systems. In case study D, an entire new configurational center emerged in the last period, as a new municipal connection knitted the formerly disjointed local grid. Note that are not the new spaces that become central, but also many existing spaces, that were formerly globally segregated.

These results suggest the extent to which configurational analysis can be a useful tool in a context of relative scarcity of resources, but imperative need of effective periurban spatial planning, allowing to test and chose planning options of potential great scope, but little budget spread.

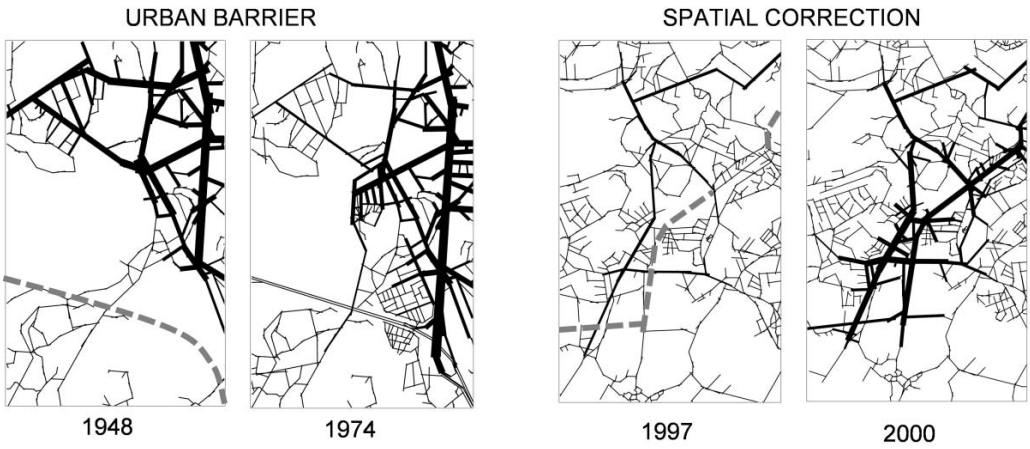

Figure 11. Urban barrier effect in case study E and spatial correction effect in case study D

But the main finding of this work is the relation between the types of urban-expansion areas building the grids, and the evolution of the systems' syntactic intelligibility. We have seen that some case studies showed an ever increasing intelligibility, while others suffered a sharp decrease during the period of most intense urban growth. These results, so different but still in areas so close and under the same metropolitan growth pressure, show that there are non-explicit processes conditioning the intelligibility of local spatial systems. To isolate those processes, making clear what in some cases leads to the emergence of intelligible systems and in others not, can be a useful contribution to planning options definition. In fact, it is accepted that syntactic intelligibility translates a positive quality of urban systems, regarding functional and psychological effects. The concept assumes that we use cities and architectural spaces as exosomatic structures, that is, as something external to us, but that stores information that helps us navigating and using it. Alan Penn (2001) puts this in a very clear way:

"Human cognition of this exosomatic structure would therefore appear to be central, not only to our ability to navigate around the world, but ultimately to our ability to live a social and economical life. It is perhaps for this reason that unintelligible environments are also so personally as well as socially depriving in their effects.

If the part of our cognitive apparatus that allows us to predict others whereabouts, to act socially, and locate ourselves with respect to others in an intentional way is exosomatic – located in an environment constructed largely by others – we are disabled if that apparatus is poorly structured."

If the differences between growth distributions can explain the configurational patterns previously stated, they are not enough to explain such a differentiated behavior regarding the systems' intelligibility. What seems to be determinant is the prevalence that urban-expansion areas assume throughout time. If we compare the charts showing intelligibility evolution with those showing urban-expansion areas prevalence, the relation between the two factors becomes clear (Figure 12).

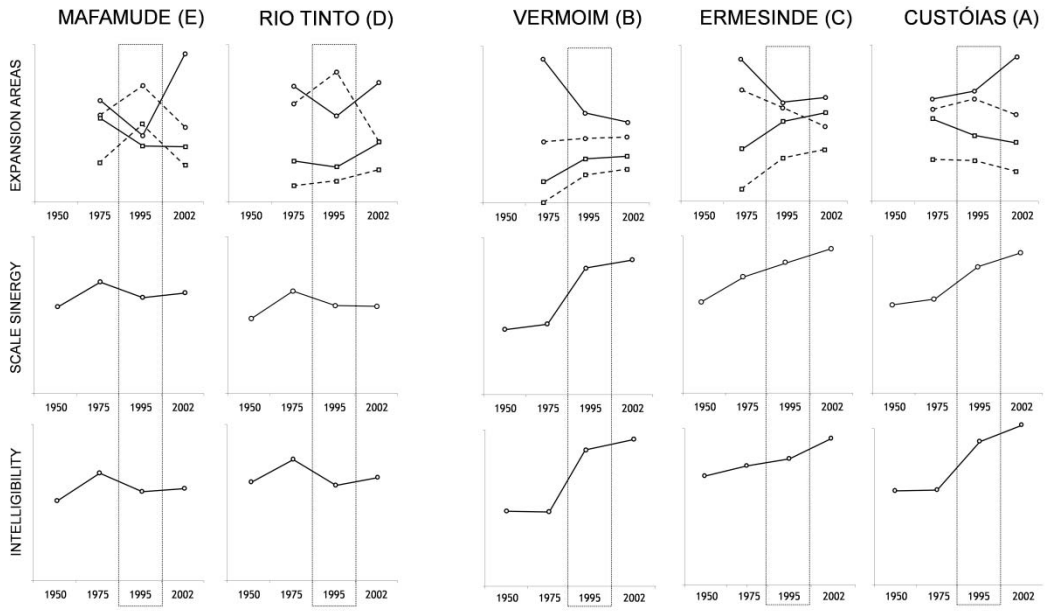

Figure 12. Relation between urban-expansion areas types and systems' intelligibility

We can see that it is exactly during the period when tributary forms overcome connective ones (case studies E and D), that intelligibility and scale synergy break down. In other words, there seems to exist a direct correspondence between the prevalence of tributary forms and intelligibility decrease. This hypothesis is corroborated by the evolution of other syntactic variables, as connectivity and axial ringiness. Connectivity shows that, although under the same growth rate, case studies E and D, become less connective with time than case studies A, B and C. Obviously, this happens because their growth is predominantly composed by tributary forms. Axial ringiness shows that tributary growth is mainly increasing the size of circuits in the graph, by increasing the perimeter of existing spatial islands. This recalls again the conclusions of Dalton and Dalton (2005), when these authors point out the importance of axial ringiness as a benchmark for the spatial classification of urban and suburban systems. In this sense, we can also say that tributary growth stresses the suburban character of the systems, while connective growth improves their urban character.

5.2.3 A simplified model of periurban growth dynamics

Next, we will present a very simplified model of the spatial dynamics operating in the studied areas, created to test the validity of the previous conclusions. The model tries to reduce the formal complexity of the real situations to much more simple patterns, though simulating their general configurational properties. We will start by simulating the stated properties of rural grids. A simplified network that tries to embody the topological properties of rural grids should have large graph circuits, composed by nodes with a degree of 3 or less (mostly 2). It also should have an axial ringiness close to the mean of the initial grids, which is 0,099 ≈ 0,1. The network on Figure 13 tries to reproduce these characteristics.

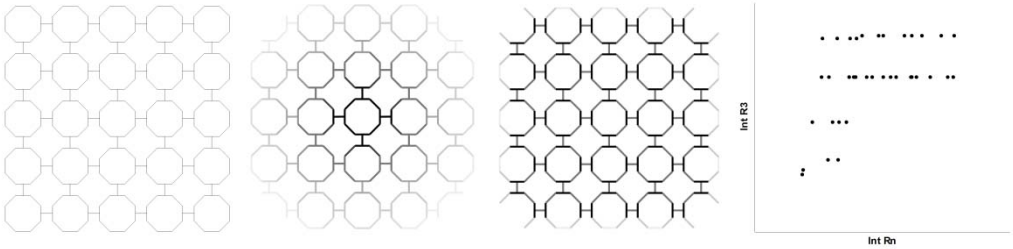

Figure 13. Conceptual grid 1

Though completely regular (made of octagons linked on four sides), and morphologically very different, it shows configurational properties similar to rural grids. Its axial ringiness is 0,096 ≈ 0,1 and all its axial lines have connectivity equal or less then 3, with strong prevalence of bi-connective lines, organized sequentially. It has circuits with 8 and 16 nodes, similar the axial description observed in rural grids. Global integration pattern is concentric because of the network's total symmetry, but the strong relation between the local integration pattern and lines' connectivity is evident. As the intelligibility (synergy) scattergram shows, this network produces the same stratified pattern in local integration values that we saw in rural grids. It's easy to conclude that these strata don't correspond to any spatial unity, but to dispersed lines in the network, only with the same connectivity values. Also, the network intelligibility is also low (0,2592), close to the initial grid's mean intelligibility (0,21).

Obviously, this is an extremely simplified approach to reality. We can improve it with other spatial structures, like the radial roads that were present in all case studies. These were more linear structures than the rural grid, made by longer axial lines with higher connectivity. if we introduce something similar in our model, the outcome becomes more likely (Figure 14).

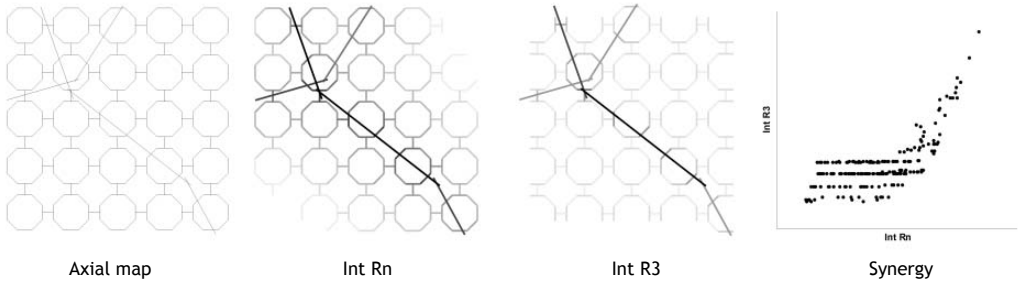

Figure 14. Conceptual grid 2

Global integration pattern is no longer concentric, but dominated by the longest and more connective lines, and spreading from them. Notwithstanding the obvious differences in size and regularity, this network shows many similarities with the study's initial grids, where a uniformly segregated rural grid, was dominated by roads of greater linearity and spatial accessibility. Looking at the intelligibility scattergram, we can also see that it has become similar to those seen before. We

have a first set of points, highly correlated, corresponding to the spaces recently introduced in the model and to those directly connected to them. And a second set, corresponding to the previous pseudo-rural grid, maintaining the stratified pattern. This set of points is much smaller than in real cases, because the real grids are much bigger than the model. For the same reason, intelligibility is now 0,4804, much higher than the initial grid's mean intelligibility. However, the proximity with what was observed in the real cases allows the simulation of the identified growth patterns. The present intelligibility value will serve as a reference to assess their consequences.

By simplicity reasons, both kinds of grid growth (connective and tributary) will be analyzed separately and only for linear forms. We can simulate tributary expansions through the random addition of new lines in the model, with the only condition that they do not create new connections between the lines of the previous grid (new circuits in the graph) (Figure 15).

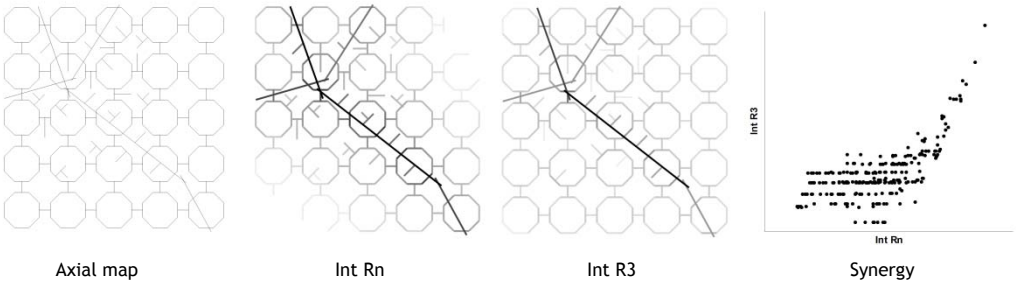

Figure 15. Conceptual grid 3

The new global integration pattern differs little from the previous. Lines that were connected to the octagons grid reproduce its structural characteristics, increasing the stratified pattern in the scattergram. Similarly, those connected to the longer lines add to the set of most correlated points. Thus, we can say that these transformations do not change the rural grid characteristics; on the contrary, they emphasize them. Also, intelligibility decreases, from 0,4804 to 0,4289. Despite the model's great simplicity, this behaviour is very similar to case studies D and E, which had losses in spatial hierarchy and intelligibility during periods of tributary growth.

In order to simulate connective growth we may simply extend the lines introduced before, creating new connections in the grid. Again, this has been done randomly, without the concern of creating any kind of particular network.

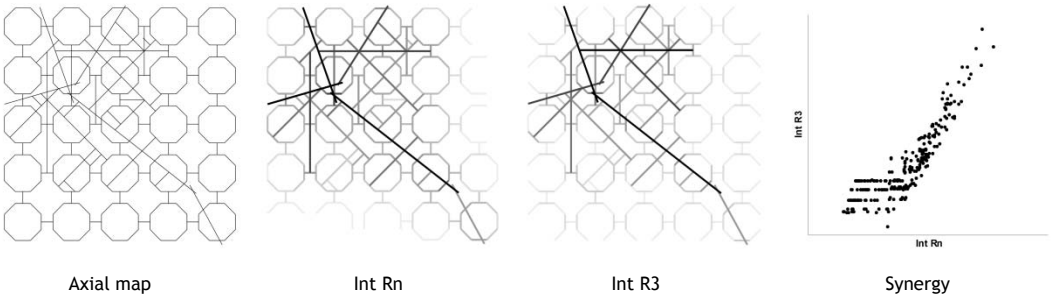

Figure 16. Conceptual grid 4

Several of the new lines appear highly integrated. Parts of the rural grid show also high integration values, changing the system's spatial hierarchy. The scattergram reveals how the octagons grid, intercepted by the new lines, loses its stratified pattern and joins the set of most correlated points. Intelligibility rises to 0,7677. These effects seem to reproduce what we have seen happening in the central zones of case studies A, B and C, were this kind of connective expansions transformed the rural grid in intelligible urban areas.

This very simple model, though avoiding innumerous aspects of reality, was able to recreate theoretically some of the empirical findings of this study. Its results, and those stated before, can be translated in a set of basic planning prescriptions for periurban areas, aiming at the creation of favorable conditions for the emergence of intelligible urban systems.

6 Conclusions and Recommendations

Periurban areas present a challenge to urban planning. The apparent lack of order of their grids makes their spatial planning seem an almost impossible task. However, configurational analysis as proved that this is not so, and that under the homogeneous confusion of the surface there are structures and growth dynamics with qualitative differences. The knowledge of these structures and their dynamics is the first step to be able to control and direct them. This study has pointed several conclusions in that direction:

- First, that rural grids (the initial matrix over which suburban growth develops) have a configurational structure intrinsically different from urban ones, without the pattern of attraction inequalities on which movement economy depends. Their consolidation by urban growth or their use as main urban movement networks can therefore drag spatial inertias of difficult overcoming.
- Second, that suburban growth assumes different spatial distributions, with also different configurational outcomes. Two types of distribution were identified: concentrated and dispersed. Concentrated growth distributions gave rise to genuine urban areas, with complex structure and clear attraction inequalities. Dispersed growth distributions gave rise to hybrid grids, with no clear distinction between rural and urban components, marked by a progressive dilution of attraction inequalities and loss of syntactic intelligibility.
- Third, that the evolution of the systems' syntactic intelligibility is conditioned by the morphological nature of urban-expansion areas, defined in this study as connective and tributary. Tributary forms lead to intelligibility decay and to the stressing of negative rural grids characteristics. Connective forms transform positively the rural grid and lead to the construction of intelligible systems.

Bearing in mind these conclusions, we can now propose a set of recommendations for the spatial planning of periurban areas. More than narrow and rigid normative criteria, we need prescriptions that are able to inform a highly uncertain and necessarily decentralized planning activity, in tune with the way cities grow and change:

- A planning activity based more in the knowledge of the structural characteristics of public space systems and less in concepts of functional nature, as occupation rates or land use zoning.
- The definition of strategies for public space systems' development rooted on their configurational properties.
- The instrumentalisation of urban growth as an engine for the implementation of previously defined spatial strategies and for the progressive transformation of the rural grid.
- The development of local land use policies based on the concentration of urban uses, enlarging and densifying existing or emerging urban areas, but discouraging dispersed and random growth.
- The promotion of a grid construction made by connective expansions shunning the tributary type. This is a low level morphological prescription, thus not difficult to fulfil. It could be implemented through planning instruments but also through the collaboration with agents of urban change. Though apparently modest, such a simple measure would have a positive global impact.

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Urban Material Analysis and Sustainability: a new methodological approach towards urban planning

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At a time when planning research is under pressure to better respond to sustainable development, revision on the urban planning models and available planning tools and methodologies has been claimed. This paper reveals a methodological approach towards planning that takes into account the analysis of the urban material dynamics as the principal indicator for the guarantee of the sustainability condition. It does this by exposing the existing relationship between the urban material dynamics and sustainability as the elementary tool to access the sustainability problem, and to approach city planning itself. In order to do so, it reveals the results of an on-going investigation, supported on the urban material flow analysis, of a case study area of 33 ha - *Brañas de Sar*, situated at *Santiago de Compostela*, Spain. This research aimed to identify in the spatial organization of *Brañas* and within its relation to the material dynamics of Santiago, the elements that allowed its functionality, in the traditional city, and their current ruined condition. The different elements that one should take in account to intervene with a planning proposal includes the physical aspects, the resources management over the territory, and the strategic approach account, towards the implementation of a sustainable urban model for the city of Santiago. The results of the case study revealed for *Brañas* the opportunity that future interventions in such site could contribute to transform it in a sustainable manner, and that such transformation would have implications at the city scale itself.

Keywords: Sustainability, Urban Material Flows, Urban Planning, Methodology, *Santiago de Compostela*

1 Planning and Sustainable Development

The negative effects of the industrial city have intensified the call for action towards the improvement of the quality of life in the city and of its environmental impacts in an ever-increasing number of publications, world conferences, research programmes and planning proposals.

In the centre of the debate of the Sustainable City, is the general agreement that the present city as we know it today, live and manage causes unsustainable environmental impacts, as well as significant economical and social pressures. And that was greatly contributed by the first warning towards the safeguard of natural resources for future generations with the WCED's Brundtland Report in 1987. Sustainable Development was defined as "*development that needs to meet the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987, p.8).

It was in 1990 with the Green Paper on the Urban Environment (CEC, 1990) that a vision for a European city would be set up, in order to have the capacity of offering protection to natural

resources and a healthy environment for its inhabitants in accordance with prevailing socio-economic conditions. Therefore, prompting municipal authorities, national governments and private organisations to face up to the declining quality of urban life in Europe. In 1992, attention was focussed on how to assure the implementation of sustainability, at the United Nations Conference - 'Earth Summit', in Rio de Janeiro, through the establishment of an Agenda urging all countries to achieve sustainable development, for all decision-making levels.

From the Aalborg Charter in 1994 to the 2002 Rio +10, additional commitments have been addressed in order to sustain our global environment and improve the quality of life of human settlements. Both authorities, at international, national, and local levels have engaged themselves with the responsibility to sustain the patterns of production, consumption, transportation and settlements development, thereby preserving opportunities for the future generations. Such conscience has been sustained on the fact that sustainable management and urban development is one of the critical agendas for the 21st century, as it is estimated that half of the world's population is now living in urban settlements, and it is believed that the world's population will rapidly grow to 8 billion by 2025.

Indeed, the city and its urban environment became a worthy laboratory for analysis, prompting several studies and discussions on how to achieve a more sustainable urban environment. However, although there is agreement on the sustainable development definition, there is no consensus on how this later term can "*be translated into development 'on the ground'*" (Williams et al, 2000, p.3). Testifying such fact is the high number of planning approaches that have been attempted and discussed in order to achieve a more sustainable city and urban development.

Preceding Williams et al (2000) remark on such lack of consensus on how to translate sustainable development 'on the ground', a call for investigation into the benefits and dangers of high-density urban living was solicited by the editors of the book 'The Compact City / A sustainable Urban Form, in 1996 (Jenks, 1996). An insight into both the theoretical debate and the practical challenges surrounding the compact city confronting sustainability was the main achievement of this book. The interest in sustainability provided the stimulus for another publication, not from the point of view of the compact city, but on urban form in general. Thus, in 2000, 'Achieving a Sustainable Urban Form', contributed to the debate on sustainable urban form, where different problems and complexities involved in defining and developing sustainable urban form were explored in several ways by a wide range of interests. The result was that as referred by Williams et al (2000), and the reinforced support for the compact city model.

According to Frey (2000), the compact city model was also well supported by The Urban Task Force report, directed by Lord Rogers, and its recommendation of 'The Compact and Well Connected City' with a clear urban edge (outer boundary) to protect the country, and that represented the United Kingdom recommendations towards the improvements of quality of life in the urban areas.

An equivalent Portuguese approach to the above mentioned report was published by Portas et al (2003) and entitled 'Urban Policies – Trends, Strategies and Opportunities'. Its main goal was to study the emerging urban forms and urban systems in Portugal and therefore visualizing the formulation and implementation of public policies and systems of planning and regulation. More specifically, it examined the complexities of the new urban geographies and the problems they

presented for spatial policy coordination and adequate forms of urban governance (Portas et al, 2003).

A debate on the form and structure of the city that was also addressed by Hildebrand Frey (2000), when addressing the diverse ways as to what ought to be done to improve the city's environmental impact. Wherein, Frey claimed that the results of such discussion is confused and inconclusive, not just because of its complexity but also because of the lack of precision in the description of urban models and a lack of focus of arguments. In the centre of Frey argument is the fact that there "*is no unimpaired evidence that one or the other city model would have a significantly higher or lower level of energy consumption, and investigation of the relationships between transport systems, densities and energy consumption are also largely inconclusive*" (Frey, 1999, p.33).

Urban planning and its relationship to sustainable urban development do live times of great uncertainty. There is not any available answer on how to achieve a more sustainable urban development 'on the ground', or a sustainable city. A call for more adequate forms on resolving such open debate is therefore required.

2 A useful vision on Sustainable Development and Urban Development

In consequence, there is an ongoing debate on the integration of the necessary actions to achieve a more sustainable development in the scope of the urban planning, and on how planning must change in order to confront a city and a territory that is the expression of a society, based on a sustainable economic model.

How it is possible to have a useful vision on sustainable development from the urban planning point of view? To do it, it is necessary to define sustainability and, later, to analyse the relationships between this definition and the urban planning field, its competences and its tools.

Sustainable Development is a recent demand, generated at the end of 20th century and expanded from 1990's. The question is: Why now? Why not at the end of 19th century, or 18th century, or before? Sustainable development is the consequence of a social recognition of the environmental impacts from the industrial productive system. Environmental impacts generated by the continuous waste dump from productive and consumer systems.

Before the industrial revolution, all traditional productive systems were based on the use of the biosphere: soil, substrate, climate, slope, vegetation and fauna. The biosphere produced the mandatory material dynamics from the relations between its elements. Therefore, the traditional societies operated by transforming this material dynamics to produce the necessary material raw to satisfy their social needs.

To do it, traditional societies modified the landscape, operating on elements of the biosphere, using social work to built permanent structures or transforming natural processes by punctual interventions. At the end, all resources were extracted from this modified material dynamics, generally biological materials. But the productivity maintenance from the biosphere depended on the return of the nutrients to the soil, extracted with material raw. And, in this sense, very important parts of the productive activity in the traditional societies were involved in the return of the nutrients to the soil and on the maintenance of the fertility.

Through the fossil fuels contribution to the empower of force, it was systematically possible to control the access to the mineral resources, and with that, the previous limitations to the use of the biosphere, as supposed by the human societies, was no longer a problem to the continuous growth of the power production that run in parallel to the production growth (Wrigley, 1987). Therefore, it offered Humanity a new vision of unlimited materials based on the enormous well of resources of the lithosphere, mobilized by the fossil fuels and on the new power plants that allowed the extraction of such resources.

A new productive model that no longer depended on the remainders return to the resources sources, as traditionally managed in the organic societies, was consequently inaugurated. On the contrary, the remainders return to the mines would have inhibited the continuing extracting of more new resources. This new productive model - the industrial productive system - makes use of a linear material dynamics, in which all the extracted resources of the terrestrial crust are spilled to means in form of consumption or waste production (Georgescu-Rogen, 1971; Naredo and Valero, 1999). A spill of residues that works by making use of the air and water as dispersion vehicles, to conduct gas, solid and liquid residues into the ground and atmosphere.

That spill of residues, consubstantial to the industrial productive model, is the main generator of the environmental problems that affect our planet, including the most relatable ones such as the climatic change. Causing to a great extent the combustion residues of the materials that contribute to produce the needed energy that guarantees the industrial productive system to work.

Aware of the environmental degradation and of the existing relationship between such degradation with the industrial metabolism, as well as conscious that also the technical industrial system does not recognize in such degradation a limitation to the productive capacity and to the subsequent need to control it; society has understood that it must act socially, by limiting the contaminating capacity of the productive system. It does this by adapting it into a system that does not destroys the environment and therefore allows its maintenance, at the same time that maintains the resources sources. This is a limitation to contamination that constitutes the ground action towards a productive model and socially sustainable.

The Kyoto Protocol together with all the alternative mechanisms to control environmental disorders, taken after Kyoto, as the European directives on water and solid waste, do embrace such social strategy. This aims to restrict the waste discharge capacity of our productive system and to orient it towards sustainability. Thus, it is a strategy that has a decisive application role on cities, on their planning and on their management.

If sustainability is being requested to the material dynamics of the industrial productive system, any interpretation on its application to any area of social activity should be based on the relationship between such social activities with the material dynamics. Therefore, its applicability on the urban planning should be effectuated based on the interpretation of the relationship between the city and the material dynamics, the metabolism, and the society (Bettini, 1996; Terradas, 2001).

The production of a given product comprises a spatial restriction based on mobility costs. Given the ability to perform the required transformation processes, the production of a specific quantity of product does requires an ability to collect the necessary resources, to transport them to the place of production as well as to distribute it to the consumers.

The spatial density of resources and the spatial density of consumers operate, as significant factors to the productive system, and that density is determinant for the spatial factor that should be understood in terms of accessibility, understood as the inverse to the mobility costs. Wherein, the access to the resources and to consumers results as a limiting factor of the production capacity.

The capacity to access the communication channels (rivers, roads, sea ports) together with the capacity of materials transportation allows the collection of resources and distribution of products, creating opportunities to increase the production rate, which is limited only by the capacity of these means of communication. Thus, enabling a new order of distributing the different activities on the ground, and the productive capacity of the entire system.

The market corresponds to the first element of this system. Wherein it expresses the distinct ways of distributing the labour work over the slightest de-homogeneous productive capacity of the territory. When there is a market, some might discontinue their produce goods, while others will increase their efficiency by dedicating themselves exclusively to the most productive activities. In the end, the transportation costs will constitute a determinant factor in order to distribute all activities.

If there is market, the specialization of the territories that allows trade will suppose an increase of the global productivity in the resources exploitation of those territories where trade takes place, thanks to the efficiency of each territory on exploring their productive vocation. The market must be understood as a machine that increases the productive capacity of the territories, and as the physical place where such production is exchanged.

The market is a place of trade that is determined by the spatial particularities that conforms the territory. Mainly by accessibility and the greatest possibilities of connection with the rest of the territory, according to people and materials mobility. Thus, the market is a place that is defined by the material dynamics of the productive system.

After a certain volume of trade, the market becomes itself a high-density centre of consumers. Thus, all those that use the market for trade are potential consumers. Activities whose productivity does not directly depend from the soil, but which can count on the market to obtain the needed resources for their productions, will also take place on the market place. Together, those urban settlements and the market will generate the city.

Thus, the city - as the physical place of the market - gets transformed itself into a place of production and consumption. It is a place where resources do arrive and are later transformed into products in urban productive activities, which are independent from the territory. These are the products that are needed to maintain the urban population, and that are traded in the city, such as the waste production of the urban consumption. Therefore, the city is a high-density focal point of mobility and material dynamics.

This is an urban material dynamics that organizes itself through the city infrastructures, and that defines the urban form. Where the urban form can be read as the result of the urban material flows matrix that is organized through it. An urban form that can be regarded as the control took for the material dynamics of the city, or as a response to it. And a response that must cope with changes of the productive capacity of the territory, the mobility ability of the territory or the social demands that stimulate production, such as, the changes of the productive model.

3 The case of Brañas de Sar in Santiago de Compostela

During the first half of 2008, the first two authors of this paper carried out a work, commissioned by the Consortium of the City of Santiago de Compostela, to verify the functionality of a specific space named Brañas de Sar, while challenging an urban planning approach that should protect the environmental values of the area.

Santiago de Compostela is the capital of the autonomous community of Galicia, located in the northwest of Spain. A monumental city that since the 9th century constitutes the principal destination for pilgrimage, and that at the European scale crosses several countries through a complex network of roads. UNESCO has classified it as World Heritage. The city's model that has guided the development of Santiago de Compostela has valued its historical centre not only through is built patrimonial value but also as a living core, supported by daily life, and therefore preventing its conversion into a mere object of tourism consumption.

Brañas de Sar is an area of 33 ha, located on the Southeast area of the historical centre of Santiago de Compostela and is limited by the River Sar. This river configures the valley located in-between the surrounding elevations that do also sustain the historical centre of the city, but from which is separated by a group of heavy communication infrastructures. The new urbanisation - City of Culture - located at Mount Gaiás, at the Southeast of Brañas de Sar, constitutes a cultural complex with a considerable size and regional scale. It aims to host activities of global significance and therefore receives people from all around the world, thus placing Brañas de Sar in a central situation, that requires an urban planning action in order to prevent speculative processes that could destroy its urban potential.

The work commissioned supposed the characterization of the space of Brañas regarding the development of future planning actions to manage the city of Santiago de Compostela towards a more sustainable model, in conjunction to the patrimonial support of the city. To do this, it was elaborated an analysis of its functionality in the past- what was Brañas? - present - what is Brañas? - and future possibilities - what can be Brañas ?– of the space of Brañas de Sar in the urban material dynamics of Santiago de Compostela.

3.1 What was Brañas?

Brañas are the remains of a very specialized area of a much larger agricultural complex, characterized by the river and water run-offs and that has produced an exclusive situation, that was therefore explored by man, who in turn, recognized its differentiated capacities and related them to the rest of the complex.

In the aerial photograph taken during the 60s (Figure 1), where it is possible to appreciate the space of Brañas and its surroundings, the traditional organic management system is still visible, as it is still possible to distinguish the organization of agrarian space, in which the River Sar is characterized as a distinct place, with a another texture and differentiated from the all the rest, and generated by the use of water.

Figure 1. Aerial photograph of Santiago. On the top of the image it shoes the old historical centre, and in diagonal - from the right top to the lower left side - the River Sar course runs through Brañas de Sar. The Mountain that is located at its right side is Mount Gaiás

The Mount Gaiás - where today lies the City of Culture – exhibits on its west side a parceling distribution hanging perpendicularly from its top until the valley. This represents the dynamics between the cultivated parcels and the exploitation of the mountain that is expressed in the line that separates them.

In the cultivated parcels, their division into very narrow stripes, is differentiated through separating lines of crops, exhibits productive strategies that combines different needs, such as restrictions to mobility in the turn of the *lameiros* or the protection against the spread of plagues, which entails the distribution of the road network that allows the access to the fields and to the hill.

Like any cultivation field, Brañas used to receive organic material of low quality, disorganized, in the form of nutrients that with support of the solar energy and of the human and animal labour would transform it into organic matter that would be assimilated by animals and/or man. The difference between Brañas with the surrounding areas, is that the organic matter arrives in Brañas dragged with the water from the river entire water basin, and especially from those places where the organic matter is concentrated: the villages, towns and cities.

While the regular fields were nourished through the result of a complex process of transformation of materials, obtained from the mountain, through the collecting, crushing, and mixing with the excrement produced by the animals and other waste, and its transportation and distribution over the fields, Brañas was a natural collector and a natural processor of organic matter. It was formed by a system of irrigated fields, a powerful producer of a variety of organic matter, such as grass, that was conserved and exported as fertilizing to the fields through the animals' digestion. Thus feeding other remote areas and maintaining the significant labour force that would allow its maintenance. It formed part of an integrated strategy of agricultural fertilization, of the nutrient cycle, which embraced a scale that was five times bigger that the surface of the irrigated area.

The Brañas area was, at that time, limited by the rest of the environment, through a limit that was established by the management possibilities of the river water gravity, and that conformed the hydraulic area, which expressed itself with the dynamics of the river, as the use of its water for irrigation and to provide mills and tanneries with the needed power force from the water course.

That hydraulic space was determined by the capacity of channels availability that, while keeping the water supply top level, conducts it on one side of the river and allows the irrigation of the limited spaces, through such channels or by the river (figure 2). In turn, these channels could benefit from the elevation to obtain the necessary mechanical energy, which would mean the loss of the water used to irrigate the fields if situated above the peak output of the mills, both upstream and downstream. The distribution of the resource requires a complex interrelation between the different needs.

This generated hydraulic space is easily recognizable in the picture through its texture that differs from the other cultivated fields. A line that is defined by a channel and, in some cases, by the strict cut line that divides the cultivated parcels from those that are flooded. A functional change that is recognizable also in the parcelling system and on the names attributed to the groups of parcels, which were registered on an archaeological report, showing the different uses that occur on both sides of the channels.

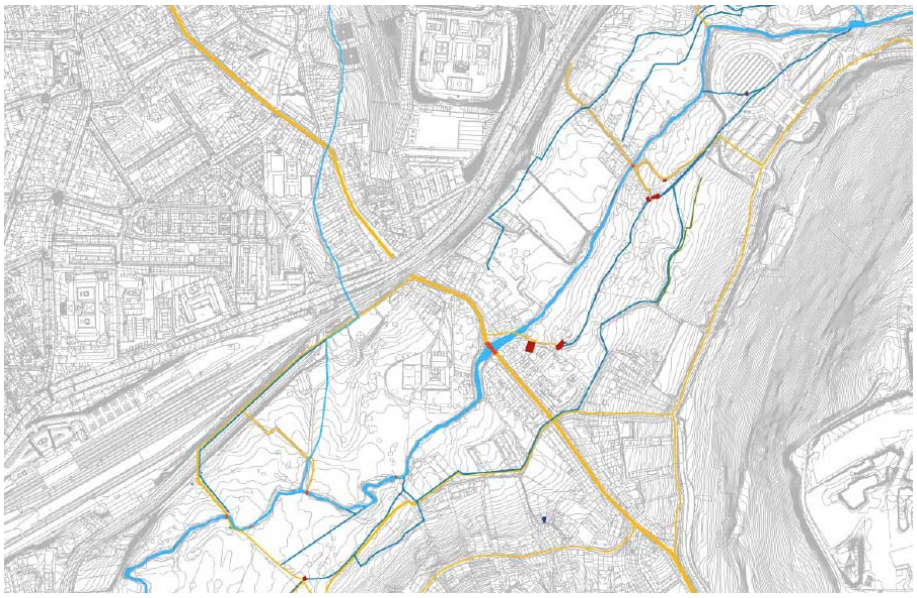

Figure 2. Roads, watermills and water channels in the area of Brañas de Sar, over a recent plan

The space of Brañas was a strongly individualized area, in terms of uses and applied techniques, very different from its surroundings, but with whom established a barrier in function of its technical possibility to generate differentiated uses. Different, but not at all unrelated to the shared material flows, as these were driven by the biosphere processes – water flows, direct or through the river – such as through the man force or the use of animals, as assimilators and force of transportation. Brañas was functionally so different from the other agricultural landscapes – as also

the agricultural fields of the mountain are very different – and inserted on a system which determined its size, its uses and functionality.

3.2 What is Brañas?

In summary, Brañas is a sophisticated space for the recovering of the organic matter that has been drained from the populations, and the nutrients that have been mobilized by the water drainage from the agrarian areas. It is a filter that filters the water to obtain the most nutrients possible, material that should be returned to the productive cycle, through the most efficient possibility to do so – food for the animals to be transform into labour force and nutrients assimilated by the plants - and therefore transforming it into an essential tool in the inevitable strategy to close the material cycle, that requires the use of the biosphere environment.

An area that works with the water cycle and therefore at the water basin scale. That receives the materials from the upper levels and that sets the conditions – chemical, biological and mechanical – in which will the water flow will conduct. Therefore, a space that is absolutely dependent from the material flows that, organized on the upper levels, and that will supply the Brañas area. A space that is therefore a consequence of these processes, and whose configuration and utility will be the expression of such flows: Brañas is the expression of material flows that operated in the upper levels of the water basin.

Therefore, it is a very sensitive to any alteration of those processes. Variations on the proportions and addition of strange materials could reduce the efficiency of its functionality and destroy its soil. It is an area that needs to evolutes by changing the material flows, which express the material dynamics changes in the territory.

When society changes from an organically technical system to an industrial society based on a mineral technical system, the material dynamic changes. Also, it changes into a model that uses mineral materials in an open cycle. Thus, now, the flow that runs in Brañas is a waste flow that is delivered by the industrial city. That flow destroys the biosphere, which has altered its productive capacity by feeding the soil and the river with materials that will destroy them. And to protect Brañas, it was necessary to remove the water, which in turn mobilizes these pollutants, and that have arrived from the water basin.

Because Brañas was also an area linked to the productive social needs, its functionality cannot be understood without the restoration of the fertility that has been lost through the runoff from the fields and from the city. It is an area that has lost its productive meaning, as it is no longer needed to guaranty the closure of the material cycles, nor necessary to recover the needed nutrients.

3.3 What can be Brañas?

Brañas is an opportunity if its territorial discourse and its relationship with the city can be restored, as it already covers almost of its entire watershed. Is a key opportunity for the definition of a strategy that allows the water return into the city and transform it as the principal ingredient for the establishment of sustainability, by recovering the closing of the urban material cycles, in particular, that of the organic material, and that coincides with the social pressure to disperse all waste.

Obviously, the conformation of Brañas area has inherited from the traditional production systems that somehow survived in the form of patrimonial assets. Such as the prevailing parcelling plots, a number of agricultural practices, the same soil, the canals in use, the management elements, all leftovers of a former reality and supported by trivial incomes from part-time activities. Leftovers of a former functionally that proved to have survived in despite the changes of agricultural practices, or on the introduction of new infrastructures or new uses. Finally, remains of a departed traditional society that can also be found in many other places, such as in the countryside or even in the city, and that co-exist with the knowledge and sensitivity of many citizens.

And to take this opportunity, Brañas needs to be a strategy that values the organic land fertilization in opposition to one based on chemical or industrial origin. Thus, that assures the return of the water and has a strategy that promotes the closing of the material cycles. These are the main goals for a sustainable urban intervention in Brañas. Goals that do however exceed the strict geographic limits of Brañas area and that spread out through the city and have transformed Brañas project from the beginning of the process while extending it to the rest of the city of Santiago de Compostela.

Recovering the water

The first major goal that one should consider to operate in Brañas is to recover the water. To do that one needs to recognize that working in Brañas is to work on its water basin. Brañas is not an isolated area, but instead the expression of the material dynamics of its basin. Recognize such water basin and the dynamics that operate within it and of its material flows, and operate on them in order to allow the return of the hydraulic dynamics to Brañas, is the necessary step to restore that space.

The water deviation from the water basin towards the major collectors was hitherto required to preserve the biological quality of river. A quality that is threatened by the high levels of polluted water that arrives from the city, with a water dynamics that is affected by the urban metabolism and by the modification of pluvial water flow forced by the waterproofing surfaces and the water collecting in the city sewer system.

The conclusion of the works on the Sar collector, that runs along the same river, has contributed to the creation of a parallel river that carries the waste material, and drives the energy from such waste flow from Santiago, and that only returns the water to the Sar when this water becomes acceptable to maintain the necessary quality for the biological capacity of the river. This infrastructure assures the water control for the next 25 years, so that the pollution problems would have been solved; however with the high cost of regulating the river dynamics until it became a little more than a decorative element; the operation that determines the environmental quality of a naturalized area is in fact to segregate it. Unwrap the network of material flows that embrace a city whose material dynamics would tend to destroy it, would exhaust it. And in this case would lose its territorial sense. The general collector should be read instead as a scalpel that in order to protect Brañas and the river, it amputates its environment.

But those twenty-five years represent an opportunity. A time during which the city can recover the river, at the same time that it works over the causes that have forced the city to withdraw the water to a collector that runs in parallel to the river, and that is hidden beneath the soil. An

opportunity that is a needed, since the European water directive demands the increase and guaranty of the natural quality of the water, and that implies the gradual abandonment of water as a mere disseminator of waste to the environment.

Additionally, in twenty-five years many of those waterproof areas of the present urban surfaces will be renewed (if urban planning allows its existence). All roofing, flooring, water drainage points, etc. will be renewed at that time, at least superficially, so that the renewal of its porosity – allowing water infiltration into the pavement – or its holding capacity and contaminants filtration – with the use of vegetal covers, when that is possible – or the replacing of the heavy metal made pipes – such as zinc or copper – can significantly change the urban water runoff.

On the other hand, the control, the reduction or the elimination of the sources of pollution such as the motor transport based on fossil fuels (if allowed by the urban planning), the use of rubber and contaminants on the tires, the smoke and other scattered points of gas emissions, fixed or mobile, must be a norm in that period.

In turn, the release of mineral contaminants will allow improving the quality of the residues of the water decontamination from the domestic water, as well as the possibility of using natural purification systems or, at least for large populations such as Santiago, the refining of the effluent. More importantly, it will allow reintegrating the organic matter removal in the form of a credit quality.
Work is needed therefore in the water basin of Brañas, in the form of: analysis and pollutants detection, such as strategies proposals to eradicate possible sources of pollution; studies on the possibilities to control pluvial runoff, appropriate surface treatments, infiltration and release of water arrival when facing heavy infrastructures.

Return the water to Brañas and restore its river, represents the first step to restore its territorial vocation, its identity. Therefore it will allow the return of the material dynamics expression of its water basin, and of the city. A city that rests on a non-pollutant material dynamics that controls the pollution and laminates the water at its source and not at the end point. Brañas owes its conformation and function to a group of dynamics that can support and generate an urban metabolism that can be productive and sustainable.

Recovering the productive function

The second main goal of a sustainable intervention in Brañas should be the recovering of its productive function. A productive function that cannot be regarded as a mere folk recreation of the past, but that allocates the definition and the structure of a functional and productive space, which is recognized by the society.

A production function that connects the material flow and that can be managed from the green spaces. A productive function that is able to recognize and profit from Brañas specificity, and the significance of its space for the recovering of the nutrients and of the high productivity.

A productive function that should not be considered as a marginal ingredient, but rather the expression of a much broader strategy that is entirely implicated with the urban material dynamics management, and that is able to connect Brañas area with the city and its territorial environment.

A functionality that should not turn the space of Brañas into something similar to the new build city collectors: these are not more than an engineering built element disconnected from the citizens

life, hidden on the underground, which hides the problems and moves them further down. It should rather be a valorisation tool for the social participation in the urban management that requires civil participation, through the direct responsibility and involvement of the population on the resolution of the problems of the city.

And, that is capable of recovering the traditional heritage, here understood as a living knowledge. A traditional knowledge whose recovery does requires new basis to express itself. Bases that allow the recognition of the proposals legitimacy, and that however represent economical knowledge - of the environment management to obtain resources - which unlike most of the industrial technical systems do not export their industrial costs in the form of environmental externalities. Basis that allows to condensate such knowledge into a new reality that recognize and updates its value.

And to create it as the most appropriate tool it must be an urban green strategy that outlines the global functionality of the city green spaces and of its surroundings, based on the understanding of their functional vocations and on the required urban needs. Complementary to the provision of environmental quality spaces that allow social activities that today demand for green areas, the urban green spaces network can play a number of integrative functions as a tool for the regeneration of the urban sustainability. Besides their territorial ecological role and bioclimatic urban functions - as an urban-filter of the polluted air, shade, long wave radiation control, wind barriers, lighting control - the water runoff control and its capacity to recycle of organic matter, offers a functional value to the vegetation, that from a sustainability vision, deserves consideration on a strategy at the city scale, that organizes it and makes it efficient.

The various sizes and varieties of Santiago's green areas do witness the magnitude that such structure represented in the past and its importance to the urban functionality. Recognize each part value, its potential in terms of size, type and position, and even more importantly the possibility of relating it with neighbourhood areas and their complementary roles is therefore necessary. This has already been acknowledged by the most completed and available green strategies as the *Plano Verde de Lisboa* (Ribeiro Telles, 1997), but will also allow the recovering of a hidden city legacy, a lost inherence that should be regenerated and placed in value by a sustainable planning.

Thus, the requested closure of the organic material cycle and the water runoff management are the main outlines that will allow the connection of Brañas area with the city, therefore by means of the enhancing of its functionality as part of a green strategy. To understand the role that the specific size area, significance and position – urban and territorial – of Brañas is essential to define the strategy and to implement it.

4 Conclusions

The first conclusion is that there is no general agreement, universally accepted, on how does the relationship between urban planning and sustainability allows the achievement of a framework for an ecological urban planning, or of a sustainable urban development 'on the ground', or a sustainable city. Uncertainty about the timing and the political legitimating of the environment contamination restrictions, as the ones resulting of post-Kyoto compromises, also don't help to make evident the urgency of such a general agreement.

Thus, the debate on the integration of the necessary actions to achieve a more sustainable development in the scope of the urban planning should be reinforced, in order to answer to the following question. How does planning must change in order to confront a city and a territory that is the expression of a society, based on a sustainable economic model?

Secondly, the case of Brañas exhibits an alternative model of planning intervention that is not the conventional one, although under a sustainable development vision. The aims for "*what Brañas should be"* demands for innovative ways of planning, in which, the urban material dynamics represents the main tool for the recognition of the role of the urban space and of support to the potential of urban planning intervention towards sustainability.

The intentions expressed require a plan of action with specific contents, as rules for urban regeneration and for public space design. These are tools that can take open green urban spaces as a field of action, and where step by step a new methodological approach towards urban planning based on the urban material analysis will emerge, spreading the ecological regeneration from the green spaces to the entire city. Green strategies can start on the green fields, but they should finish on the "grey" infrastructure of the city.

In this sense, the acceptance of the urban material dynamics as a crucial factor to guaranty the planning sustainability might transform the entire objective of the urban planning. Shifting it from its present function, as a mere organizer of activities along the territory, until it is converted as the main hub of integration of the required mechanisms that guaranty the material dynamics of the city, in order to achieve its sustainable transformation by means of the new social demands against waste emissions.

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Microclimatic (MSC) scenarios: innovation in environmental urban planning. Redefining urban sustainability in the space between buildings

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In a context of a great uncertainty respect to the future of the world and the cities, it is necessary new and innovating processes for building sustainable cities and public spaces. In front of this scenario, the local sustainability perspective establishes that public space maintenance and care between constructions or urban micro space acquires great relevance for the social cohesion, citizen interaction and urban sustainability. Cities recovery as coexistence fields requires increasing spaces qualification and activities diversity in order to make them more comfortable and pleasant for the citizens. This paper describes the urban micro space construction process from the sustainability perspective as well as a new method of environmental-urban planning which incorporates microclimatic scenarios as a new tool of analysis to redefine urban sustainability in the space located between buildings. At the same time, it replaces the methodological linearity by a heuristic and iterative management among morphological, constructive, materials and climatic variables, key factors to define building environment and its performance. The conceptual development of this new planning perspective has as a purpose to understand the system of relationships among the site, the architecture, the specificity of the climate and the inhabitants' comfort. This paper concludes emphasizing the influence of climatic variable upon neighborhoods, human activities and energy loads. It concludes describing the building process of scenarios to mitigate the impacts in the micro urban public space and to advance towards sustainability.

Keywords: urban micro space, microclimatic scenarios, environmental urban planning, environmental variables

1 Introduction

On a global scale, urban policies are focused towards environmental, economical and social sustainability achievement at all levels, promoting saving-rational use of all energy resources as essential part in built urban territory planning. Some advances have been achieved in planning and environmental design. Nevertheless, in many Latin-American and Venezuelan cities rapid expansion, urban development increasing, population and activities concentration in urban cities produce urban planning disarticulation within the environmental topic, climate and its interrelationship with urban morphology keep being ignored by those who have the responsibility of creating urban spaces which affects the use of exterior space – especially between buildings – and the built habitat sustainability.

At this moment, when cities around the world are suffering great mutations in their growth-expansion and manifestation of this transforming process spoil urban environmental quality, the need for action at different scales on public space it is clearly expressed, creating new and innovating tools that promote space use, enjoyment and appropriation, as well as sustainable changes in urban field. Facing this perspective, planning and urban-environmental design acquires great relevancy for cities recovering as living areas, social cohesion and interaction among citizens and demand increasing spaces qualification and activity variety in the exterior space implementing new and creative strategies for protecting and getting profit of natural resources, as an answer to urban and architectural problems.

In this study, the adopted approach points towards microclimate scenarios production as a testing and sustainable design tool of the microspace – among buildings – based upon different urban morpho-typological characteristics and roles, microclimate conditions, solar radiation, wind and vegetation and their interconnection. It is a multidimensional method to build the microspace and a new sustainable vision in order to improve living conditions, as well as the rational use of energy in the built environment. The value of this work is to state how to empower microspace relationships and conditions, since such a vision that equally brings together urban, environmental and social variable, extending its scopes, not only in the different levels of performance but as a possible strategy of being applied in the different urban zones.

On the other hand, the last goal is to encourage the use and appropriation of public microspace, promoting through planning and sustainability, an active role of the various dimensions of the site – spatial-temporal-environmental-social – in order to establish guidelines and principles of ordering and environmental-urban control that encourage the good use of natural resources in the different locations and minimizing energy expenses to improve comfort conditions and act systemically as rehabilitators of urban space.

2 Urban sustainability. Local sustainability

A new vision of sustainable urban design is the result of urban visions, urban paradigm change and building based on political world program of sustainable development. Alborg's letter in 1994, pointed out that "the city is the biggest entity capable of initially tackling the numerous architectural, social, economic, political, environmental imbalances and of natural resources that affect the modern world and it is the smallest unit in which problems must be properly solved in an integrated, holistic and sustainable way" (European Conference on Sustainable Cities, 1994). But the advance requires a commitment that goes beyond rhetoric, there must be priority to optimize, diversify and to regenerate the existing city, promoting the most efficient use of the built, intensifying and rescheduling the urban net. Planning must include change and reconsideration, understanding where citizens' life is developed. Our projects must fall into the creation of systems that contribute to create new nets of interpersonal relationships through public space in different urban scales.

In the study of a New Public Space, Eco-Valle (Vallejo et al, 2005) states that urban plans that guide the growth of our cities follow a model that systematically repeats itself overlapping it to different geographical, physical, climate and environmental realities. Public space is planned without identity features, it appears as a sterile field of activities and without minimal conditions for developing the necessary social life that a city is. The same study points out that the city is not built by impulses looking only to solve specific problems, designing objects (whether buildings or urban spaces) in an isolate way, no matter the relationship they have for and to the city. The city can be planned from buildings, whenever it offers a continuous interrelationship between public and private space, between the citizen and the individual, between the artificial and the natural. In these spaces of meeting where 'the static with the dynamic', 'the opened with the closed', 'the full with the empty' mix together, it is where we can find better support for buildings and hence, for the city as well.

According to Kees (2006), in Echo-neighborhoods in Europe, sustainability in urban design covers a wide spectrum of non-technical fields, the sphere of social behaviours and that of the spatial

organization can influence in the grade of sustainability of urban concentrations. From the point of view of design discipline, the term sustainability is centred on sustainable technology and urban and social integration. This vision of sustainability in urban design highlights the aspects linked to: social cohesion, public-private relationship, climate orientation and efficient use among others.

3 Urban microclimate control

Architectural and urban design practice has been done without considering impacts that produce in the environment and reverberate in the imbalance of urban mean and population comfort. The natural-climate mean, object of interventions has not been properly treated, and in most cases, it introduces aggressively to the man through temperature, humidity, insulation and wind. Therefore, climate needs to be controlled in order to attend man's needs.

Microclimate influences determined thermal aspects in urban spaces in an integrated relationship. According to this topic of Climate and Architecture of the Center of environmental and Energy investigations (1997), the site appears as context and environment, as well as a great determinant of the urban and architectural problem. The main physiognomy of the site together with climate variables establishes variations; the distribution of temperature conditions and winds create different and perfectly defined zones with exposed zones to climate factors with different qualities and different microclimates (SMC). In urban performances, it is necessary to consider even the microclimate level of the most immediate environment – between buildings – in order to adapt conditions of the environment to human comfort. These microclimate conditions must be controlled to generate quality and attractive spaces to the user.

Among the conditions that influence microclimate of urban and architectural performance, it is the built mean as a determinant factor. Urban and built morphology affect thermal stability and energy interchange possibilities among the built mass and the environment. Building factors, position and height respect to colliding buildings intervene in the possibilities of energy supply and ventilation. Environmental variables, orientation and relative position of the built mass contribute to define space condition regarding to atmospheric agents and can constitute in obstacles to radiation and/or ventilation of space. Vegetation considered as intervening of climate factor in the different micro-macro scales of space can cause temperature variations between close zones and light air flows that improve energy balance.

From this approach of urban and architectural design, these considerations sustained in local handling, climate, orientation, sunlight and wind are essential to improve urban field as well as living conditions; they admit local resources, sun and wind as energy saving resources. These considerations also emphasize the convenience of acting from the most immediate environment, from building design and its adjacent spaces, factors management that affect climate variables can modify its values in the requested sense. That means to use building-urban resources to generate required climate parameters to produce-perceive comfort sensation. This approach starts from the reflection about man-mean-environment relationship; it states the connection and adequateness to the present and, at the same time, it offers a perspective of future. That is to say, the projection toward an energy and ecologic future more balanced to promote a qualitative habitat and to open perspectives in urban sustainability field.

4 Urban microspace construction from sustainability

In everyday life, relationships and spaces in which normal activities are spread out is where attention and effort should be focused in order to improve life conditions and cities, desirable scenarios for developing community activities and social interaction (Gehl, 2006). In this sense, use and appropriation of public space promoted from sustainability can improve habitability of urban exterior space and it constitute a good basis for building process of public urban microspace (UM), as well as to promote collective activities that can become in a valuable experience and a good start.

In Eco-Valle study (2005) it is considered states that building urban microspace has a double aim: one aim of social feature that encourage the generation of activities and the second aim has an urban-environmental characteristic, because it looks for conditioning and climate comfort of public space. This place must work as support for multiple activities and events, even beyond what it can be planned. A space where inhabitants of such living areas can interact freely, they can be identified with space and have protection and comfort. Hence, it is necessary to choose strategies that guarantee environmental quality, exterior space conditioning and building from multidimensional perspective considering the two aims mentioned above – social and climate comfort features- in order to promote the re-generation of public space.

5 Multidimensionality of urban public microspace building process

When exploring about the topic sustainable urban spaces, some authors consider it as privileged field for urban strategies formulation, understood as instruments of transformation and qualification of cities (Novick, 2003). According to the new forms of considering what is public, the reinsertion within the idea of normative space must be considered the multidimensional or meta-topic condition that involves interacting variables in space as elements of cohesion to build innovating scenarios in planning and urban-environmental design as well as in the redefinition of urban sustainability. The rescue of public microspace as a consolidated space (Ochoa, 2004) implies to integrate the pertaining sense and physical meeting into urban space, in order to overcome the isolated conception in space building and the actual capital losses condition in usage and appropriation of microspace by users-inhabitants. Considering that the most important quality of these spaces is the presence of people, activities and events, it is necessary to combine intervening factors to achieve more attractive and meaningful community spaces be.

In the study of new sustainable communities, Kees (2006) it is proposed to use the term “Situation” to describe the new condition of urban microspace in all its complexity. It is referred to the capacity ordinary situations have to keep elements together which are frequently very heterogeneous and to give them a common meaning in a relevant criterion of urban spaces as well. The term situation (taken from strategic planning) is useful, because it deals with recognizing a moment in the continuum process of spatial, temporal and social transformation, where space is involved. It is and integral approach consisting of a simultaneously sustainable urban strategy vision, instead of a linear plan, in consecutive phases. Simultaneity and lines density of the approach turn around a net capable of capturing the complexity of different elements. It is a method that allows facing the complexity of the study, recognition and multidimensional solution of public urban microspace.

Physical Dimension

In the conditions for space building, Gehl (2006) states that *in life between buildings*, physical dimension or physical environment influences the composition of activities. Activities achievement, usage and space appropriation is determined by physical configuration (morpho-typological) which combined with environment can create better or worse exterior conditions (what we call SMC) and also animated cities or without life. In his book "The Social Life of Small Urban Spaces", White (1980) describes the close relationship among urban space qualities and civil activities. By means of physical environment design, it is possible to influence the models of activities to be developed and in the optimization and use of urban space. According to White, although physical frame does not have direct influence in quality, content and intensity of contacts, this connection is important. The form can influence the possibility of social interaction and physical dimension bears a quality that can itself motivate users, make time of space use longer and widen the spectrum of activities in the exterior.

Undoubtedly, physical context has a crucial and direct role; sometimes architecture can literally be an obstacle to desirable activity models. Physical disposition can encourage or inhibit the contact among individuals according to limits, distances, levels and orientation. On the other hand, spatial physical structure gives an order that provides to the individual a series of social, spatial and temporal reference points. The physical structure reflects and supports the desirable social model and it is manifested in organizing and distributing the elements to create spaces which function is promoting the scenario for daily activities. The mixture of different typologies and the attention to public and private relationship can remarkably enhance social cohesion in space. Cohesion level increasing of the users group can act as mechanisms to establish gradual corrections. These mechanisms are effective in "micro" scales so that the user can modify and self identify with the built environment. The user-inhabitant has seen his participation limited in the urban ecosystem. We assume as a goal his incorporation to develop the urban microspace. Therefore, public microspace must be thought as a unit, where physical, climate and social components come in to order space as dimensional stimulus which condition built spaces and give its character to constitute spaces of life and social relationship.

Social Dimension

The model of sustainable social space admits non-delimited forms of public space programming. Space will be successful only if it is used continuously. In order to know the perspective that guarantees the social aim of space, it is necessary to achieve an approximation to what some authors have described as public space in city, "conjugation of space as a place for the most elementary action of social production" (Habermas, cit. in Joseph, 1999) and of public as a site of common interests. Linked to these two concepts, it states that public space is presented as a shared space, in which spontaneous and fluid relationships are achieve, generated from interaction systems among users, in established contexts. Such scenarios are places in constant reformulation, due to appropriation since its use is instead a process (Lefèbvre, 1991 in Ghel, 2006).

From a social perspective, space is known as "social space", a place in which social life goes on. "Social space is a social product". It refers to the conjugation of a *material context* that acts a

source and resource- and to the *social relationships* that establish individuals as *users*, by means of *processes* they function form their own *spatial practices*. This concept highlights the interaction – material context, social relationship, users, processes and spatial practices- and makes evident the implicit complexity in the building process of public space, in different urban scales. Social structure and physical structure provided with community spaces permits displacement offering major security and more sense of pertaining to exterior zones. The zone that the individual perceives as pertaining, the living environment can spread much further resulting in major use of public microspace. Space gradation makes possible major interaction among inhabitants. Try out different exterior spaces results in major surveillance and collective responsibility as part of living habitat.

In other words, in urban context, talking about public space is to deals with organized *macro* spaces for interchanging, until dealing with those *micro* spaces that constitutes from improvised or planned interaction of users. This possibility is a dominant tendency in how actions are organizes in order to improve public space quality. That is to say, to look for local and exclusive improvement of a given environment named public “microspace”. According to actual concept, when defining public microspace is crucial that a space is capable of reaching regulating levels that allow determination and satisfaction of minimal necessary conditions. So, public space is reduced to a microspace that can quantitatively be defined (physical area, spatial and environmental conditions and population) and it loses the singular public space condition. All these mean that new forms of conceiving public space are being generating, the public and private gathered in microspaces where searching needs satisfaction is achieved together with others, generating affective links that allow sharing common urban space and creating sense of pertaining.

Environmental Dimension

Environmental dimension management depends on climate knowledge and its effects in the built elements, as well as in the exterior surrounding. It is necessary to know the intervening climate factors within the urban micro space, especially thermal effects and air effects produced by the elements that compose the urban environment. Exterior public space is defined by temperature, humidity and air quality that surrounds our bodies. The object today is to study of its surroundings and activity, as well as its necessary means for its concretion.

Some researches about urban energetic equilibrium highlight sun incidence in built space and radiation effects that reach surfaces and building becoming in latent heat. This heat produces earnings by absorption and reflection which instead, increase surface temperature and exterior air. Thermal forces that act from the outside combine radiation effects and convection as a product of energy interchange, according to the temperature in the surfaces and air movement. This flow produces effects in the environment and contributes to increase temperature and interior-exterior heat transmission.

On the other hand, researches on environmental matter underline the influence of the wind and vegetation in heat controlling and temperature reduction of sun exposed surfaces. Green areas also contribute to microclimate controlling in relation to temperature, radiation, wind speed and humidity. Especially, by its low thermal conductivity, high absorption capacity and evaporation and as an element to guide wind flow (Higueras, 2006). Research also highlights that in the urban areas,

wind condition and its speed is determined by built mass, its organization and distribution of the elements in the space.

In order to know the constants acting in environmental equilibrium and select essentials elements that determine space multidimensionality to thermal optimization and control in the building process of the urban micro space, it was necessary to consider the approach of the different studies about man-mean-built environment relationship. From this knowledge area, we distinguish those that have studied the urban form materialization from the environmental point of view and have addressed the main intervening elements in planning and urban space designing, as well as in exterior spaces treatment. At the same time, the necessary aspects to obtain an adequate design of the site.

Olgyay (1968) considers as key intervening elements in defining public space, building heights, density, compactness, isolation, openings, closings, vegetation, sun exposure, wind exposure, protection, shadows, distances, sizes, types of superficial materials and pavements as intervening factors in thermal quality of built environment. Givoni (1989) states as distinguished elements of planning which produces effects within urban microclimate, those related to size and density of the built urban area in different ventilation conditions, air temperature, radiation equilibrium and natural lighting. Bustos (1993) emphasizes location, ventilation, wind speed, breezes uses, orientation and insulation in terms of heat gains and losses. He also stresses the morphology as an intervening element, the open, closed, dispersed, compact, density, separation among buildings, building heights, barriers to guide winds, sun radiation exposure, superficial elements nature and climate stability. With regard to the lot, the author emphasizes the aspects of orientation, dimensions, form, occupation, alignment, closings and surface materials in terms of radiation absorption and reflection; besides vegetation, ventilation, shading, water presence, humidity and lighting.

Some constants agree within these researches as attributes and intervening elements in exterior space. In order to obtain the elements which allow us working with urban micro space, we selectively used the characteristics of the space and those of the buildings and we formulated new intervening categories in urban micro space. For this research, variables are selected and grouped in three categories: climate resource and vegetation, urban and building morphology and building, bounding and surfaces characteristics (Figure 1).

In the present research, these three categories and associated variables are key compounding elements that characterize PUBLIC OR URBAN MICRO SPACE multidimensionality considered for microclimate scenarios construction (MSC) of space between buildings from urban sustainability perspective. These components constitute the dimensions for architectural treatment of public space.

Climate resource	Urban morphology	Building
Sun Solar radiation Shadows Orientation Winds Vegetation Lighting	Urban structure and morphology: Urban net Orientation Occupation density Buildings height Location in the lot Distribution in the lot Size, geometry and surface of the lot	Building conditions Bounding characteristics Building elements Constructive characteristic and aesthetic conditions: Materials /Finishes Color Pavements and walls

Figure 1. Categories of intervening constants variables in exterior space

In order to define the method, we conjugate the most relevant elements. These categories allow verifying the interconnection among variables. The study considers three relevant components. These components-elements are identified in the method as: climate ENVIRONMENT, the BASE and the LIMIT SURFACE which constitute the bounding or built physical environment, Climate and Users perception. The Environment comprises immediate climate conditions of micro space; the Base corresponds to space where micro space settles; the Limit Surface corresponds to the limit or space framework we are dealing with (Figure 2). These components-elements form the parts that interact in micro space and allow forming MSC and the proposed method. The composing elements of this body represent the analysis synthesis carried out about urban space multidimensionality.

The first component comprises the access to environmental elements: sun, temperature, humidity, solar radiation, shadows, winds, ventilation conditions, winds conduction and channeling and vegetation. The second component includes morpho-typological elements of space and those located in the base plan. It comprises occupation aspects, building typology, buildings height, location and distribution in the lot, size, geometry and surface of the lot, pavements, walls and coverings. The third component contemplates building elements and bounding qualities such as: surface area, openings, materials, finishes and color. The components of the three dimensions must be treated simultaneously and interrelated. It is important building and morpho-typological components linking of the space with climate environment. All together with usage and activities, users' participation it is essential for micro space definition and identification with itself.

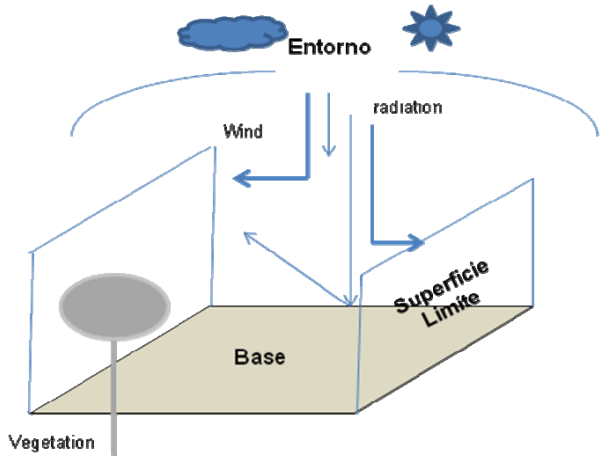

Figure 2. Microspace multidimensionality. Components-elements

6 Method

Taking into account the complexity of the different analysis units of the research, the heuristic, iterative approach was privileged among key variables, in order to define environmental behavior and the formulation of micro climate strategies in actual urban developments. Since this methodology was meant to cover the different issues in order to find solutions from the principles of sustainable design.

In the first phase of the method, it is necessary to completely evaluate micro space to determine for each place, the forming elements or conditions within the polyvalent integral

conception, the space in its three dimensions. This contributes to create guidelines and parameters of integrated environmental design and materialization process of urban form.

The proposed methodology comprises the three (3) dimensions of the study: the Environment –spatial coordinate- comprises environmental conditions; Base and Surface Limit –urban-building coordinate- includes morpho-typological characteristics, building characteristics and material. The use and schedule –temporary coordinate-. These three coordinates together with the activity system and usage requirements constitutes the system of relationships or method to build micro urban-scale scenarios. The interconnection of the components-elements, the comparison and relationship system synthesis allow establishing micro climate scenarios and characterizing configuration constant of public micro space among buildings. The main idea of the proposed method is to constitute a space treatment methodological basis and an environmental-urban project basis as well, according to which public space should have a defined, thought and built shape with such intention as the architecture. It is the architectural conception of public space.

Methodology

The methodology integrates the environmental elements and spatial constants in public space and comprises the following stages:

Stage 1. Selection of study areas according to proposed criteria.

Stage 2. Record of different “situations” of relationship among components-elements ENVIONMENT-BASE-SURFACE-LIMIT (Figure 3). Environmental condition (solar, winds, vegetation); morpho-typological characteristic (distances, orientation, surfaces) bounding configuration, surfaces and pavements (heights, dimensions, elements, types and properties of surfaces).

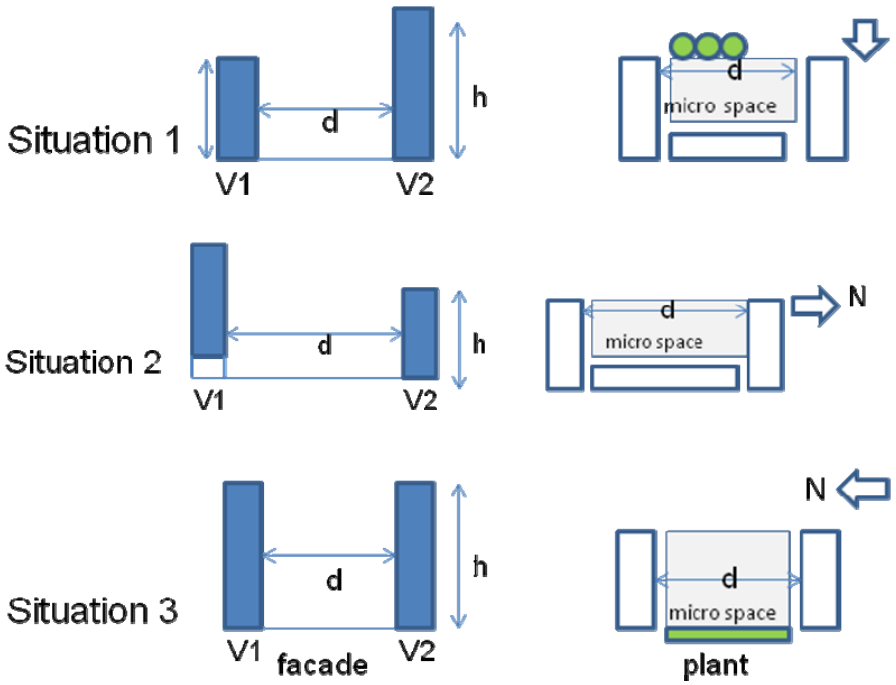

Figure 3. Record of different situations of components-elements

Stage 3. Determination of scenarios for each registered situation through the interaction-constrast of components-elements for each established spatial unit. The relationship system is ruled by the interaction of variables that constantly intervene in micro space and constitute the three coordinates of study: spatial, temporary and environmental-urban. The goal is to manage the components in order to establish adequate design strategies to thermal control and ventilation of public micro space.

Environment and Base relationship. With this goal, components-elements variables are interconnected oriented to reach basic strategies that guarantee comfort. To reach solar blocking by radiation effects, the variables Orientation, elements location, density and distance among buildings are linked. This relationship contributes to guarantee permanent shadow in micro space. A higher density, greater is the possibility of shading and distribution of spaces according to the shadow cast. Building organization and buildings nonaligned promote shading production over other buildings as well as to the environment. The Orientation and dimensions of the lot relationship allow controlling the angle of solar obstruction in the exterior and the curve of solar obstruction admits space orientation towards determined situations.

<table>
<tr><td colspan="7">Environment-Base relationship</td></tr>
<tr><td rowspan="2">Environment</td><td colspan="6">BASE</td></tr>
<tr><td>dimension of the lot</td><td>location of elements</td><td>density</td><td>Distance among buildings</td><td>Type of pavement Color</td><td>Pavements properties</td></tr>
<tr><td>Orientation</td><td colspan="4">Solar blocking</td><td colspan="2">Surfaces control</td></tr>
<tr><td>Radiation</td><td colspan="6">Solar radiation control</td></tr>
<tr><td>Ventilation</td><td colspan="4">Air movement</td><td colspan="2"></td></tr>
<tr><td>Vegetation</td><td colspan="2">Solar radiation control</td><td></td><td></td><td colspan="2">Solar radiation control</td></tr>
</table>

Figure 4. Environment-Base relationship

In order to control solar radiation, variables Orientation, pavements, type, color and surfaces properties are linked. This relationship contributes to establish exterior surfaces typology. Low coefficients of reflection control reflected solar radiation and low coefficients of absorption avoid soils and surfaces heating. In order to control air movement, that is flow and rotation effects, the variables: winds, space orientation, uses distribution, density and elements location are manipulated. This manipulation contributes to promote the movement of the air as well as to guarantee the adequate flow of ventilation. The variable Vegetation intervenes in solar radiation management of the space. By effects of control, the dimension of the lot, organization (m^2 per person) and distribution is linked. The presence of green as soil surface intervenes in solar radiation control and as vegetal protector.

Environment and Limit Surface Relationship. With this goal, variables of components-elements are interconnected oriented to reach solar blocking in order to control solar radiation of bounding building. To reach solar blocking, the variables Orientation, facades location and volume dimensions according to solar obstruction angle are linked. This relationship allows controlling solar, reducing sunny hours in facades and guarantee self-protection and permanent shading towards the environment. The relationship Orientation, buildings height and separation among them must be considered for each orientation. Equalizing volume is invalid due to different conditions.

In order to reach passive conditioning, variables Ventilation, typology of the building and volume dimensions are linked. The relationship Orientation, block typology, dimensions of openings, surfaces finishes of bounding and protecting elements guarantee ventilation crossing from and to exterior space and act as a barrier generating direction and wind speed changes. The variable Vegetation linked to bounding surface also intervenes in solar radiation management and space conditioning. By effects of control, it is important to interrelate the green and building bounding to protect and use as vegetal delimiter and protective cover.

Environment- Limit surface Relationship					
ENVIRONMENT	LIMIT SURFACE				
	Heights	Volume dimensions	Building typology	Bounding surface	Distance among buildings
Orientation	Solar blocking				Solar blocking
Radiation				Solar Radiation Control	
Ventilation	Open block			Passive conditioning	
Vegetation		Solar Radiation Control			

Figure 5. Environment and limit surface relationship

Environment-schedule period: with this goal, it is established the interconnection of climate variables temperature, solar radiation and ventilation in representative schedule periods of the site, according to climate variability and the relationship with the components-elements Base and Limit Surface per spatial unit. The purpose is to control required physical and urban characteristics according to micro space orientation.

The variables that act in combination with temperature, solar radiation and winds in the different schedules periods and per spatial unit must linked among themselves as well as to comfort ranges of the site (Psychometric Diagram), in order to establish conditions and guarantee required comfort: air temperature, radiation effects, conduction and wind speed. The type and distribution of vegetation is another intervening variable to take into consideration.

Environment-schedule period Relationship			
Environment	Schedule period		
	Morning period	Afternoon period	Evening period
Orientation Temperature Radiation Ventilation Vegetation	Physical and urban characteristics	Physical and urban characteristics	Physical and urban characteristics

Figure 6: Environment-schedule period relationship

Environment, Base and Limit Surface and Use-Activity Relationship. It is established the connection of the variables Temperature, Radiation, vegetation and winds as well as the variables Space organization, dimensions, limit elements, pavements, closings, and site surfaces. The goal is to establish the physical requirements according to previewed activities; use-schedule and comfort averages required to use motivation and previewed community activities. The objective is environmental multiplicity: expectant areas for resting, refreshing, walking, games, sports. The ultimate goal is to increase the limits of micro space perception. In this phase, it is important users'

participation to know the requirements and determine minimal conditions necessary to satisfy their needs.

<table>
<tr><td colspan="8">Environment, Base, Limit Surface and Use-Activity Relationship</td></tr>
<tr><td rowspan="2">ENVIRONMENT</td><td>Type of user</td><td colspan="5">Activity</td><td>Use</td></tr>
<tr><td>Age</td><td>Meetings</td><td>Reading</td><td>Game</td><td>Resting</td><td>Sport</td><td>Frequency</td></tr>
<tr><td>Temperature</td><td></td><td colspan="5" rowspan="4">Environmental requirements
Temperature Conditions
Ventilation Conditions
Vegetation</td><td></td></tr>
<tr><td>Radiation</td><td></td><td></td></tr>
<tr><td>Ventilation</td><td></td><td></td></tr>
<tr><td>Vegetation</td><td></td><td></td></tr>
<tr><td>BASE</td><td></td><td colspan="5"></td><td></td></tr>
<tr><td>Coverings</td><td></td><td colspan="5" rowspan="3">Physical requirements
Space organization, dimension,
Limiting elements, pavements
vegetation</td><td></td></tr>
<tr><td>Pavements</td><td></td><td></td></tr>
<tr><td>Materials</td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="5"></td><td></td></tr>
<tr><td>LIMIT SURFACE</td><td></td><td colspan="5"></td><td></td></tr>
<tr><td>Bounding</td><td></td><td colspan="5" rowspan="4">Physical requirements
Closings, openings and surfaces</td><td></td></tr>
<tr><td>Openings</td><td></td><td></td></tr>
<tr><td>Walls</td><td></td><td></td></tr>
<tr><td>Surfaces</td><td></td><td></td></tr>
</table>

Figure 7. Environment, Base, Limit Surface and Use-Activity Relationship

Besides, the analysis components and comparison will allow establishing thermal adequate requirements to public micro space and determining guidelines and morpho-environmental ordering principles as strategies to microclimate control of space between buildings, according to microclimate conditions and characteristics of the site. Since the relationship system, it is possible to build scenarios in order to computing simulations. The analysis and validation of the statements will be implemented through the combination of predetermined principles and variables in computational and physical simulation scenarios on a test. Comparative study of the variables combination results, behavior and its implication will permit the prediction of different morpho-urban and climates situations, as well as the multidimensional establishment of project strategies of ordering and environmental design of public urban micro space. The proposed statement searches equilibrium among natural conditions of the city, the inhabitants' needs and urban conditions of built habitat. All these, concerns initially outlined.

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Desertification assessment for the Guadalentín River Basin, Spain using the MedAction® PSS (Policy Support System) integrated model

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The Guadalentín River Basin (3,300 km2) in South-eastern Spain is an important case study since it is reported as one of the severest case of land and water degradation and desertification processes in Europe. For this reason the Guadalentín region was incorporated in the EC-funded MEDACTION project (Policies for Land Use to Combat Desertification). For the comprehensive understanding of the complex dynamics and interactions between the biophysical and socio-economic dimensions (and reaction intensity through absorption and buffering processes), that can lead to environmental degradation, a modelling tool was applied - the MedAction® Policy Support System (PSS) which is an integrated model applied to the region of the Guadalentín Basin at a relevant time-span of 30 years. The MedAction® PSS links science with policy making allowing the integration of policy themes, options and indicators, where the desertification issue can be analyzed through a comparative "what-if" scenario applied at the regional scale. For the present study it was tested a number of relevant scenarios related to land and water management, crop subsidy and an extreme climatic event. For the Guadalentín Region the main conclusions derived from the MedAction® PSS model outputs are the strong evidence that regional land and water resources are clearly mismanaged and farming options are primarily guided to profit maximization with little regard to environmental sustainability. All these conditionings have significant negative consequences on environmental quality and overall sustainability. The MedAction® PSS modelling tool allowed an improved perceptive of desertification drivers, being a valuable contribute for an improved understanding and management of land degradation and desertification phenomena, and therefore it is a resourceful tool for effective policy implementation and in the long-run, sustainable development.

Keywords: MedAction® PSS, Guadalentín Basin Region, Desertification-indicators, Biophysical and Socio-economic scenarios.

1 Introduction

1.1 The Guadalentín River Basin importance

The Guadalentín Basin is an important study case of desertification processes in the Northern Mediterranean region. According to Onate and Peco (2005) and Laguna *et al*. (2000) the desertification problematic in the Guadalentín Region is rooted in certain physical circumstances - a semi-arid climate which affects vegetation cover; the scarce availably of water resources (river and groundwater) associated with highly erodible metamorphic and sedimentary rock; over which recent historical trends of land use, social and technological change have developed (e.g. intensive farming systems). Desertification in Spain is largely a society-driven problem, which can be effectively managed only through a thorough understanding of the main ecological, socio-cultural, and economic driving forces (UNCCD, 1994 and Kok and Delden, 2006). Due to all these features the Guadalentín River Basin is declared as one of the severest case of desertification in Europe (Lopez-Bermudez, 1998 *cit. in* Cummings *et al*, 2001).

The Guadalentín basin was selected as one of the research areas within the EC Fifth Framework Program - MEDACTION project, since it embodies much of the problems of Mediterranean land degradation (Barrio et al., 1996). The present version of The MedAction Policy

Support System is applied to the Guadalentín river basin in Spain. The MEDACTION project (Policies for land use to combat desertification) adopted an integrated, multi-disciplinary approach, involving social and natural sciences as well as the principal stakeholders in the region to: a) develop land use change scenarios at various scales, b) analyze effects of past policies in the target areas, c) analyse the cost of land degradation and benefits of mitigation measures; d) develop options of land use policies, mitigation strategies, and incentives to combat desertification (Joost, 200?). For this project, it was developed a tool to analyse issues regarding land degradation and desertification processes – the MedAction® Policy Support System. This tool is characterized as an integrated assessment model that incorporates both socio-economic and physical processes and as well corresponding driving forces, such as demographic and economic growth as well as climate change (Mulligan, 2005).

1.2 The Guadalentín River Basin

1.2.1 Biophysical and Socio-economic Characterization

The Guadalentín Basin is located in Southeast Spain (Figure 1), covers an area of 3,300 km^2 and administratively it belongs to the Autonomous Region of Murcia. The Guadalentín River is one of the major tributaries of the Segura River, which drains to the Mediterranean Sea. Most of its tributaries are ephemeral streams, whereas only the main course – the Guadalentín River - is periodic to perennial. The upper section of the basin has a dense drainage intensity, the middle sections are characterized by an undulating landscape with long pediments and incised river terraces, and the lowlands is characterized by a flat valley bottom with a series of well developed alluvial fans at the base of the *sierras* (hilly areas)

The climate varies from semi-arid to sub-humid Mediterranean (approx. annual precipitation 300-350 mm/year; average annual temperature from 18 to 22ºC.). Precipitation shows a high inter-seasonal variation, where most of the rainfall occurs during the winter season; summer droughts last for more than 4-5 months; and annual potential evapo-transpiration rates of 1000-2000 mm are common (Post *et al.*, 2006). With such dry climate, the water table is very deep, 400 meters or even more (Post *et al.*, 2006; Kosmas and Valsamis, 2001).

1.2.2 Agricultural Sector Characterization

In the Guadalentín Region, agricultural production has Mediterranean characteristics, based on the dry-irrigated duality. Agriculture is directly related to the availability of water as the most important limiting factor (Gomez-Limon and Berbel, 2000), even more than soil properties which only acts as a physical basis, as fertilizers are used to compensate the lack of soil nutrients (Onate and Pena, 2005). Water shortage intensifies every year in the agricultural sector with the increase of irrigated area, directly related to water demand (Kosmas and Valsamis, 2001). Water scarcity is especially acute in the region due to the expansion of non-traditional irrigated crops in the lowlands (fruit and vegetable crops) with higher water demand, triggering over-exploitation of aquifers and consequent overall water systems degradation (Albiac-Murillo *et al.*, 2002).

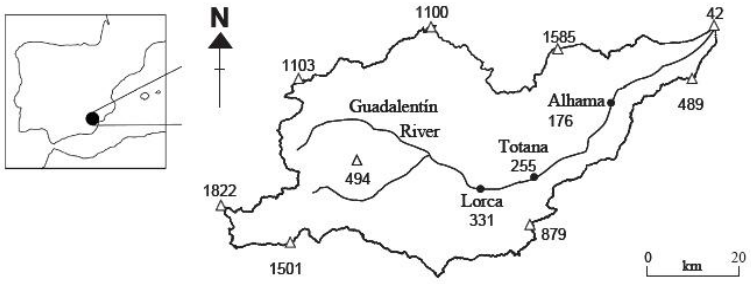

Figure 1. Location of the Guadalentín River Basin in Spain (left). Source: Delden *et al.* (2005). Main cities and altitudes, meters above sea level (right). Source: Onate and Peco (2005).

- Lowlands Agriculture

Guadalentín lowlands (Figure 2), is characterized by the highest growth rates in Spain, and therefore its recognition as the ‘‘Orchard of Europe’’ (CESRM, 1997 *cit. in* Onate and Peco, 2005). Large share of the production is located in the basin lowlands with the development of intensive irrigated agriculture (water and fertilizers high input) providing much higher net outputs (higher production and profitability rates) than those obtained from the adjacent hilly areas where traditional and terrace agriculture is located (Table 1). The main agricultural crops in the basin valley are irrigated vegetables, cereals, almonds, citrus and fruit. The intrinsic structural water deficit did not limit the expansion of irrigated area. By the contrary, the construction of several dams, the overexploitation of groundwater and water transfer channels from other basins (the Tajo-Segura channel) has contributed to its expansion (Laguna *et al.,* 2000). Additionally, in the Guadalentín River valley the soil has high salt content due to intense irrigation strategies and the excessive use of fertilizers to compensate low soil capacity for agricultural development.

The resulting increase in productivity and change in land use established a cycle of unsustainable socio-economic development within the irrigated region, accelerating the desertification processes (UNCCD, 1994; EEA, 1996).

- Highlands Agriculture

In the Guadalentín highlands (Figure 2), the dryland production is centred in the Mediterranean trilogy – cereals, vineyards and olives, with the recent addition of almonds. This agricultural system is directly affected by climatic variability and drought tendency. The low profitability of highland dry farming, with its shallow soils and semiarid climatic conditions, are not economical sustainable without any financial support. In Guadalentín, subsidies have helped the preservation of declining dryland farms on sloped land, preventing rural exodus. Although in several cases, subsidies have negatively affected land degradation and desertification as well as land abandonment (Kosmas and Valsamis, 2001).

- Farmers Structure

According to Kosmas and Valsamis (2001), the Guadalentín Basin agricultural lands has an extension of 113,500 ha, from which 88,374 ha (78%) are private and 22,793 ha (20%) are rented; irrigated lands are smaller and mostly rented (<5ha), while the drylands are bigger and mostly private. Most of the farmers are members of co-operatives and rely on them for almost all financial

farming aspects (including subsidies application), where the corporate farmers benefit higher irrigation expansion. Additionally, in the highlands, 40% of Basin farmers are part-time farmers totally dependent on subsidies; and generally land management and soil protection techniques are neglected (Kosmas and Valsamis, 2001).

1.3 Guadalentín Basin Desertification Drivers

According to Onate and Peco (2005), the immediate causes of desertification in the Guadalentín Region are: a) The expansion of irrigated agriculture in the valley, is a main driver for aquifer over-exploitation and surface depletion in semi-arid climates, soil salinization and water resources and pollution, drying off fluvial courses and springs, dying and destruction of wetlands and soil losses caused by erosion; b) Traditional land use abandonment and the occurrence of intense and rapid land use changes in the surrounding impoverished hilly dry land areas, including both intensification and abandonment of agricultural practices as well as sudden changes in crop choices following the more rewarding EU subsidies. These changes act on a sensitive combination of semi-arid climate and vulnerable soils, which effects erosion rates.

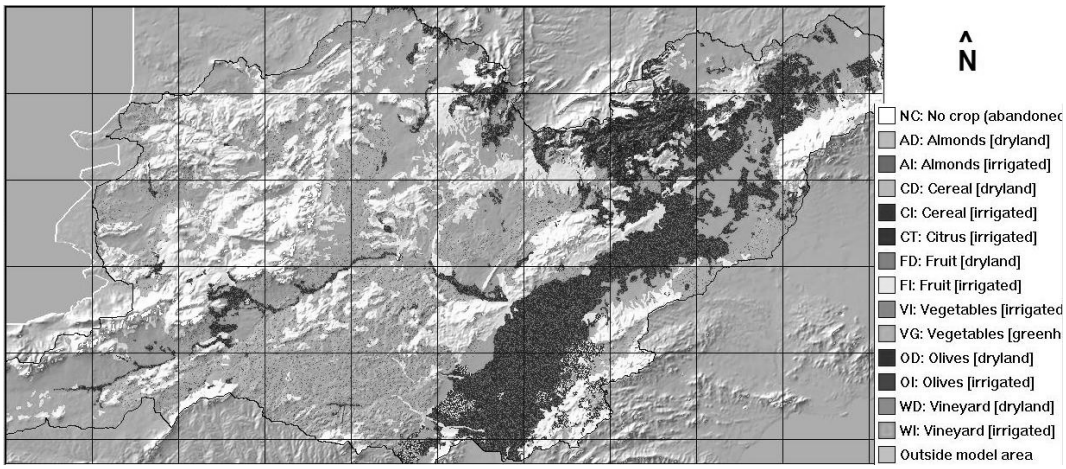

Figure 2. MedAction® PSS initial crop type map. The darker area represent the Guadalentín basin lowlands with high concentration of irrigated cultures *(vegetables, cereals, almonds, citrus and fruit).* The grey area represent the highlands where the dryland cultures are distributed (*almonds, cereal and olives*). The whiter area represents natural vegetation areas with herbaceous, shrubs and forested areas.

1.3.1 Technological Drivers

The most expressive technological drivers sustaining Guadalentín region high agricultural productivity are:

1. A developed transport infrastructure, with faster access of production systems to regional and international markets (Kosmas and Valsamis, 2001; Kok *et al*., 2003);

2. The construction of dams: the regulation capacity of the dams of the Segura River basin makes up nearly 1,100 hm^3; the spreading use of submersible pumps in the region, led from the 60s, to an unprecedented increase of extracted water volumes (Cummings *et al*, 2001);

3. Construction of the Tagus-Segura transfer channel: operational since 1980 contributed clearly to irrigation expansion, by transporting an average volume water of 250 hm^3/year (Cummings *et al*.,

2001). Furthermore, the new National Hydrological Plan, foresees a 6 billion € investment in a new water transfer infrastructure from the Ebro River basin (Northeast Spain) to Murcia and neighbouring regions (Albiac-Murillo *et al*., 2002);

4. New water management guidelines: the introduction of the dripping irrigation technique, substituting the previous flooding irrigation procedure, allowing the expansion and intensification of irrigated area, that also contributed to the reduction of crops such as cereals and cotton, and the introduction of horticulture and the reinforcement of vineyards (Kosmas and Valsamis, 2001).

1.3.2 Water and Agricultural Policies

Spanish law defines water as a "public good", meaning that the water itself is practically cost-free. The current cost of water in irrigated public Spanish lands is about 0.12 €/m^3, including regulation, transport and distribution to the farming plot, with public subsidies of approximately 90% (Corominas, 1996 *cit. in* Ortega *et al*., 2004). The White Book on Water from the Spanish Ministry of Environment sustains that future administration will mainly support irrigation areas with higher economic profits, but not the low profit irrigated areas. The high-priced Ebro water-transfer project is a result of this policy (Albiac-Murillo *et al*, 2002). Spanish Water policies support infrastructure construction and structural aid for efficiency enhancements, as well water concessions, for the promotion of irrigation expansion at the expense of neglected drylands, declining since the late 1970s drought (Kosmas and Valsamis, 2001). Additionally, according to MIMAM, 2001 *cit. in* Onate and Peco, 2005, converting dry land into irrigated is three times economically more advantageous which causes framers to expand their irrigated land. The marginal value of water of dryland is 0.18 – 0.36 €/m^3 and for irrigated 0.054 €/m^3.

Since Spain entered to the EEC in 1986, land use changed significantly from traditional dry-farming techniques associated with pasture towards a profit-oriented agriculture obtained through intensive irrigation farming (Post *et al*., 2006) partly driven by subsidies and increased export opportunities to the EU (Kosmas and Valsamis, 2001), worsening water deficit and forcing new water transfers (Onate and Peco, 2005).

1.3.3 Environmental factors

The Guadalentín environmental context is characterized by surface and groundwater overexploitation, soil and aquifer salinization and natural habitat destruction along with a massive increase of irrigation agriculture in the valley.

- Groundwater overexploitation

The Spanish government has declared the *Valle del Guadalentín* as an overexploited hydro-geological unit, with mean annual recharge of 29×10^6 m^3/yr, and mean annual exploitation of 99×10^6 m^3/yr (EEA, 1996). The Guadalentín basin has been exploited for over 500 years. The severe droughts that occurred in the southern Iberian Peninsula during the 1980 – 1995 period contributed to the increase of water demand which is the main cause of its over-exploitation, with a consequent negative impact on existing drills and becoming infeasible the construction of new perforations (GSGTB, 2006).

Basin's Water deficit is structural and keeps increasing, it is officially estimated to be 460 hm3, although considering illegal exploitation this figure may reach 800 hm3/year. The Tajo-Segura water transfer canal and a new projected one to transport water from the Ebro River down to the Guadalentín Region (Kok *et al*., 2003) is a consequence of the regions high water demand and dependance.

- Soil and aquifer degradation

Soil and aquifer salinization becomes more severe by anthropogenic activities such as irrigation, deforestation and overgrazing (Faulkner and Hill, 1997). Contamination problems affect the Guadalentín aquifers, either due to point-source pollution (urban and industrial) or as a result of widespread pollution caused by agricultural (incorrect use of fertilizers and chemicals) and livestock activities (Laguna *et al.*, 2000). Recent droughts, the scarcity of water in certain river sections and the increase of water consumption have led to the use of badly treated and highly saline water with consequent soil degradation widespread (Albiac-Murillo *et al.,* 2002). The reuse of poorly purified and industrial waters in semiarid areas have a harmful effect since irrigation with saline water lowers agricultural productivity due to soil salinization (Onate and Pena, 2005). Furthermore, aquifer salinity is an indicator of its overexploitation (Kok and Patel, 2003). Land degradation and desertification processes are aggravated by the region high temperatures and subsequent high potential evapo-transpiration, resulting in serious water deficit (Perez-Sirvent *et al.*, 2003; UNC, 2006).

2 Methodology

2.1 MedAction® PSS Integrated Model - Overview

Desertification is a complex problem which includes the biophysical, technological and socioeconomic dimensions. MedAction PSS is used to assess and monitor the desertification phenomena and land degradation at the regional level. This integrated model is useful to understand and analyse the complex environmental system with its relevant components, their interactions and dynamics when subjected to an external or internal driving force (e.g. climate or land use change) and reaction intensity through absorption and buffering processes of either biophysical and socio-economic spheres. This policy decision tool allows a holistic and intuitive perception, and is diagnosis-oriented to support policies.

According to Mulligan (2005), the user interface of the MedAction® PSS features a system diagram (Figure 3, upper right) representing the different interacting sub-models and processes (Figure 3). The system diagram contains six different integrated models: climate and weather, hydrology and soil, vegetation, water management, land use and farmers decisions. Within each model a series of sub-modules exist, where each sub-model is made up of a series of processes (Mulligan, 2005). "The MedAction system couples external and internal biophysical processes with external and internal human processes. External biophysical processes include climate and weather. Internal biophysical processes include all of the hydrological processes (surface and subsurface), soil wash erosion and sedimentation, vegetation growth, development and succession for crops and natural vegetation and soil salinization. The external socio-economic components include external markets for crops, agricultural incentives, water 'imports' and the various policy options (water

pricing, terracing, crop planning and irrigation). The internal socio-economic components include water demands and usage, water resources allocation, land use (change), profit and crop choice and dynamic land suitability".

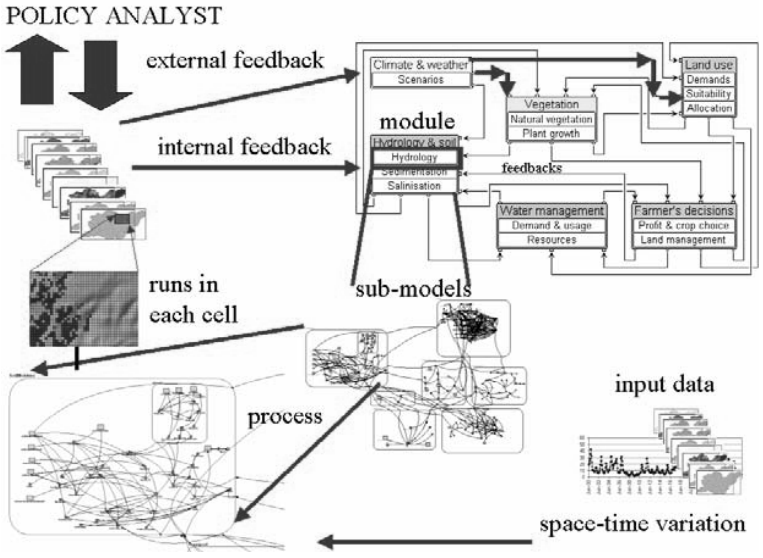

Figure 3. A Basic outline of the structure of the MedAction® PSS. Source: Mulligan (2005)

The MedAction® PSS, allows the analysis of a series of "what-if" scenarios (Table 3), that can be used to evaluate desertification and land degradation drivers at the regional and local scale. From the quantitative models outputs, represented as policy-relevant indicators (e.g. soil and aquifer salinity, sediment discharge, farmers profit, harvested area, water management, available resources, demands and shortage) it is possible to built narrative storylines that express the impacts of a varied socio-economic and environmental drivers. The model simulations are applied for the entire Guadalentín basin area (3,300 km2), for a 30-year period (between the years 2000 and 2030), the spatial resolution of the integrated sub-models is 1 ha and the temporal resolution varies from one day to one year (depending on the sub-model process).

2.2 Data Derivation

To explore the dynamics of desertification and land degradation processes and the impact of its drivers, it was used the MedAction® PSS model for the Guadalentín Basin. Firstly, it was executed the baseline scenario, where all indicator parameters were left as default, and it was used as the reference framework for the evaluation of the proposed "what-if" scenarios. From these study-scenarios, the policy-relevant indicators outputs – time-series and maps - were statistically compared to the reference or baseline indicator values (using Equation 1), identifying significant quantitative changes, over the 30-year period and for the entire basin area, upon which a narrative story can be developed.

$$change \quad (\%) = \frac{baseline - scenario}{baseline} \quad x \quad 100$$ (Equation 1)

2.3 The MedAction® PSS Tool

2.3.1 The MedAction PSS baseline outputs

For the Guadalentín Basin, the climate scenario based on the ECHAM global climate model, indicates a decrease of precipitation (-0.560 mm/month) and temperature increase (+0.170° C./yr).

In general, all socio-economic sectors claim an areal cover increase over the 30 years period. According to Delden et al (2005), "the output of the Standard run in 2030 shows a land use quite similar to the current situation. The built-up area (industry, tourism, residential, greenhouses) increased slightly at the expense of agriculture. The latter experiences a slight additional decline because of the decrease in precipitation causing dryland crops to produce lower yields and irrigated crops to use more irrigation water, both leading to a decline in profits and land abandonment".

Concerning the water resources, the aquifers get severely overexploited in the year 2007 (Figure 4), being progressively replaced by the reservoir resources. It is assumed that there is enough water available from outside the region to meet most demands, since the monthly input from Tajo River is 2.0 x $10^6 m^3$ (Delden et al, 2005).

The original Subsidy and Crop prices, and Water resources indicators can be found in Table 1 and 2.

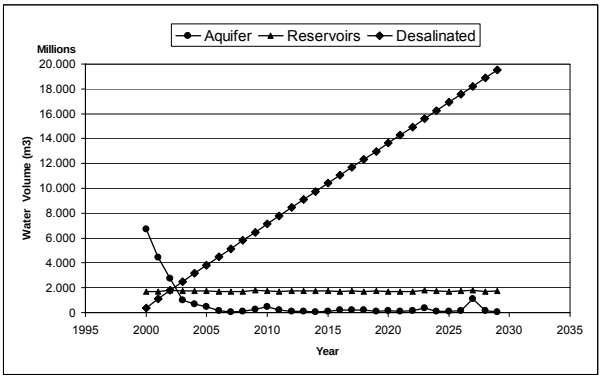

Figure 4. Water resources of Aquifer, Reservoirs and Desalinated water of Guadalentín Basin during the 2000-2030 period. Baseline simulation

Table 1. MedAction® PSS "Farmers Decisions" module. Original values of "Profit and Crop choices" and "Crop properties" parameters

Profit and Crop choice	Price (€/kg)	Initial cost (€)	Yearly cost (€/yr)	Subsidy (€/yr)	Tax (€/yr)	Max harvest (kg/ha yr)	Initial Area (ha)	Average Profit (€/yr)	(%)
dryland almonds	0.79	5 000	0	2 500	0	484	44 924	17 174 641	3
irrigated almonds	0.79	5 000	0	2 700	0	2 218	7 486	13 114 819	2
dryland cereal	0.17	5 000	0	2 300	0	4 686	101 668	80 988 062	14
irrigated cereal	0.20	5 000	0	3 500	0	5 240	27 979	29 320 492	5
irrigated citrus	0.20	5 000	0	1 200	0	19 379	12 769	49 486 290	8
dryland fruit	0.51	5 000	0	1 200	0	1 362	48 601	33 755 427	6
irrigated fruit	0.41	5 000	1 650	0	0	15 814	22 024	142 791 240	24
irrigated vegetables	0.36	5 000	6 200	0	0	34 064	15 841	194 247 617	33
greenhouse vegetables	0.45	5 000	13 300	0	10 000	101 479	362	16 502 629	3
dryland olive	0.52	5 000	0	1 950	0	1 398	2 340	1 698 036	0
irrigated olive	0.53	5 000	0	1 750	0	3 626	842	1 614 889	0
dryland vineyard	0.32	5 000	0	1 950	0	2 400	2 249	1 724 182	0
irrigated vineyard	0.32	5 000	250	0	0	5 940	494	933 745	0
								583 352 068	100

Table 2. MedAction® PSS "Water Management" module. Original values of "Water Resources" and "Salinization" parameters

	Original water price (€/m^3)	Initial Volume (m^3)	Original resource salinity (g/m^3)
Aquifer	0.20	6.5×10^8	17.5
Reservoir	0.25	8.9×10^7	15.0
Desalinated sea water	0.30	5.0×10^6	80.0

2.3.2 The Biophysical and Socio-economic scenarios developed

Table 3. Scenarios development in MedAction® PSS

S.1 – Biophysical scenario: "Severe drought or precipitation absence"
Description: Simulation of extreme climatic event where there is no rainfall during the 2000-2030 period.
MedAction Model: "climate and weather" model, "weather generators" parameter, "precipitation offset" map. The precipitation values are set to zero.
Simulation of the impact of agricultural and water policies on the biophysical and socio-economic systems.

S.2 – Agricultural subsidies: "No subsidy for irrigated crops".
MedAction Model: "Farmers decision" model, "Profit and crop choice" sub-model, parameter "Crop subsidy" of the "Crop properties" table. The subsidy value for irrigated crops (almonds, cereal, olive and vineyard, with the exception for citrus, as there are no dryland citrus in the Region) where reset to zero €/year in the year 2000 (ongoing until 2030).

S.3 – Agricultural subsidies: "Irrigated almonds subsidy increase of 50%"
MedAction Model: "Farmers decision" model, "Profit and crop choice" sub-model, "Crop properties" table: substitute irrigated almonds subsidy from 2700 to 4050 €/year (for the 2000-2030 period).

S.4 - Water Resources: "Aquifer resource total restriction and Reservoir water cost increase"
Description: The MedAction® PSS was used to predict the impacts of water availability and price on the biophysical and socio-economic systems of the Guadalentín Region. Some relevant parameters were changed: the "Maximum extraction limit" and "Water price" from the Water Resources sub-model (included in the Water Management model) and the parameter value of "Salt content" of Desalinated water from the Salinization sub-model (included in the Hydrology and Soil model). All changes are applied at 2000 and are linear up to the year 2030.
For the Aquifer resource the policy extraction limit was set from 500.000.000 to 5.000.000 m^3/month (initial volume 650.000.000 m^3). For the Reservoir resource the policy extraction limit was enlarged from 60.000.000 to 600.000.000. The water price was changed from 0.25 to 3,15 Euros/m^3. This analysis accounts for the predicted construction of the Ebro water transfer infrastructure. For the Desalinated water resource, the policy extraction limit was also enlarged from 10.000.000 to 100.000.000. The water price was changed from 0.30 to 3.15 Euros/m^3. The "Salt content" parameter was also changed, from 80g/m^3 (2000-2005) to 50 g/m^3 (2005-2020) to 30g/m^3 (2020-2030) following technological development in water purification techniques.

S.5 - Water Resources: "No inter-regional water transfers and desalinated water usage restriction"
Description: From the MedAction PSS, "Water Management" model, "Resources" sub-model, the "monthly production of desalinated water" parameter was changed from 500.000 to 0 m^3/month; the "monthly inputs from Tajo" parameter was changed from 2.000.000 to 0 m^3/month (during 2000-2030). The remaining parameter values were left unchanged: "initial water volume in the reservoirs" 88.880.000 m^3; "initial volume in the aquifer" 650.000.000 m^3; "total available water" from aquifer and reservoirs 738.880.000 m^3.

3 Simulation Results and Discussion

In Table 4 it can be found the 30 year average of the proposed simulations and baseline using the MedAction PSS® tool, for the entire Guadalentín Basin area and for the 2000-2030 period. The model outputs are related to the biophysical and environmental sectors, farmers choices and water management. The simulations (1-5) outputs are statistically correlated with the baseline values (Equation 1). Positive correlations are interpreted as an decrease of the indicator final output regarding the baseline, and vice-versa.

Table 4. Baseline and Simulation results (30 yr average and standard deviation). S.1 – Biophysical scenario: "Severe drought or precipitation absence"; S.2 – Agricultural subsidies: "No subsidy for irrigated crops"; S.3 – Agricultural subsidies: "Irrigated almonds subsidy increase of 50%"; S.4 - Water Resources: "Aquifer resource total restriction and Reservoir water cost increase"; S.5. Water Resources: "No inter-regional water transfers and desalinated water usage restriction"

	30yr Average Values	Baseline		S1		S2		S3		S4		S5	
		AVG	*SD*	AVG	*SD*	AVG	*SD*	AVG	*SD*	AVG	*SD*	AVG	*SD*
BIOPHYSICAL	**Hydrology and Soil**												
	- Sediment discharge [m³]	135	*59*	97	*16*	-1	*38*	-3	*46*	-1	*46*	-24	*67*
	- Average soil salinity [gr/m³]	139	*22*	-30	*16*	-9	*7*	8	*6*	2	*1*	1	*1*
	- Aquifer salinity [gr/m³]	16	*2*	-540	*200*	-68	*40*	44	*24*	-8	*13*	10	*10*
	Land Use Suitability [-]												
	- Natural Vegetation	10	*0*	21	*6*	0	*1*	0	*1*	0	*1*	0	*1*
	- Dryland agriculture	8	*0*	9	*4*	0	*1*	0	*1*	0	*1*	0	*1*
	- Irrigated agriculture	4	*1*	52	*17*	-1	*8*	2	*8*	2	*7*	2	*7*
	- Vegetables	5	*0*	8	*3*	0	*1*	0	*1*	0	*1*	0	*1*
	Vegetation Cover (cell, 1ha)												
	- Dryland	1	*0*	93	*6*	4	*6*	-2	*8*	1	*7*	-1674	*1642*
	- Irrigated	4	*0*	-32	*20*	-6	*4*	3	*6*	-4	*3*	9963	*4813*
	- Natural Vegetation	4	*0*	87	*7*	2	*7*	-1	*3*	-3	*5*	0	*5*
FARMERS CHOISES	**Harvested area [ha/yr]**												
	- Dryland	148.473	*1.164*	-330	*160*	-321	*157*	28	*22*	-1	*1*	0	*0*
	- Irrigated	48.757	*2.072*	110	*44*	-2854	*896*	-182	*120*	33	*17*	0	*3*
	- Vegetables	16.773	*2.260*	-160	*83*	-159	*85*	44	*19*	-16	*13*	-2	*10*
	Average Profit [€/ha/yr]												
	- Dryland	12.944	*3.985*	182	*66*	5	*11*	-8	*34*	0	*7*	-1	*5*
	- Irrigated	14.015	*4.358*	101	*570*	143	*225*	63	*386*	187	*129*	-1	*14*
	- Vegetables	12.536	*13.588*	166	*242*	117	*398*	93	*89*	46	*86*	38	*153*
	Cumulative Avg. Irrigation [m³ha/yr]												
	- Aquifer	12.720	*9.457*	543	*305*	10	*15*	-364	*392*	51	*30*	-656	*162*
	- Reservoirs	18.867	*9.361*	-1,3E+20	*5,2E+20*	-18	*25*	200	*252*	-1,9E+20	*7,1E+20*	-408	*193*
	- Desalinated	167	*138*	-3,4E+18	*1,1E+19*	-202	*657*	-697	*1490*	-1,0E+17	*4,6E+17*	62	*72*
WATER MANAGEMENT	**Agric. Water Demands [m³/yr]**												
	- Aquifer	7,7E+07	*5,9E+07*	75	*38*	90	*2*	2	*25*	52	*29*	-3	*15*
	- Reservoirs	1,2E+08	*6,1E+07*	-1,7E+22	*9,3E+22*	81	*23*	42	*40*	-1,2E+24	*4,4E+24*	0	*18*
	- Desalinated	1,2E+06	*1,1E+06*	- 2,2E+20	*1,2E+21*	57	*77*	45	*79*	-1,1E+21	*5,7E+21*	88	*27*
	Water Shortage [m³/yr]												
	Agriculture	-8,9E+08	*9,4E+08*	64	*14*	91	*1*	-51	*26*	-116	*91*	12	*13*
	Urban	5,1E+06	*1,8E+06*	-1,1E+21	*4,4E+21*	88	*17*	17	*24*	-1,6E+22	*8,9E+22*	-94	*133*
	Water Resources [m³/yr]												
	- Aquifer Volume	7,0E+08	*1,5E+09*	89	*14*	92	*2*	-35	*48*	-8347	*6435*	-7	*28*
	- Aquifer Extraction	7,9E+07	*6,2E+07*	76	*37*	90	*2*	2	*26*	52	*29*	-3	*15*
	- Aquifer Replenishment	5,7E+07	*3,3E+07*	84	*7*	90	*2*	5	*14*	4	*12*	-4	*21*
	- Reservoirs Volume	1,7E+09	*3,2E+07*	6	*4*	92	*0*	-1	*2*	1	*3*	0	*2*
	- Reservoirs Extraction	1,2E+08	*6,1E+07*	-946	*3098*	87	*5*	46	*22*	-1465	*4667*	0	*17*
	- Reservoirs Replenishment	1,2E+08	*5,9E+07*	-1321	*5332*	87	*8*	46	*23*	-629	*2589*	-2	*19*
	- Desalinated Volume	1,0E+10	*5,8E+09*	13	*4*	92	*0*	-1	*1*	4	*2*	99	*3*
	- Desalinated Extraction	4,9E+06	*1,7E+06*	-419	*1198*	90	*3*	17	*14*	-2564	*13741*	90	*23*
	- Desalinated Replenishment	6,0E+07	*0*	0	*0*	92	*0*	0	*0*	0	*0*	100	*2*
	ESA Overall [-]	1	*0*	-9,7	*3,3*	0,4	*0,2*	0,0	*0,1*	0,2	*0,2*	0	*0*

3.1 "Severe drought or absence of precipitation" Scenario (S1)

3.1.1 Results

Regarding the Farmers profit and harvested area indicators, for the 30-yr simulation period, the aridity increase had an impact on the harvested area indicator: as dryland crops harvest increases (330%), as well as vegetable crops (160%), and irrigated cropland decrease (-110%), the total water shortage indicator for the agricultural sector (-64%) also decreases. The agricultural sector water demand indicator increases from reservoirs (+1.7x10^{22} %), with lower price than desalinated; and from desalinated sea water (+5.3x10^{20} %). As a consequence of the higher irrigation input, generally with higher salt content (Table 2), leads to the increase of the average soil salinity for all the region extent. It is recorded an increase of the harvested area indicator for the dryland perennial crops, such

as vineyard (235%), olives (147%), almonds (55%), and irrigated cereal (52%). All these crops are more adapted to climate adversity, being less water dependent (less soil moisture to maximum growth), being as well the most profitable crops – with higher market value, subsidies and yield (Table 1), and additionally, farmers have less water demand thus, less farming expenses.

Furthermore, the farmers selection on dry perennial (tree) crops, generally associated with natural understory vegetation, specially those located in the hilly areas, can contribute significantly to a general decrease of all erosion indicators, namely sediment discharge (-97%).

It is also recorded an overall decrease of farmers profit; the dryland crops total profit is decreased (-182%), as well as Irrigated crops (-101%) and vegetable crops (-166%), except for irrigated almonds being the most (and only) profitable crop.

The overall environmentally sensitive areas (ESA) indicator, which describes the potential risk of desertification, illustrates that within a drought scenario the risk of desertification increases (10%).

Regarding the Water resources indicators, within a more arid environment it is recorded a decrease of the volume of aquifer water resource (-89%), being its natural recharge negative due to the lack of precipitation (-84%) with consequent increase of aquifer salinity (540%) as a clear indication of its exploitation. Aquifer resource gets severely over-exploited during the 2000 to 2007 period, being this water resource replaced by the next cheapest possible option; Reservoirs (volume extraction increase of 946% with increasing resource replenishment) and Desalinated water (increase of 419%).

Land use suitability changed also due to soil salinity increase (30%), mostly due to the use of irrigation water with poor quality; and soil moisture decrease (-71%): Natural vegetation suitability decreases (-21%) due to the consequent plant water-stress increase; total Irrigated crops decreases (-52%), as well as Dryland crops decrease (-9%) and Vegetables (-8%). The need to increase irrigation effort, especially from other water resources, to compensate the lack of precipitation demonstrates that the suitability for irrigated agriculture decreases the most.

3.1.2 Discussion

As Guadalentín environment becomes more arid, with overexploited groundwater, water demand increases exponentially being dependent on the water supplied from outside the region, provided at higher costs and frequently with lower quality (e.g. higher salt content). Consequently soil and aquifer becomes degraded due to salinization.

Typically, severe droughts have a larger impact on dryland than irrigated farmland as the loss of rainfall water cannot be compensated by irrigation. But in the Guadalentín Basin, the agricultural sectior is strongly dependent on inter-regional water import, from the Tajo-Segura water transfer channel, being a cheapest and with better quality resource than desalinated water.

This biophysical driver can have consequences in local and regional economy with crop change or land abandonment, ultimately with consequent labour cuts and rural exodus. According to Iglesias et al (2003), farmers drought adaptation capacity is based on the adoption of more complex cropping patterns that include permanent crops and appropriate crop rotations, that operate under a flexible water demand, and on its flexibility to allocate their permanent labour resources. For this analysis it is recorded an increase of dryland and vegetable crops, as irrigated cropland area

decreased, with a direct consequence in overall profit decline, as irrigated crops are more profitable than dryland farming. Nevertheless, the profitability of the irrigated agriculture depends largely on the crop market price and attributed crop subsidies; if they are high enough, profits can still be made even if more is spent on irrigation water.

3.2 “No subsidy for irrigated crops” Scenario (S2)

3.2.1 Results

For the 30-yr simulation period, for the Farmers profit and harvested area indicators, it is noticed that due to the extinction of irrigated crop subsidies, it is recorded an overall Farmers profit decrease, with a major decrease of Irrigated crops (-143%) and Vegetables (-117%), as dryland crops profit remains almost unchanged (-5%). The most affected crops by this policy restrain are: irrigated cereal has the highest decrease (-100%), followed by irrigated almonds (-65%), irrigated olives (-45%) and irrigated vineyards (-28%). Although irrigated crop subsidy are ceased in this evaluation scenario, it is recorded a strong overall increase of Harvested area regarding irrigated crops (2854%), followed by dryland (321%) and vegetables (159%), where almost all crops have an harvest area increase, especially irrigated vineyard which have the major increase (2706%).

For the water resources indicators it is noticed that agricultural cumulative average irrigation from the Desalinated water (202%) and from Reservoirs resources (18%) increased, with irrigated water derived from the Aquifer decreased (-10%). This farming choice has an impact on Aquifer salinity which increases its salt content (68%), with consequent Soil salinity indicator increase (9%).
It is recorded that even with an overall increase of irrigated crops harvest, agricultural water demand decreases for all sources, Aquifer (-90%), Reservoir (-81%) and Desalinated water (-57%). Regarding water resources, it is shown an overall decrease of all water sources volume, extraction and replenishment (87-92%). It is also noticed an increase of water shortage for agriculture (-91%) and urban areas (-88%).

3.2.2 Discussion

This scenario was proposed to evaluate the effect of the elimination of subsidies for irrigated crops as an attempt to preserve soil and aquifer resources, namely by saving water, reduce inter-regional water dependence, and to test farmers choices. In this way, it was observed that regardless the elimination of subsidies for irrigated crops, it is recorded, that farming choices react in an opposite way, with substantial increase of irrigated areas harvest, since these crops are more profitable than dryland crops. The crop with highest harvested area increase is irrigated vineyard, which is well adapted to the regional climate and has a lower irrigation intensity demand. Although overall harvest area increases, average framing profit decreases, especially for irrigated and vegetable crops, reflecting the imposed subsidy cuts. In this case, farming costs, including water costs, are not minimized by external agricultural subsidies.

It is also recorded a decrease of water resources, demands and shortage. Agricultural irrigation is highly derived from desalinization plants with consequent soil degradation and pollution by salinization.

3.3 “Irrigated almonds subsidy increase of 50%” Scenario (S3)

3.3.1 Results

For the 30-yr simulation period the Farmers profit and harvested area indicators, it was recorded an overall increase of Irrigated Harvested area (182%), mainly due to the leading increase of irrigated almonds (416%), although all remaining irrigated crops decrease in area. In the other hand, Vegetable and dryland crops have a moderate decrease of their harvested area (-44% and -28%, respectively). General Average Farmers Profit decrease, namely for the most profitable crop of the Region: Vegetables (-93%) and Irrigated crops (-63%, especially irrigated fruit -50%), except for irrigated almonds which has a profit increase (46%). It is also recorded a small increase of the overall Dryland farming profit (8%).

For the Water resources indicators it is noticed that the Cumulative average irrigation has a significant increase, namely from the Desalinated plant resource (~700%) and from the Aquifer (364%), while irrigation derived from Reservoirs decreased (200%). Regarding Water Demand, it is recorded an accentuated increase of Reservoir water demand ($1{,}0x10^{17}$%), mainly due to the ex-patriots sector demand. Aquifer water resource demand increases slightly (34%), while Desalinated water demand decreased (-17%). Aquifer water resource demand from the agricultural sector increased (34%), with consequent impact on water shortage (51%), even though it is recorded an increase of Aquifer resource volume (35%). Associated to Aquifer resource demand increase, aquifer salinity indicator also decreases (-44%). The overall water extraction from the available resources decreased, namely from Reservoirs (-46%) and Desalinated plants (-17%), as Aquifer extraction remains almost unchanged.

3.3.2 Discussion

This scenario was included in this study to test the hypothesis that an increase of irrigated almonds subsidy would have a positive impact on sustainable land management in the Region; since this crop is more adapted to local conditionings (low soil moisture), requires low-intensity agricultural techniques, and it can be combined with natural vegetation on its understory providing better conditions for soil protection against erosion and organic matter development. Being a crop type with an considerable annual average profit, for this simulation, irrigated almonds have a considerable harvested area increase, as well as farmers profit, being a clear signal of the influence that agricultural policies has on farmers decisions. It is noticed that even already having profitable crops, farmers chose to reduce existing developed croplands and substitute them by a more profitable one. In addition, according to Kosmas and Valsamis (2001), agricultural subsidies and crop profit are the main influence of farmers decisions: CAP subsidies allocated to specific types of crops or land uses in conjunction with the market prices greatly affect the intensity of the land use, control farmers choices and land use patterns.

3.4 “Aquifer resource total restriction and Reservoir water cost increase” Scenario (S4)

3.4.1 Results

For the 30-yr period simulation, the farmers profit and harvested area indicators reveal that regarding the Harvested area indicator, irrigated farmlands area decreased (-33%), while vegetable crop areas increased (16%). Overall Farmers profit decreased with an higher fall for the Irrigated crops (-187%) and Vegetables (-46%). For the Dryland crops these parameters remain unaltered.

Regarding the Water resources indicators, the Cumulative average irrigation indicators increased, as water is mainly derived from Reservoirs ($1{,}9x10^{20}$ %) and Desalinated plants ($1{,}0x10^{17}$ %), with a decrease of water derived from Aquifer (-51%). These values are related to the agricultural water demand increase from these resources, Reservoir ($1{,}2x10^{24}$ %) and Desalinated plants ($1{,}1x10^{21}$ %) with a recorded decrease of Aquifer water demand (-52%). It is shown an increase of the Aquifer water resource volume (8347%) with almost no observed replenishment, although its extraction has decreased (-52%). For the 2000-2030 period, Water extraction from Desalinated plants and Reservoir have increased (2564 and 1465%, respectively), where Reservoir water replenishment increased (629%). The use of these water sources, with higher salt content prologues an higher aquifer salinity content (8%). It was also observed a strong water shortage increase in urban areas ($1{,}6x10^{22}$ %) during certain periods, and as well for the agricultural sector (116%).

3.4.2. Discussion

This simulation was introduced due to the 1998 declaration of aquifer over-exploitation, by the Segura Hydrographical confederation in 1998: “The phreatic level was located between 300 and 400 meters in depth and salinity has increased up to 3-9 g/l, which is a severe risk to soil quality and agricultural production” (GSGTB, 2006). A Management Plan for the Aquifer should legally be implemented, in which the water usage should be restricted until its recovery (Cummings *et al*., 2001). Accounting to recent European policies regarding water protection and conservation (e.g. 2000/60/EC), one measure to ensure this purpose is to establish proper water prices corresponding to its agricultural usage demand.

According to the present simulation, the main advantage of the implementation of aquifer water extraction restriction is the accumulation of groundwater resources. The policy restriction to extract aquifer water resources across a relevant period resulted in a lower agricultural consumption rate when initial stocks are already at critical capacity. According to Iglesias *et al*. (2003) water supply cuts would create a response from farmers that would decide to decrease farming water dependency and this way to save (aquifer) water. In the Guadalentín Basin, farmers choose the next available and cheapest option, Reservoir, followed by the Desalinated water resource. More expensive water resources are used if the agricultural profits can cover this extra expense, without major changes of harvested area (crop management).

The agricultural sector water demand increases within this scenario for the reservoir and desalinated resources, as water becomes more expensive, where only the most profitable irrigated crops are chosen to afford this extra cost. If farming profits cannot cover this further investment, it can

lead to negative implications in the socio-economic structure the Basin rural sector, including harvested area decrease, and ultimately rural exodus.

3.5 "No inter-regional water transfers and desalinated water usage restriction" Scenario (S5)

3.5.1 Results

Regarding the farmers profit and harvested area indicators, during the 30 year period simulation, the harvested area and average profit indicators remains unchanged, except for the average profit indicator of vegetables that decreased (-38%). The Vegetation cover indicator changed considerably, dryland crops area increased (1674%) and irrigated crops decreased considerably (-9963%).

For the Water resources indicators, the Average cumulative irrigation indicator from Aquifer and Reservoir resources increased (656% and 408%, respectively) and desalinated water resource decreased (-62%). Therefore, in average, "sediment discharge" increased (24%) and aquifer salinity decreased (-10%).

Water demands remained constant, except for desalinated water which decreased (-89%). Water shortage for agriculture decreased slightly for the agriculture sector (-12%) and increased for the urban sector (94%). Regarding water resources, Aquifer and Reservoir indicators of volume, extraction and replenishment remained almost constant, except for the Desalinized source, which indicators decreased (~ -100%).

3.5.2 Discussion

This simulation was intended to analyse what would happen to the Guadalentín agricultural sector if its only water supply is the aquifer resource, knowing that this resource gets overexploited in 2007, according to the baseline simulation (Figure 4. Therefore it is noticed a strong decrease of irrigated crops, being partly substituted by dryland farming, while cumulative average irrigation provided by the aquifer resource has a strong increase.

4 Conclusions

Using an holistic, integrated and dynamic model tool – the MedAction® PSS, it was possible to simulate numerous "what-if" scenarios (many more could be included), addressing the environmental and socio-economic spheres of the Guadalentín river basin in Spain, in particular the impact of water and agricultural subsidies and restrictions on the agricultural sector. From these analyses it was possible to identify two main conclusions regarding regional water resources and farmers decisions related to crops choices and farming profits.

For the Guadalentín agricultural sector, water shortage is a serious drawback, being aggravated by the fact that in the Basin, irrigation is a top priority, where water demand is much higher than supply, with the addition that water deficit has always been an intrinsic structural problems, due to regional climatic conditionings, such as long and dry summers and the occurrence of pluriannual droughts. Guadalentín agricultural sector is strongly dependent on technological man-inputs and inter-regional water transfer infrastructure.

- Water availability are an important issue; the groundwater resource is severely over-exploited (years 2007-2030) and most of the irrigation water is transported from other regions, through

sophisticated water transfer infrastructures: the Tajo-Segura channel, and probably in the future, also by the Ebro River (Northeast Spain) water transfer channel.

Additionally, in the nearby desalinization plants, purifying water techniques allow the availability of large volumes of water that can be used in agriculture. This water resource, although with an higher salt content, is an option when aquifer and reservoir resources are less available; being the third in line of farmers options due to its higher cost, desalinization techniques are currently an expensive procedure and still needs further improvements to provide better water quality, with lower salt content.

For the Guadalentín agricultural sector it is urgent the implementation of an efficient irrigation management to reduce environmental problems created by the excessive use of water resources, with consequent soil and aquifer degradation and pollution. The increase of water price is seen as an incentive to save water, making farmers switch from irrigated to dryland agriculture. In this way, fertiliser use also decreases having a positive impact in the reduction of non-point chemical pollution by agriculture. Less irrigation is also associated to less salt input on soils, since most of the times the water has poor quality.

Farmers should reconsider crop choices with less water demand and more adapted to local biophysical conditionings (soil, water availability and climate) and improve water management techniques (efficient and minimum use of water).

- Farmers decisions are acutely influenced by external drivers such as Spanish and European subsidies which have a direct influence on farmers choices. Framers management choices are driven to profit maximization, with little concern on environmental or agricultural sustainability. In this way, Land use is quickly changed to the next most profitable crops, even if the existing one is already profitable, leading to further land degradation in an already poor-quality soil. This trend is also known as the “subsidy culture” syndrome. It is noticed that for the agricultural sector, socio-economic conditionings are more important than biophysical or environmental constrains, that can be rapidly overcomed by strong man-input strategies.

The establishment of certain restrictions such as water usage restrictions (from regional aquifers or inter-regional water inputs), water cost increase, or eliminating (irrigated) crops subsidies, has a significant impact on farmlands profits.

If irrigated farmlands become less profitable and switching back to dryland crops is too expensive, especially if initial or recent investments are high, this conjecture can lead to the area decrease or even abandonment of irrigated croplands, leading to the reduction of agricultural labour demand, and eventually the land could be abandoned. These events could produce collateral effects, “since irrigated farmlands employ a ration of seven to eight times as high labour input per area” (Onate and Peco, 2005), being the main source of employment in many rural areas of Spain. Any major economic or political change (and aswell as the occurrence of extreme climatic events) could significantly affect the agricultural sector of the Guadalentín basin with serious consequences on rural employment and consequent massive rural exodus.

In conclusion, the type of unsustained water management and land mishandle identified in the Guadalentín Region, can lead to further land degradation and probably desertification. Therefore, there is the extreme urgency to develop and apply integrated tools where several relevant scenarios

can be approached and analysed in order to improve the comprehension of the desertification and land degradation phenomena, the interactions and feedbacks between the environmental and socio-economic dimensions, so that policy-makers and end-users can adopt the best possible set of land and water management options.

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The Urban Spaces of Uncertainty - The Environmental Assessment Perspective

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Uncertainties hamper the implementation of Environmental Assessment (EA) methodologies. However, many researches focus on the introduction of fundamental concepts, guidelines, or environmental assessment framework, but not operational methods. In order to quantitatively characterize the uncertainties of environmental impacts, and considering that the existing EA approaches are based on qualitative judgments or lack adequate quantitative analysis, this paper helps to develop an integrated technique of uncertainty analysis on land use change and its environmental impacts into the environmental assessment process for urban spaces using scenario planning approaches. Considering this, and in order to scientifically forecast, analyze, and assess the trends of changes in environmental quality in urban spaces, it is necessary to quantitatively characterize the uncertainties of environmental impacts by systematically establishing relationships between land use changes and the environment in the decision-making process. This paper pretends to enable a systematic characterization of urban planning, to identify key environmental factors, with regard to uncertainties and scenario planning.

Keywords: Environment Assessment, urban spaces, scenario planning.

''Environment assessment is as good as the planning system itself is.''

This argument was put forward by one transport planner in a workshop, exploring ways of increasing the influence of environmental assessments in transport planning. In "*Views on planning and expectations of SEA: the case of transport planning*" Hidén et al (2004)

1 Introduction

The sheer growth in number and size of cities is causing concern at local, regional and global levels, not least because of the environmental problems associated with the physical concentration of people and activities. Cities have increasingly become a focus for environmental action, with local and national governments struggling to devise efficient strategies for sustainable development. However, pass trend of low-density approaches to urban development results in increased consumption of energy, resources, increase of transport demand and land use, thereby raising environment concerns to levels that often exceed the legal or recommended human safety limits.

One of the greatest challenges that urban planners are facing, and that will be crucial in the next few years, is to understand how urban areas evolve through the interactions between human behaviours and biophysical processes. The complexity of these interactions can be extraordinary multifaceted and as demonstrated difficult solution. Yet, our failure to understand and to account adequately environment assessment in policy decisions has historically yielded infrastructure investment and land use decisions with long-term unplanned effects (and in most cases with negative consequences).

Environmental concerns should be a prior consideration at any planning stage. The Environmental Assessment[22] (EA) methodologies are used as a fundamental approach for improving environmental performance, and is a priceless tool to integrate environmental concerns in the decision-making planning process with the over moving trend toward sustainability goals. However, various uncertainties in the decision-making process hamper the application of EA, and considering that urban planning is for the future, there are significant uncertainties and potential risks inherently with them, which have been discussed in various literatures (for more details see Nijkamp and Perrels, 1994). Therefore, a more systematic approach is needed to forecast the potential environmental impacts of land use changes caused by urban planning under uncertainties, and demonstrate key factors that planners and decision makers should focus in formulating preventative strategies using quantitative analysis. This paper aims to demonstrate that a possible integration technique of uncertainty analysis on land use change and its environmental impacts into the EA process using scenario planning approaches.

2 Issues in urban sustainable development

Nijkamp and Perrels define sustainable cities as "cities where socio-economic interests are brought together in harmony (co-evolution) with environmental and energy concerns in order to ensure continuity in change". Thus, consideration of environmental, social and economic aspects is at the heart of ensuring that urban development is sustainable. According to Haughton and Hunter, a strategic long-term vision for individual cities should have at its mind the prioritization of environmental concerns and actions, and a central aim of enhancing the quality of life for present and future inhabitants, while contributing to local and global sustainability (as Patrick Geddes stated back in 1905: "think global act local").

It is in this context that the issue of urban sustainability has gained legal tender, and has become an important issue in social science research. Complex multi-layered plans, programs and legislation (policies) are already in place for managing and planning the urban environment[23]. Traditional policy controls include land use planning, regulation, investment in infrastructure and operation of public facilities. In addition, concern over urban environmental problems is leading to the growth of measures such as local authority environmental appraisal, recycling initiatives, integrated urban transport planning and studies on efficient energy use in urban areas. The starting point for many of these approaches has been the collection and analysis of data pertaining to the urban environment, and the development of environmental indicators, though, urban sustainability is dependent on more than just ecological sustainability.

Sustainability issues are not a static chart, since cities are continually evolving and interrelate with the world around them. This context inherits an overwhelming state of change, with trends such as globalization and market (de)regulation, in a context of economic, technology, industry,

[22] The term EA is associated, in this paper, as both SEA (Strategic Environment Assessment) and EIA (Environment Impact Assessment) methodologies, considering that SEA is the "bigger brother" of EIA for projects, programs and plans, which has been applied to a large extent in many countries world-wide. Despite these facts the authors question: Is SEA a new methodology or a new name for an existing methodology?

[23] European Union Directive on the environmental assessment of plans and programmes (2001/42/EC); Portuguese Law for environmental assessment of plans and programmes (*Decreto Lei nº* 232/2007); Portuguese Law for land use management (*Decreto Lei nº* 316/2007).

communications and social structures. Along with such cycles are structural transitions from primary resource-based activities, to secondary manufacturing, to tertiary services and quaternary knowledge-based activity. The restructuring of urban systems and infrastructure for sustainability cannot occur quickly. Assessment over a strategic time horizon such as 10 to 20 years shows the fundamental requirement of “delinking” of economic growth and social welfare from environmental impact, so that one can rise while the other is reduced. This “delinking” takes place in different ways in each sector, but there are possibly three important stages: stabilization of impact growth, redirection of negative trends, and longer-term sustainability as a desired goal.

Consideration of these issues comes at a time when many cities are looking seriously at issues of economic regeneration, the reversal of urban decay, and the improvement of urban living conditions (see the Portuguese case in Polis XXI policy). The current paper goes on to look at the rationale for increasing participation in sustainable development planning and implementation, and focus on one specific approach. The discussion starts with a brief outline of past approaches to traditional public participation in urban planning decision making in general and in relation to environmental constrains issues.

3 Failures on traditional urban planning decision-making process

Traditional approaches to policy and decision making in urban planning have usually been science centred and based on (local) expert opinion. Science is seen as the main rational basis for action, with other concerns including alternative forms of understanding and different significance structures. There has been an awareness of the limitations of this approach with, for example, local authorities being faced with demand for greater participation on the part of the public in decisions concerning science and technology, in line with elements of the 1992 Rio Declaration regarding the right of the public to access environmental information, decision-making and adequate judicial procedures for redressing any failure.

However, the typical focus of activities to increase public participation in decision making has been on informing the public, either through increasing public understanding of science or increasing precise access to valuable information. Typical justifications for increased public understanding are based on notions such as: general public ignorance in matters of science and technology; citizen’s lives are impoverished by exclusion from scientific thought; wider exposure to scientific thinking will lead to greater acceptance and support for science and technology.

It is considered that better public understanding of science can be a major element in promoting local and regional prosperity, in raising the quality of public decision-making and in enriching the common citizen´s life. Therefore, the goal of increasing participation has focused on making the public better informed, but has not encouraged a critical evaluation of scientific establishments or tried to include citizen’s views into research policy. The domination by scientific modes of analysis still persists in many current debates on urban planning and environmental issues, despite the fact that this approach often ignores social, cultural and governance dimensions.

A further failure of traditional approaches is their inability to deal with the uncertain nature of many environmental variable and problems. Funtowicz and Ravetz characterize many environmental problems as being typical of what they term “*post-normal science*”. That is, they are problems with

high decision stakes (through which we understand the various costs, benefits and value commitments that are involved) and high systems uncertainties (the problem is concerned with the comprehension or management of an inherently complex reality). The term "*post-normal*" is used to indicate that the puzzle solving exercises of normal science are no longer appropriate for the resolution of policy issues, and that uncertainty processes means that the role of people (their awareness, values, agreement and participation) can and should be increasingly improved.

3.1 Urban environment decision-making constrains

Urban planning experts tend to be predisposed in responding to those questions that they are particular proficient, rather than having the decision-making situation as their departure point. Today, the motivation of any environmental assessment in urban planning process is to help, assist and improve decision making. Thus, its approach is not based on a natural science perspective, but on decision theory. Although this connection to decision-making science is reflected in recent EA literature (for more detail see Kørnøv and Thissen, 2000), there are very few practical conclusions that have been drawn to improve and enhance linkages between the EA process and the decision-making process of a policy, plan or programme (PPPs).

Decision-making science reveals that uncertainties, information gaps and cognitive limitations, are typical features in the process. But the information about its impacts has a particularly high extent of uncertainty, different actors attach different the objectives and intentions to policies and there is a high risk of unforeseen impacts. Decision-making sciences offer approaches to explain and understand the decision-making context and the way it affects EA, and this process may raise some appropriate questions:

- Is the desired level limited to monitoring or will the urban planners aspire to measure environmental effects?
- Do urban planners want to have a strong element of public and stakeholder engagement in the process?

The range of one's perceptions (usually mentioned as scoping) should entail a dialogue to clarify these questions and what are the costs and benefits of different options. EA analysts have to choose a set of methods and tools to do systematic analysis, as well as the time to consider the substantive issues with the same depth.

The idea behind the development of environmental impact assessment (EIA) and strategic environmental assessment (SEA) concepts to urban planning evaluation (in the context of PPPs) was the notion of rational decision-making[24]. The need of public participation in decision-making and the lack of environmental control and feedback are therefore emphasised. At the same time, the rationalist school predominated in decision-making theory, so rational planning seemed to be the key to solving all problems (an attitude sometimes called ''planning euphoria''). Early literature on EA emphasised rationalism, and its language is dominated by rationalist concepts such as objective, systematic and comprehensive (Petts, 1999). The original approaches to EA were founded on rationalist assumptions on decision-making. Applying rational planning or decision-making to more

[24] The procedural origins of EA are rooted in rational planning theory, developed in the mid-1950s and widely discussed and propagated in the late 1960s and early 1970s (Faludi, 1973).

complex and strategic decisions, under the label of SEA, can be more difficult than at the project level. The standard rationality model of any EA process is based on two points: It depends on a rational process of decision-making, where the choice of options is based on clear objectives; and it assumes that all information is currently available.

In a rational decision-making process, the stakeholders consider all available information, and the role of EA therefore is to introduce any lacking information about the possible environmental effects of different options. The use of analytical approaches, in contrast, recognises the difficulties related to describing political decision-making processes according to such a rational model. On the PPPs level, the outcome of a decision is difficult to predict considering that more interest groups and actors are involved and procedures are less formalised than on the project level and decisions often materialize in negotiations. As the rationality model is too static to explain strategic decision-making, analysis has to focus on issues of several stakeholder interests. This means that every action implies the acceptance of certain values and the rejection of others (Dunn, 1994). In other words, this can be stated as the possibility to deal with systems that are characterized by complexity of a technical and multi-participant nature.

4 The need for a different approach in environment assessment

Environmental assessment procedures can vary in different sectors and countries. Thus, current EA practice is still limited with regarding same methodological issues, participatory approaches, quality control (follow-up) as well as general procedural and institutional deficits. In conclusions drawn from the European Union's 1994 Workshop on EA Methodology and Research, the main technical and institutional problems of EA can be summarized as the diagram of Figure 1.

Different institutional backgrounds and the variety of PPPs, and possible environmental impacts, require differentiated information-gathering procedures and methodologies. If EA is to be a universal instrument, it can be problematic to base its results on inadequate and uncertain information. One of the stated key objectives of EA is to change the way in which decisions are made by incorporating environmental values into the decision-making process. This cannot be adequately achieved as long as the procedure and methods of environmental assessment are based on the objective identification, prediction and evaluation of the environmental impacts of concrete and objective solutions.

Instead, EA has to go beyond the analysis of the environmental impacts of decisions and influence the process and content of priorities, issues and values that preside over decision-making. Kørnøv and Thissen (2000) claim that EA has been based on the assumption that the provision of rational information will be enough to improve decision-making. Brown and Thérivel (2000) conclude that emphasis should be on the EA process rather than on the product.

In real life, on the other hand, cognitive boundaries, behavioural biases, ambiguity and variability of preferences as well as implementation problems can also influence the decision-making, and it can be a process of learning and negotiation between multiple actors, considering that focusing on the prediction of environmental impacts does not ensure the integration of environmental values into the decision-making process.

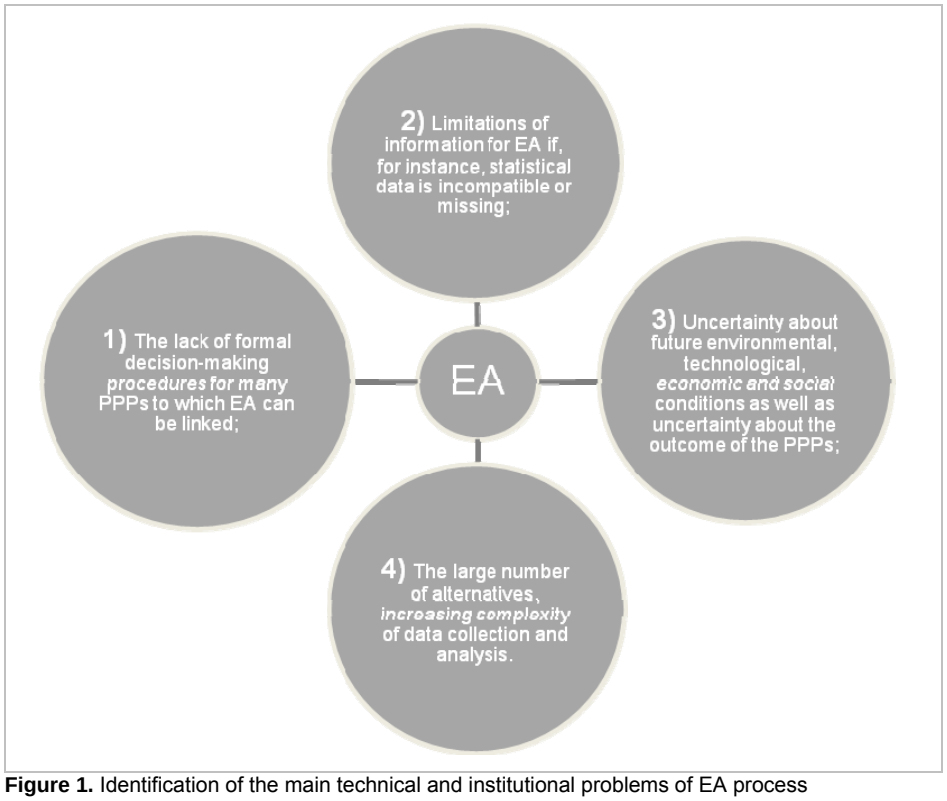

Figure 1. Identification of the main technical and institutional problems of EA process

Participation of environmental authorities and the public are the two key points where EA seeks to affect existing patterns of decision-making. Initially, environmental interest organisations are set up as actors and, secondly, EA provides for the public to be informed about the consequences of decisions before there is a final agreement about the subject of analysis. Thus, EA changes the basis of information as well as the structure of decision-making. The question is whether these procedures adequately improve the consideration of environmental values in decision-making. Public participation is difficult to realise and is unlikely to be successful in strategic decision-making from an environmental point of view because consequences are often unspecific and not related to people's concerns. Moreover, environmental values are often contradictory to economic or social objectives. And it is simply too late if new stakeholders (environmentally orientated) raise their voice at the end of the decision-making process. Most decisions cannot be revised and it is unlikely for solutions proposed and negotiated at an earlier stage of decision-making to be changed.

5 Towards forward-looking approaches

The current rapid rate of change is increasing the uncertainties related to possible future trends and about the effectiveness of environment oriented policies. Recent projections of environmental trends, in particular, give great reason for concern: climate change, for example, is increasingly recognised as a major threat to our way of life; the observed decline in biodiversity and loss of ecosystem services is not expected to reverse unless new actions are introduced; and the unsustainable patterns of resource use and waste generation are expected to continue to get worse. These diverse issues - dynamic changes, complexity, uncertainty and unfavourable projections - occurring over a

range of geographic scales, have generated a growth in demand for more analytical data and analytical approaches.

Recent European Environment Agency's (EEA) analyses (EEA, 2007a; EEA, 2008b) show that there are many limitations in the current use of forward-looking tools in environmental assessments. There is a need to:

- Develop more targeted forward-looking integrated EAs at appropriate geographic scales (integrating social, technological, environmental, economic and demographic issues);
- Include future perspectives routinely in regular environment reporting activities and systems (adapting existing information systems to regularly capture data on future perspectives and emerging issues, and including more forward-looking perspectives in national environmental reporting products);
- Strengthen institutional capacity to perform forward-looking assessments at all levels (increasing expertise and resources to build and carry out forward-looking studies).
- Improving institutional capacities to absorb and better utilise the information generated in processes of strategic political decision-making.

One of the basic requirements for the efficient use of forward-looking assessments is to improve and further develop forward-looking components of environmental information (such as viable data collation) and integrate these into existing information systems. Here, the need to fill a gap in this area by developing forward-looking components of environment information systems that will ultimately contribute to a better analytical approach. Such forward-looking information systems should include both purely quantitative information and combinations of qualitative and qualitative information. The objective of the forward-looking approaches is not to produce better data to reflect a reality that has not yet unfolded, but to produce information that provides deeper understanding and insights into possible future developments.

A further requirement, in addition to improving the information base, is to ensure the consistency of assessments related to the past, present and future. There are many tools and approaches to support different types of assessment, but they may not provide coherent outputs if not selected and designed so as to complement each other. Such tools and approaches can be used with different effectiveness to deal with complexity and to manage with uncertainties that are increasing with time scope (as seen in Figure 2). While projections might effectively support decision processes where uncertainties are not too large, scenario-based analyses become more important in the context of longer-term assessments that can deal with a larger degree of uncertainties and complexity.

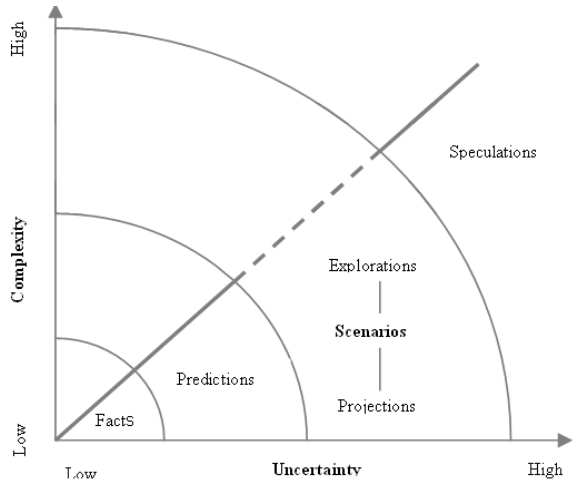

Figure 2. The uncertainty and complexity of underlying system dynamics in forward-looking assessments; Adapted from: Zurek and Henrichs, 2007.

6 A formal approach to scenario development

Few resources are specific to the unique problems of developing scenarios for natural sciences and environmental assessment in particular, and the development of scenarios (as a part of the so called forward-looking tools, seen in point 5 of this paper) can be quite a multifaceted process and intrinsically involves substantial expert interaction. As a result, urban planners have been discouraged from using scenarios for collaborative decision making due to a lack of guidance and regulation on how to formally plan scenarios for urban and/or environmental planning. Additionally, the urban planners have distrusted forecasting and long-term planning activities similar to scenarios because in their point of view such a method is only practical if the future can be extrapolated from the past (Fahey and Randall, 1998a).

While projections might effectively support decision processes where uncertainties are not too large, scenario-based analyses become more important in the context of longer-term assessments that deal with a larger degree of uncertainties and complexity, since they allow the combination of the creativity of (stakeholder-based) and quantitative analysis. One of the main characteristics of a scenario is that it must be physically and politically credible. Credible (or plausible) scenarios provide rational descriptions and explanations of possible happenings, adding credibility to the body of work that scenarios are meant to supplement. To further increase credibility, a plausible scenario should also be internally consistent with the driving forces that are critical to the development of the scenario trajectory.

Considering the need to eliminate redundancy, scenario development should be distinct by focusing on different driving forces and/or scenario objectives; however it should still holds a set of common variable inputs so that results from different scenarios can be compared. Useful scenarios sets have to be creative and test its limits when exploring the indefinite future, while remaining connected to the purpose of their use and being fully defined quantitatively and qualitatively (Maack, 2001). The simplest baseline scenario is that of the “official future”, a “business-as-usual” scenario of a widely accepted future state of the world. Decision-makers will not accept future choices unless the official future is questioned.

6.1 The spaces of uncertainty

Uncertainty is the inability to determine the true magnitude or form of certain variables or characteristics of a system. Any planning practice comes with a common sense of uncertainty that is its inability to determine the true magnitude or form of variables or characteristics of a system or, as generally defined by Walker et al (2003) ‘‘any departure from the unachievable ideal of complete determinism’’. Uncertainties are inherent in urban/environment scenario development (as it will be developed in point 6.3 of this paper), even though some of them can be abridged as the future discloses. Uncertainties associated with urban development and EA scenarios are not easily resolved and demand more analysis (Schwartz and Ogilvy, 1998b; Leney et al, 2004). There is an extensive literature on understanding and estimating uncertainties in environmental studies (Beven and Freer, 2001). However, measuring and communicating uncertainties to stakeholders continues to be one of the most challenging aspects of scenario applications (National Academies, 2007). To ensure successful communication of uncertainty, it is necessary to establish credibility and trust of the scenarios to important stakeholders. In addition, continuously involving stakeholders in the scenario uncertainty sources is critical. Therefore, considering uncertainty in urban development is a necessity for fully understanding the implications of scenarios methodologies. Specific causes of uncertainty may include: lack of basic knowledge; errors in data; model structures; model parameters; inadequacy in condition approximations; subjective judgment; inappropriate assumptions; ambiguously defined concepts; errors in projections of human behaviour.

Although it seems important to reveal the causes, and how to treat various uncertainties associated with scenarios, it deserves an extensive research by itself and detailed discussions on this topic are beyond the scope of this paper.

6.2 Environment assessment and scenario analysis

Scenario analysis can play an important role in ex-post and ex-ante stages of environment planning. In this framework, scenario analysis can be divided into predictive, explorative and normative types (Börjeson et al, 2006). Predictive scenarios respond to the question “what will happen?” and make it possible to plan and adapt to situations that are expected to occur. Explorative scenarios intend to explore situations or developments that are regarded as possible to happen from a variety of perspectives. This makes this kind of scenarios suitable to use as a framework for alternatives and assessment of the impacts of an environment development. Normative scenarios address the question “How can a specific target be reached?” and focus on how future situations or objectives can be realised. Using scenario analysis *ex post* may seem counter intuitive since this is in essence a prospective approach. However, if we consider the cyclical character of decision making, in EA follow-up, scenarios can be used both as a basis for learning and analysis. Similar to the use of *ex ante* EA (Höjer et al, 2008) predictive scenarios are useful because all policy outcomes are usually not known at the time of the evaluation. In the learning stage, predictive and explorative scenarios can be used to evaluate whether the set objectives of the policy will be reached. If it is found out that the objectives will not be reached.

Plausible scenarios ultimately are linked to real data that should be evaluated prior to their use in resources planning and decision-making. For a model-based approach, this step refers to

gathering and processing model input data, running the model(s) for each scenario, and processing model output data. Primary model input and output variables are determined by the scenario definitions and should have been identified in the conceptualization step, along with appropriate spatial and temporal resolutions and scales (very important factors in defining scenario parameters).

6.3 Common scenario scopes in urban planning and environment assessment

When scenarios involve complex interactions between natural and human systems, the identification of scenario themes as plot lines within a story-like narrative can facilitate discussion about different issues. Scenario themes are typically suggested by the cause and effect relationships between the most critical and most uncertain variables. Themes may include those that describe the future in terms of growing or declining forces (e.g. improved vs. declined environmental monitoring networks), good news and bad news (e.g. sustained deficiency vs. changeable climate), or winners and losers (e.g. increased urban populations vs. higher rural settlements).Themes can also be characterized in the form of cycles of sporadic change or states of change, representing a sequence of events that feed off each other to cause a movement towards a assured state (e.g. a series of development, or a series of mistakes leading to stagnation). Urban development using scenario planning is most usually determined by decision-makers or their advisors (experts) with particular set of well defined objectives. As a result, urban environment assessment scenario-planning efforts have commonly focused on a particular subset of future conditions that helps to narrow the scope of the process. Common scenario scopes (more typical used) in urban planning concerning environment assessment embrace the following points:

a) Climate scenarios are based on climate projections and are designed to represent future climate such that potential impacts of anthropogenic climate change are explore.

b) Socioeconomic scenarios characterize demographic driving forces, and the sensitivity, adaptability, and vulnerability of socioeconomic systems.

c) Ecosystems scenarios (including socio-ecological systems) that include future environmental factors and conditions that can consist in threats and have consequences towards land-use.

d) Environmental scenarios that focus on water resources represent water's importance in human continued existence, ecosystems management, economic activities, power generation, and a variety of other industries.

e) Land-use scenarios represent issues related to food security, carbon cycling, and land-management practices.

f) Technological scenarios include technological changes that affect societal and environmental growth. As changes in technological development can impact various other scenario factors, there can be significant overlap between this scenario category and others.

For most environmental studies in urban planning, it seems obvious that all of these categories are closely interconnected with feedbacks and consideration of any one in segregation can potentially lead to defective scenario outcomes. As a result, successful environmental scenario studies usually combine elements of climate, socioeconomic, environmental, and technological scenarios.

Drawing upon the increasingly knowledge and experience as described in the literature, the authors of this paper put forward the notion that a land-development and environment assessment scenarios set are both a bridge that connects the process of planning and the cognitive tools that helps to stretches people's thinking and broadens their views in urban planning and environment concerns. The dual function entitles a scenario set to be a favoured member of a family of inherent instruments that humans operate in making decisions.

A number of different, yet similar, mock-ups should be utilized in order to explore the range of uncertainties that were possible through the various scenario outcomes. Each storyline represented a unique path of development towards the future and all subsequent scenarios were treated as equally likely to occur with no attached probabilities.

7 Conclusions

Several authors indicate that there exists a general agreement in the environmental assessment community that scenario planning is a practical, effective way to put environmental outputs to more beneficial use for long-term decision-making. In spite of these facts, the lack of general guidance on how to approach formal scenario planning has discouraged environmental analyst and stakeholders from using scenarios to inform decision-making in urban planning processes.

Motivated by this “hitch”, the authors anticipated the discussion in scenario approach that can be applicable to environmental assessment studies. There remain, however, exceptional issues that deserve particular attention when pursuing scenario planning for environmental and urban studies. Like environmental predictions, scenario results are of limited value if the involved uncertainty is not properly considered. Hence, understanding scenario uncertainty and communicating it to stakeholders in an appropriate way represent a particular area that deserves extensive further discussions and further research efforts.

In addition, scenarios of a more variable nature can provide more constructive information than simply relying on broad-scale, long term global change scenarios that are widely available (as has typically been the case). Several directions can be taken to respond to this, including: (a) The development of approaches that can in fact combine expert- and citizen-driven scenarios, and research-based strategic scenarios using analytical approaches; (b) The creation of other scenarios from the knowledge of experts and citizens that is largely unexploited in current scenario studies, considering more availability of data and information;(c) The use of policy-responsive scenarios that are inherently connected to the direction future conditions might take and are capable of physically manifesting environmental management at a variety of scales and time frames.

In the authors perspective and in conclusion, an extensive and active discussion among researchers working on scenario-related environmental studies should always be encouraged to enable sharing of relevant resources, information, data, processes and ideas. The availability of generic tools for the development of prearranged scenarios (e.g. climate, land-use and socioeconomic scenarios) can greatly facilitate the scenario construction process and result in cost savings that could make formal scenario development a much more affordable and less time consuming, thus more appreciated, means of environmental and urban planning.

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Analysis, evaluation and indicators of sustainable urban concepts

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This paper presents a study of sustainable urban concepts with a focus on mobility, emissions and energy use. Such concept is considered for the project "La Prolongación de la Castellana" in the north of Madrid, the largest sustainable urban project in Europe. This project will serve as a case study for the analysis, definition, evaluation and valorization of urban sustainable indicators. The rating of quantitative indicators, which deals with a complex search for boundaries and gradations of the indicators, is combined with a more explanatory approach of qualitative indicators. Hence we become an evaluation system that combines a one-shot rating with a descriptive analysis. This outcome can be used as a framework to evaluate other urban projects.

Keywords: transport, indicators, urban planning, sustainability, environmental assessment.

1 Introduction

'Sustainability', 'Global Warming', 'Climate Change' have become the concerns of daily life, the concepts can be found in newspapers, technical articles, advertisements etc. The term sustainability however seems to be used as a mask covering up the true meaning and necessities for the changing world. Developers use it as a commercial line, architects whenever they use a recyclable material and even lay persons when placing a solar panel on their roofs. Knowledge of the true meaning of sustainability is rather scarce, even in the 'intellectual' world there is a non-consensus about the definition, the prior goals and the means of achieving the goals. However, all agree that there is a necessity for change in the world, in the lines of resolving the problems of global warming and climate change.

In the sustainability debate, one can make a difference between the environmental impact affecting the world and more local environmental problems. Cities and urban patterns play an important role in this discussion because of their local and global environmental impact. Development of cities has an impact on global environmental problems as well as people living within are confronted with air pollution, traffic noise, social and economical problems. In urban areas the economical, social and environmental dimensions meet most strongly. Cities are places were most environmental problems concentrate, but also where business is made and investments happen, i.e. the city as driver of economy, and where most social interactions occur. Therefore, the focus of sustainability of this investigation lies on cities, their problems and strengths. Because there is a worldwide concern about the environmental problems of cities and the social and economical problems they generate.

2. Objectives and scope

This paper is a part of a graduate thesis (for contents see Figure 2) for the Department of Architecture, Urbanism and Planning at Katholieke Universiteit Leuven. The following objectives are pursued:

1. Investigate some existing urban sustainable indicator systems and their concepts
2. Create and validate an indicator system (Figure 1)
3. Investigation and application of the case study: “Operation Chamartin” in Madrid
4. Criteria for and explanation of the design of sustainable cities

All these objectives can be examined for all the sectors of sustainability, but this thesis will only focus on transport and its related aspects. Although this thesis is only concentrating on transport, the foundations will be laid for other investigators to study these objectives and the concepts of sustainability for other sectors.

For the different indicators, this involves:

- Exploration of the role of transport related subjects in the urban sustainable indicators
- An indicator system consisting of quantitative and qualitative indicators of transport, and its related subjects, followed by examples to valorize quantitative and qualitative indicators that can be used as a framework for further research.
- Examining the global concepts of the project in further detail for transport related subjects.
- Because this thesis will not be going into detail for all the aspects of sustainability, it will not indicate precisely how sustainable this project is; it will however give information about how sustainable the transport concept of the project is.
- Problems, concepts, recommendations and examples for the design of urban areas with especially sustainable transport in mind.

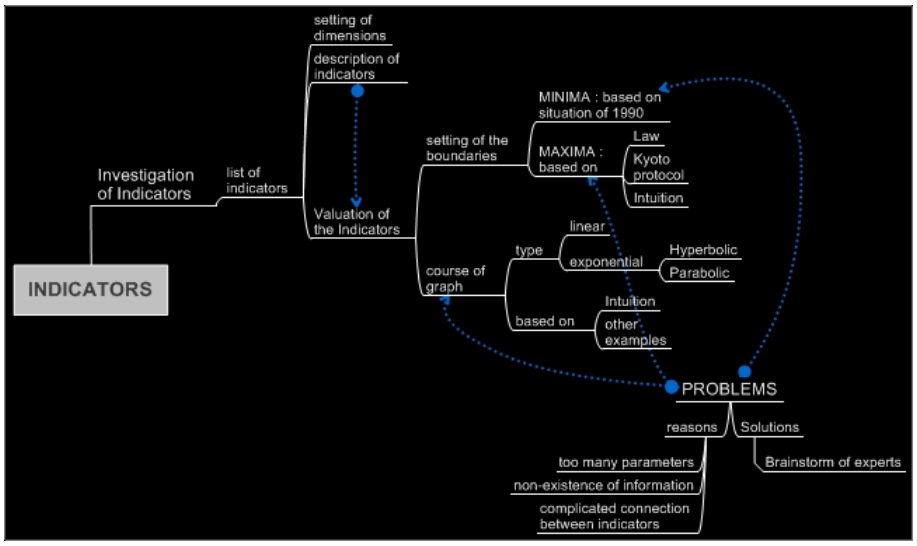

Figure 1. Scheme of Methodology for Indicator list

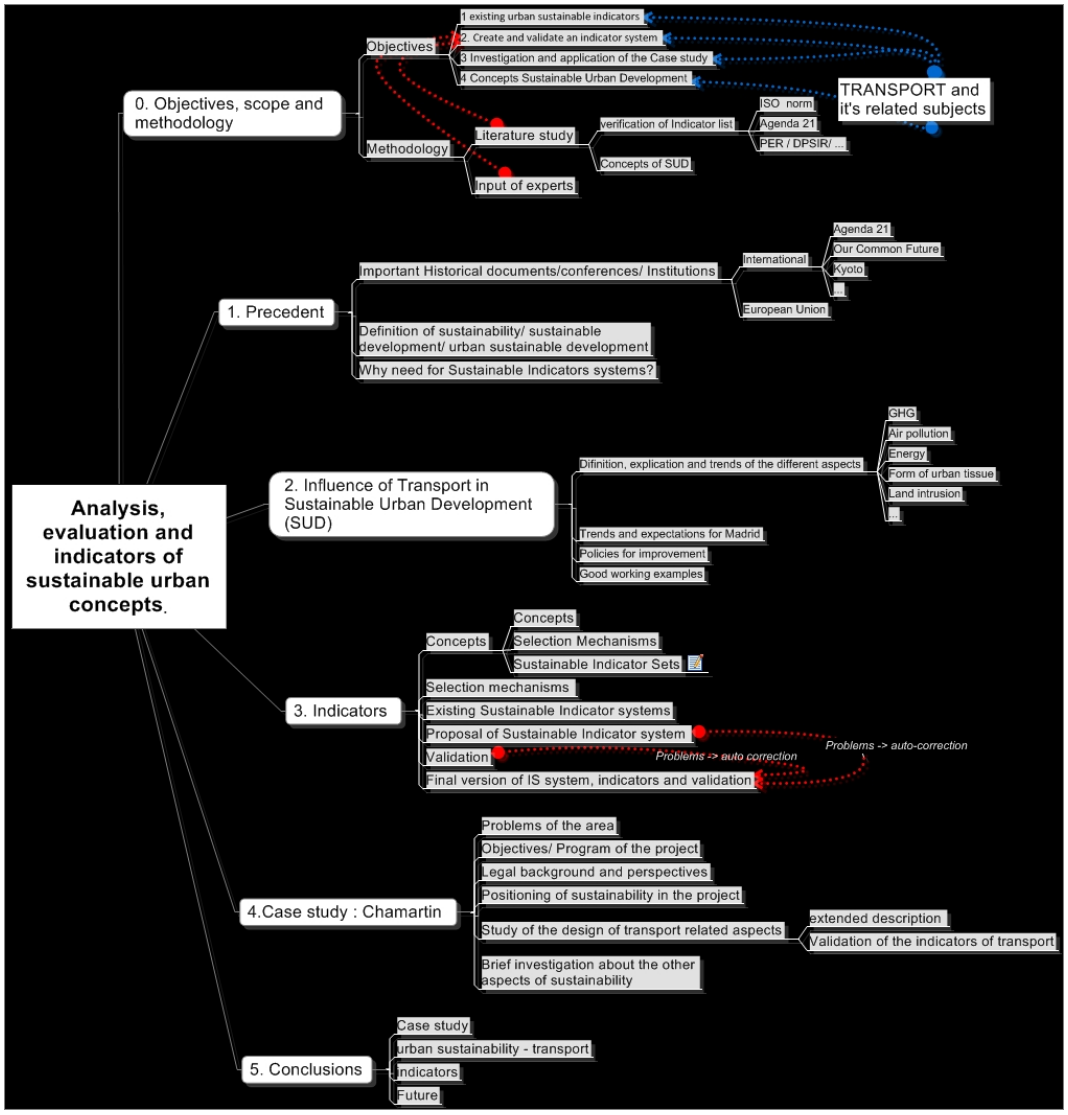

Figure 2. Scheme of Thesis

3. Sustainable Urban Development (SUD)

3.1 Definitions

3.1.1 Definition of SUD

The question arises what we mean by the term “Sustainable Development”. There is a lot of criticism even about the most well known definition: “Development that meets the needs of the present without jeopardizing the ability of future generations to meet their own needs”[25], particularly for accepting conventional notions of continued economic growth as the path to improved human welfare, for insufficiently incorporating an analysis of global power relations, and for developing a definition of sustainable development that is highly antropocentric and dependent on the difficult-to-define concept of 'need'. (Wheeler & Beatley, 2004, p. 53) O’Riordan said in his 1988 essay that this definition, more in particular its vagueness, would lead to people claiming everything as 'sustainable

[25] In “Our Common Future”.

development' and thus reducing it to something meaningless. The same comment is given by Branden P. (Deakin et al., 2005, p. xi) when stating that the public debate about sustainable development is active but that it lacks structure and meaning regarding the components of sustainable development and if we are not careful it becomes a discussion on practically everything in which human beings engage and thus loses its focus and substance.

Different people use the term in different ways, there are a variety of definitions, some emphasizing development as economic growth while others see it more as environmental protection.

The problem as stated by Nitin Desai (Dresner, 2008) about agreeing on the meaning of sustainable development isn't fundamentally about agreeing upon a precise definition, but about agreeing upon the value that would underly any such definition.

Some environmentalists argue that the definition is a contradiction in terms and is only concealing the continuing destruction of the world. Economists on the other hand warn for too much cautiousness about the future, in particular for the concern about depleting the natural resources before the economical growth. But the sustainable development debate is not about growth versus environment, is is about equity; concern about sustainability must be based on moral obligations towards future generations-not just for personal interest. This concern was also stated in the Brundtland report with the crucial sentence : "Even a narrow notion of physical sustainability implies a concern for social equity between generations, a concern that most logically be extended to equity within each generation". (Dresner, 2008, p. 2)

3.1.2 Definition of urban sustainability

Although the term 'sustainable development' first shows up in 1972, in Limits to Growth, and has been commonly applied to urban planning and architecture only since the 1990s, the concern about unsustainable urban planning has a much longer history. Some of its pioneers are Ebenezer Howard, with his book on "garden cities", Lewis Mumford etc.

It is interesting to investigate what is meant by sustainability in the urban context. If we look at the term 'urban sustainability' we encounter a juxtaposition of the words 'urban' and 'sustainability'. This juxtaposition may appear to be a gross contradiction because of the question whether cities, urban tissue can be sustainable because of their dependancy on goods and services from outside the city. However, it can be explained with the following definitions:

[Urban Sustainability is] the process of developing a built environment that meets people's needs whilst avoiding unacceptable social or environmental impacts. (Hamilton et al, 2002 as cited in (Bell S., 2008))

Sustainable urban development may be defined as a process of synergetic integration and co-evolution among the great subsystems making up a city (economic, social, physical and environmental), which guarantees the local population a non-decreasing level of well-being in the long term, without compromising the possibilities of development of surrounding areas and contributing by this towards reducing the harmful effects of development on the biosphere. (Camagni, 1998 as cited in (Bell S., 2008))

We can also compare urban sustainability with urban sustainable development to get a better understanding of the term. Sustainability is describing a desirable state or set of conditions that persists over time. Development however means a process by which sustainability can be attained.

As with the definition of sustainable development, there is also a considerable debate about the meaning, use and significance of this term. There is however a general consensus that there is a need for introducing environmental considerations to the policy debate of the future of our cities. Whether this is a balance between social, environmental and economical or environmental issues should be paramount.

3.1.3 The need for Sustainable Indicators

"There is a general lack of capacity. . .for the collection and assessment of data, for their transformation into useful information and for their dissemination." "Indicators of sustainable development need to be developed to provide solid bases for decision-making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems." (Agenda 21, Rio 1992)

As pointed out by Brandon P. (Deakin et al., 2005), discussions about sustainable development have an underlying question: what are we prepared to sacrifice now in order to ensure that future generations do not suffer in this way? In order to know this there is an even more practical question: how will we know that we have made progress? How will we recognize progress with sustainable development? By addressing two issues; the need for a structure, a common language, and ways of measuring progress. Measuring the direction of current trends is not new in urban planning but the subject takes on an urgent form if we are trying to change the cities in a radical way. For this reason and to educate the public about the direction of current trends and to secure political support for change, sustainable indicators have become one of the central tools of sustainable urban planning strategies.

Current urban policies of improving sustainability is not enough, there is a need for more radical policy making, as stated by Spiekermann and Wegener (Wegener & Spiekermann, 2007). These radical policies will not be implemented if one can not clearly demonstrate the effects that it brings with it. Policies might have very different effects, working on the environmental, social and economical dimensions they also might have negative effects; they might work against each other whereas some policies might reinforce each other. Because of the direct, indirect and short-and long-term effects the methods needed to measure policies for a more sustainable urban environment will need to be very advanced.

3.2 Transport in SUD

"*compared with 1990, transport would record, in 2030, the third-strongest growth with +20.8%, after residential (+28.5%) and tertiary (+41.7%). In 2030, transport in the EU-25 should represent 30% of the final energy demand, i.e. still the largest share." "In 2030, CO2 emissions in transport should … represent 27.6% of total emissions."* (Dupressoir, S. et al., 2007, p. 92)

Urban transport is one of the most crucial aspects of cities from the sustainable point of view. It plays its problems and benefits on the environmental, social and economical dimension. For this reason, urban transport requires outstanding coordinated action on urban transport planning.

The greatest benefit from efficient transport systems is the economic development. Personal mobility for work, study and leisure have become the key ingredients of modern life. But transport has also lead to economical growth during the boom years; more construction, shopping and tourism are effects of more transport. Production of transport vehicles, production of the fuels that power them, private and public expenditures connected to the provision of transport infrastructure, and the value of the transport services are all factors that contribute to an economy's GDP. The transport sector alone has employed approximately seven million individual for the EU-15 (Panorama of Transport 2002 as cited in (World Business Council for Sustainable Development, 2004)) and EU reports personal consumption of transport by households for 2000 at nearly 700billion euro, which is just over an 14% of the total household expenditure. (European Union Energy and Transport in Figures, 2002) Even in these times of economical crisis, where transport demand is reduced, stimulus packages are discussed which make the link between transport and economical growth. These policies would involve realizing a well designed scheme that can reduce transport volumes with a shift to less polluting modes of transport without changing the economical activities. (EEA-European Environment Agency , 2009) Unfortunately, transport trends are not going into the direction of better environmental conditions and "'decoupling' transport impacts from economic activity is still in its infancy". ((EEA-European Environment Agency , 2009, p. 4)

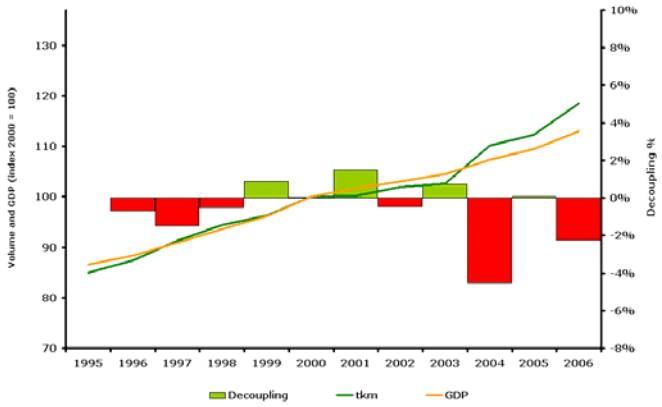

Figure 3. Trend in freight transport demand and GDP (EEA, April 2009)

These benefits from transport however come at a high price. Air pollution, congestion, noise, energy consumption, land requirements, accidents are the main problems of transport. The Key messages from the EEA (2009) are:

Freight transport continues to grow with the largest increase in the transport modes that consume the most energy; road and air freight. During most years of the last decade, freight transport has been increasing more rapidly than the economical growth. (see Figure 3, The two curves show the development in GDP and freight transport volumes, while the columns show the level of annual decoupling. Green indicates faster growth in GDP than in transport while red indicates stronger

growth in transport than in GDP.) There is a need for a shift to less energy consuming modes and better use of road transport fleet.

Passenger transport, by road and air has continued to increase. Between 1995 and 2006 car ownership levels in the EU-27 has increased by 22%, with most growth in Eastern and central Europe where passenger transport almost tripled. “High levels of car ownership and the relatively low modal share of public transport are continuing to have a negative environmental, social and economic impact, with congestion in urban areas being a problem across Europe.” (EEA-European Environment Agency, 2009, p. 14)

Greenhouse Gasses. The amount of Greenhouse Gasses has risen with 27% (excluding the international aviation and marine sectors) between 1990 and 2006 in the EU, because of the growing transport volume.

Air pollution that are causing most problems in Europe are fine Particulates ((PM_{10}) and nitrogen oxides (NOx). Both, emitted trough transport directly into the breathing zone, have important impact on human health. Studies about this matter have been very the subject of intense research these last years. Where epidemiolical studies have proved the relation between particles and mortality, even with concentrations below guidelines. (Pönkä et al., 1997 as cited in (Lautso K. et al., 2004)) Even though there is a reduction in road transport exhaust emissions across Europe, there has been no noteworthy improvement in concentrations of fine particles and nitrogen oxides.

Noise. Many cities around the world are facing noise problems produced by transport, with road transport being by far the main source. These noise exposures affect citizen’s quality of life and health such as annoyance, sleep disturbance, effects on the cardiovascular system, mental health and children’s school performance ((EC, 2004); (EC, 2002) In 1995 some 113 million people are affected by noise levels of over 65 dB(A), and 450 million of over 55 dB(A), as showed by the Dobris Assessment. Of agglomerations with more than 250 000 inhabitants in Europe, there are almost 67 million people exposed to daily road noise levels exceeding 55 L_{de} living in agglomerations. While between 1970 and 1980 the concerns shifted to air pollution rather than noise exposure, in latest years there is a high level of concern regarding noise exposure. To improve noise addressing strategies, EU member states reported standardized noise data in a structured way in 2007, making it possible to start looking at noise exposure across Europe.

Another important aspect of transport is the land intrusion of its infrastructure for motorized traffic flow. The land what is taken it by this infrastructure could be put to other, more sustainable uses or left to nature. Destroying natural habitats, damaging areas because of dumps of infrastructural works, creating barrier effects, degrading of location values (biological, cultural, historical, scenic sites of value) are the main problems. Decent infrastructure for cyclist or pedestrians are often secondary to motorized traffic or even not existing. Leaving the most weak party without good and safe transport infrastructure. When addressing the environmental aspect of transport infrastructure we must take the direct and indirect effects into account. Not only the aspects of more land intrusion, new infrastructure and expansion of old roads matter but also the fact that these constructions induce traffic volume because of the increase of accessibility and convenience. (EEA, 1995)

For all the above reasons, urban planning must take on a strong responsibility for managing the urban mobility demand together with the environmental problems. This requires policies that incorporate all dimensions of sustainability, with long term strategies.

4 Indicators

The need for an instrument to measure progress is already explained in previous chapter. This chapter will give some more information about this instrument, i.e. sustainable indicators (SI's). With this information and the investigation of existing indicator sets, a new sustainable indicator set (SIS), focused on transport, is created. Analyzing the case study will be done by using this SIS.

4.1 Concepts

4.1.1 Definition

In general terms we can explain an indicator (e.g.: the amount of passenger trips) as a measure of the observable part of a phenomenon that allows us to evaluate the unobservable part of that phenomenon (Chevalier *et al.*, 1992 as cited in Castro Boñano, 2004). For example, an indicator of social security is a variable that will give us tangible information about an aspect the reality of which cannot be captured in a direct or total form. As a matter of fact, our entire scientific information system is full of indicators that allow us to give a detailed description of the data of this area. In the case of the urban environmental concepts it is more difficult to encounter these data, because of their change in time and the limited scope. Another explanation of indicators, as part of a system is given by Galoppin (1996). This author defines indicators as variables (not as values), i.e. as operating representations of an attribute (quality, characteristics, property) of a system. Therefore indicators are images of an attribute, which are defined in terms of measurement procedures or determined observations (Castro Boñano, 2004). To sum up it is interesting to quote:the definition of the working group of sustainable Indicators, led by Hernández Aja of the institute of E.T.S.A.M: "The term indicator represents a complex situation in a simplified manner, which permits us to evaluate its evolution through time or its comparison between different spaces or structures. An indicator is a variable that surpasses its net value to represent a more complex reality that should be easily understood and evaluated for all citizens "(Grupo de Trabajo sobre Indicadores de sostenibilidad, 2004: 60).

4.1.2 Criteria

Quite a number of authors describe criteria for an "ideal indicator", for example OECD (1993), Galoppin (1997) and Adriaanse (1993) give the following criteria :

a. The values of the indicators have to be measurable
b. The data have to be available or obtainable through specific measuring.
c. The methodology of the collection of the data has to be transparent, clear and standardized
d. The financial means, technical and human, for the construction and monitoring of the indicators have to available.
e. The indicators have to be "profitable" or cost efficient, relativizing the cost with the objective that it should be measured.

f. The indicators should receive large political acceptance at the appropriate level of decision making.
g. It is fundamental for the use of indicators to get the cooperation and help of the public.

4.1.3 Possible Problems

Agenda 21 suggests indicators and indicator systems for the Urban Environment, also applicable for the Local Agenda 21. Some problems might arise with using indicator systems, these are (based on (Fernández Sánchez, G., 2008) and Zarzoza 1996 as cited in (Bonaño, 2004)):

- *Selection of the indicators and their characteristics*: The practical difficulty of including subjective indicators or indicators of perception, the disaggregated nature of social indicators (the need to aggregate something to gain significance), and the ambiguity of the significance of the indicator or the disassociation with the factor to measure.
- *Problem of comparison, in time and space*: When tracking an indicator over time it could lose its significance because of the variations of the basic statistics in time. In the spatial comparison there is the problem of heterogeneity between systems. An SI system always depends on the context in which it is created. An indicator system for one city might not be usable for another city. Therefore one should have an indicator system for that specific city or municipality even if it is logical to have an homogeneous pattern (same objectives, same type of indicators etc.). But there are authors (Wilson et al. 2007; Piño Neculqueo, 2001 as cited in ((Fernández Sánchez, G., 2008), p. 37)) who have indicated numerous problems of heterogeneity between sustainable urban indicator systems, showing that there does not exist a global consensus on how to select indicators.
- A lack of participation of all the involved actors in the selection process of the indicators. (Barrutia et al. 2007)
- The amount of used indicators ought to be relatively small but as representative as possible. (Button, 2002; Alarcón, 2005)
- The evaluation method of urban indicators also lacks consensus. It depends on whether they are qualitative or quantitative, on the equation with which we are measuring, on the access to data and information, and the existing norms as legal reference.
- Scale problem: it often happens that the spatial dimension of the objective of the study does not coincide with the spatial dimension of decision making, which generates problems with the analysis of the interaction between the ecological and social systems. (Wilson et al., 1999 as cited in (Bonaño, 2004))

4.2 Existing Sustainable Indicator Systems

The SI system this thesis started off with is the one by Vandevyvere H.[26.] Since this is a doctoral thesis and does not have the objective of an SI system to measure sustainable transport, other existing SI systems are explored to be adopt a critical attitude towards Vandevyvere's system and find more indicators for transport and its related aspects. Not only the transport related indicators are

[26] See Attachments for Han Vandevyvere.

investigated but also the systems background, selection mechanism, model of sustainability and place of the transport nucleus in the sustainability model.

Well known (inter)national as regional systems are examined, some in more detail then others depending on their relevance. Not all investigated systems are discussed in this thesis because of their less investigation level or impracticability.

4.2.1 Han Vandevyvere

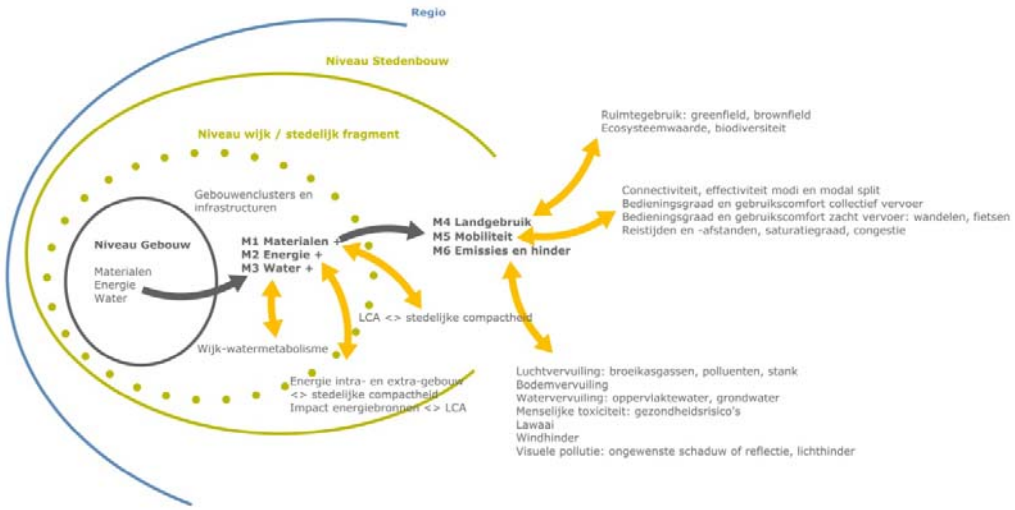

Figure 4. SI system of Han Vandevyvere:environmental-technical sustainability on micro-urban scale

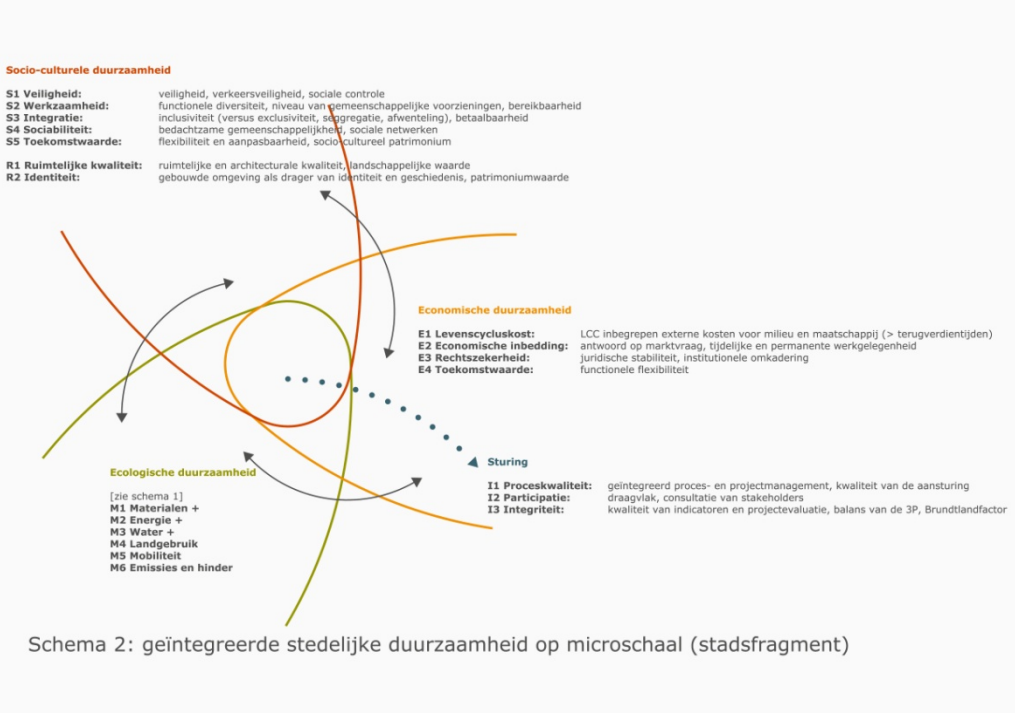

Figure 5. SI sytem of Han Vandevyvere : integrated urban sustainability on micro scale

4.2.2 Dobris

Aimed at all those interested in environmental control, this report provides an objective, reliable and rigorous basis for decision making, information and raises awareness about environmental problems facing Europe today.

The report consists of six main parts and fourty chapters explaining the many related aspects of the diagnosis of the environmental condition of Europe. These parts are: Context, state of the environment, pressures, sources of the pressures i.e. human activities, problems in Europe and the conclusions.

In the absence of an established set of environmental indicators on European level, they opted for a series of criteria to help assess which information should be included. These nine criteria are :

- threat to sustainability;
- impact of global problems in the European area;
- prominence of a European aspect;
- transboundary aspect;
- long-term character;
- risk for human health;
- social or cultural impacts;
- ecological damage;
- economic loss.

These criteria were used to identify prominent European environmental problems as well as to choose which material to focus on in each chapter.

The proposed storyline to follow in order to make the diagnosis (which environmental problems there are and the steps to tackle them) can be seen in figure 3. The linkages between the different elements are crucial to design better strategies in order to tackle environmental problems across sectors, sectors deserving priority can be determined.

Figure 6. schematic representation of the storyline (European Environment Agency)

To deal with the urban environmental problems (chapter 10), they proposed an experimental indicator set consisting of 55 sustainable urban indicators, grouped under 16 attributes. This system was created to investigate the urban environmental problems in 72 cities, finally ending up with only 51 European cities because of the lack of data. Out of this set, the indicators that are interesting for these research are extracted (Table 1)

Table 1. Dobris, Transport Related Indicators Extracted from SI list (EEA, 1995)

Indicators of Urban Patterns		
Urban land-cover	Transportation network	Motorway length (km) (11) Railway length (km) (12) % of total urban area (13)
Urban Mobility	Modal split	number (18) and average length (19) of trips in km per inhabitant per mode of transportation per day
	Commuting patterns	number of commuters into and out of conurbation (20) as % of the urban population (21)
	Traffic volumes	total (22) and inflow/outflow (23) in vehicle-kms number of vehicles on main routes vehicle-kms (24)
Indicators of Urban Flow		
Energy	a) Energy consumption	electricity use in GWh per year (30) energy use by fuel type and sector (31)
	b) Energy production plants	number (32) and type (33) of power and heating plants in the conurbation
Indicators of Urban Environmental Quality		
Acoustic quality	Exposure to noise (inhabitant per time period)	exposure to noise above 65 dB (49) and above 75 dB (50) % of groundwater resources in total water supply (26)
Quality of air	a) Long term: SO_2+TSP	annual mean concentrations (45)

As we can see, Modal split, Commuting Patterns and Traffic Volumes are measured under the indicator of 'Modal Split' whereas the 'Urban land up-cover measures the amount of land taken in by Transportation networks. These indicators are grouped together as 'Indicators for Urban Patterns', expressing the situation of the urban tissue. Indicators such as Quality of air, Acoustic Quality and Traffic Safety belong to the group 'Indicators of Urban Environmental Quality'. The Dobris Report does not order its indicators according to the subdivision of social, economical and environmental dimension, nevertheless we can find transport related indicators suitable under the social and environmental dimensions. We must also stress that most indicators fall under the Economical dimension.

4.2.3 PROPOLIS

The EU research project PROPOLIS (Planning and Research of Policies for Land Use and Transport for Increasing Urban Sustainability) is part of the Key Action' City of Tomorrow and Cultural Heritage' of the 5th Framework Programme for Research and Technology Development of the European Union. The main goal is to assess urban strategies and to demonstrate their long-term effects in European cities. To obtain this objective they have developed a framework of methodologies including land use, transport and environmental models, indicators as well as evaluation and presentation systems.

The indicator list consists of the tree dimensions of sustainability- environmental, socio-cultural and economic-subdivided into nine themes and counting thirty-five indicators. They are traced back to state-of-the-art urban land-use and transport models.

The economic dimension consists of indicators measured by a cost-benefit analysis whereas the ecological and social dimension consist of indicators measured by a multi-criteria analysis.
The model has already been applied to seven European Regions: Bilbao, Brussels, Dortmund, Helsinki, Inverness, Naples and Vicenza. City-specific local policy strategies have also been investigated for all the regions, together with the global policies of the land-use and transport model.

We must emphasize that the indicator list lacks indicators of land use such as greenhouse gases, air pollution etc. Some of these are tested in the individual studies for the cities.

Together with these indicators they also defined a set of background variables, used to understand and explain the behaviour of the policies.

Table 1 PROPOLIS indicator system

	Theme	Indicator
Environmental indicators	Global climate change	Greenhouse gases from transport
	Air pollution	Acidifying gases from transport Volatile organic compounds from transport
	Consumption of natural resources	Consumption of mineral oil products, transport Land coverage Need for additional new construction
	Environmental quality	Fragmentation of open space Quality of open space
Social indicators	Health	Exposure to PM from transport in the living environment Exposure to NO_2 from transport in the living environment Exposure to traffic noise Traffic deaths Traffic injuries
	Equity	Justice of distribution of economic benefits Justice of exposure to PM Justice of exposure to NO_2 Justice of exposure to noise Segregation
	Opportunities	Housing standard Vitality of city centre Vitality of surrounding region Productivity gain from land use
	Accessibility and traffic	Total time spent in traffic Level of service of public transport and slow modes Accessibility to city centre Accessibility to services Accessibility to open space
Economic indicators	Total net benefit from transport	Transport investment costs Transport user benefits Transport operator benefits Government benefits from transport Transport external accident costs Transport external emissions costs Transport external greenhouse gases costs Transport external noise costs

Figure 7. PROPOLIS indicator system (Wegener & Spiekermann, 2007)

With a view to putting together an indicator system measuring transport models, this system is very useful because of the fact that this system, contrary to the other explained systems, is solely measuring transport policies and therefore places transport at the centre of the three dimensions of sustainability. We cannot however use this indicator system to achieve the object of this thesis- a SI system that measures a project's sustainability- because of the specifics of the PROPOLIS goal, i.e. creating a system to compare the long term effect of different policies.

BACKGROUND VARIABLE	UNIT
TRANSPORT STATISTICS	
Yearly travelled distance by mode *	million pass. km/ a
Yearly travel time by mode *	million pass.h/ a
Average travel distance / trip by mode *	km/ trip
Average travel time / trip by mode *	minutes/trip
Average travel speed by mode *	km/h
Modal share in peak by mode *	share %
Traffic volumes	veh/hour
Car trips as % of all trips, by zone	%
LAND USE STATISTICS	
Floor space /capita, by zone	m2/capita
Residential rent, by zone	euro/inh./month
Number of inhabitants in SEG 1 by superzones **	#
Number of inhabitants in SEG 2 by superzones **	#
Number of inhabitants in SEG 3 by superzones **	#
Total number of inhabitants by superzones **	#
Total employment	#
Employment by sector and zone	
- Primary and industry	#
- Public services and administration	#
- Private services and commerce	#
ECONOMIC BACKGROUND VARIABLES	
Tax revenues from transport, passenger traffic	MEuro/a
Tax revenues from transport, goods traffic	MEuro/a
Revenues from road pricing, passenger cars	MEuro/a
Revenues from road pricing, goods vehicles	MEuro/a
Revenues from car parking	MEuro/a
Revenues of public transport operator	MEuro/a
Change of floor prices	MEuro/a

* Modes: Public transport, private cars, walk & bike, (goods vehicles)

** Superzones: City centre, Inner urban, Outer urban, Rest of metropolitan, Rest of region/Urbanised, Rest of region/Rural

Figure 8. List of PROPOLIS background variables (Lautso K. et al., 2004)

4.2.4 BEQUEST

BEQUEST (Building, Environment QUality Evaluation for SusTainability), funded by the European Commission, is a group of experts in the built environment with the main focus on "the evaluation of the present environment for the benefit of future generations and the bringing together of what has been developed to assess the sustainability of urban development." (Deakin et al., 2005, p. xi)

Focusing on the concepts of ecological integrity, equity, participation and future, the four-sides model PICABUE was born. This model combines the concern for the quality of the environment, the equity

of the use of resources, and the participation of the public in decision making. This model was used in the beginning to design a standard language between the members of the group and later to compare SD programmes.

The BEQUEST FRAMEWORK is very interesting because it puts together four dimensions of SUD : the Urban development activity, the sustainability issues, the spatial level and the time scale but also for what makes up the sustainability issues, i.e. economic, environmental, social and institutional. In comparison to the other discussed models, this framework adds another dimension of sustainability. Another objective of the framework is that it does not let it depend on global measurement towards a more sustainable future but makes it possible to place the project or the policies in the local context. This way the person who has to make the decisions understands the process of decision making and is able to adjust the framework to its context. Hence an international framework is created linked to the Local Agenda 21.

Explanation of the four dimensions of SUD:

1. *The urban development activities: SUD is a process; therefore it can be defined by the activities Planning, Property Development, Design, Construction and Operation. The sustainable objectives and the policies differ in every of these activities and therefore need to be investigated separately. In spite of this separation they are also connected to each other.*
2. *Environmental, economic and social issues : Human activities entail effects, these are created by economical, social or environmental stresses. The Institutional level is added because of the importance of good governance policy that has to ensure equal access to resources, together with social participation and judicial means. Ethical systems are also part of the institutional issue.*
3. *Spatial levels: Urban development does not work only on the scale of the city, the impact of decisions and effects ranges from a single material to a whole city district.*
4. *Time: Impact on decisions made now has to be seen in the long-term.*

It is interesting to see here that 'Transport and Utilities' are part of the Economical dimension. The Environmental dimension includes transport related indicators such as Land Use, Environmental Pollution and Natural Resources. Even all the Social indicators[27] presented here can be related to effects of transport as well as the Institutional[28] ones.

4.2.5 EUROFOUND

EUROFOUND (EUROpean FOUNDation for the improvement of living and working conditions), a European Union body, set up by the European Council for assisting the formulation of future policy on social and work-related matters. (Voula Mega and Jorn Pedersen, EUROFOUND, 1998)

The basic framework for the development of indicators (Figure 10) emerges from the policy fields of the European Charter of Sustainable Cities and Towns, and the PSR-model of OECD.

[27] For example the indicator 'Access' can relate to the access to public transport as well as for access to cultural, educational, social, health care etc. provisions.
[28] For example Governance policies concerning promotion of public transport.

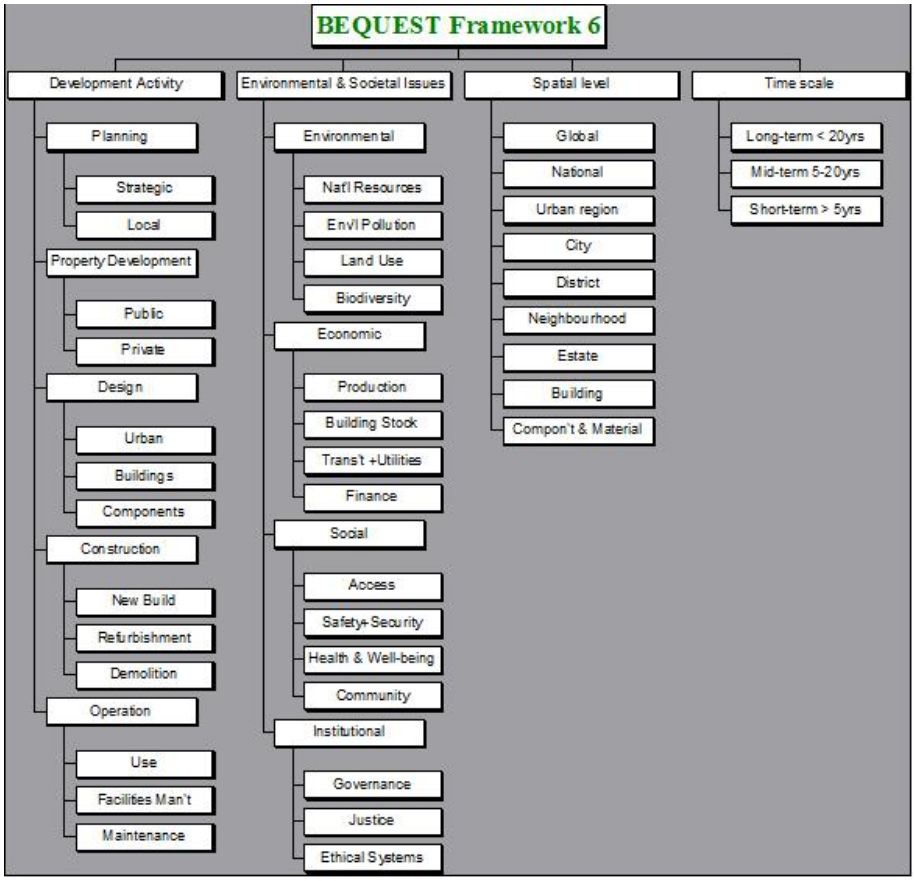

Figure 9 BEQUEST FRAMEWORK (Deakin et al., 2005, p. 34)

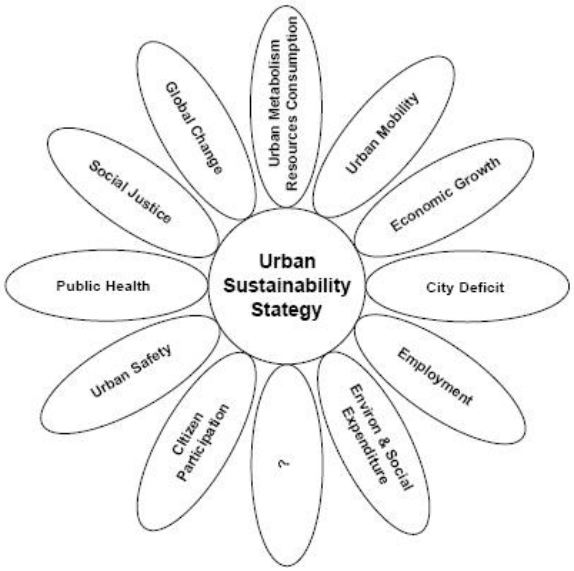

Figure 10. Composing urban policies and performance indicators (Voula Mega and Jorn Pedersen, EUROFOUND, 1998)

The variety of the scale and the nature of policies, with indicators assigned to a policy theme, results in the variety of indicators needed to declare whether a city moves in the direction of change

as stated in the Charter. The indicator set consists of 16 indicators that refer to a specific theme; the responsibility of a city for the global environment (Responsibility for Global Climate, Acidification of the environment, Toxification of Ecosystems, energy and water consumption), important aspects of the local quality of life linked to global considerations (local disturbances, air quality, urban mobility, waste management), key social elements (social justice, housing, urban safety and citizen participation) and indicators expressing the quality of spaces promoting public health, social life and cultural heritage (green, public space and heritage indicator). An indicator unique to the city is also added to express a unique asset, characteristic or event of that city.

The report gives a well detailed description of the indicators, together with sub indicators, policy management, necessary data and some examples. Because of our interest in indicators measuring transport policy, this one is extracted from the report.

(E) URBAN MOBILITY INDICATOR (UMI) OR CLEAN TRANSPORTATION INDICATOR

Definition:	The use of environment-friendly means of transport, especially for enforced mobility, defined as mobility for commuting and basic needs.
Measure:	Urban Mobility equivalent (Umeq) = total number of passenger kilometres by non-environment-friendly means (private car) per inhabitant and per year. (If passenger kilometres cannot be estimated, trips can be used). Enforced Umeq (EUMeq) = total number of passenger kilometres – passenger kilometres by foot and bicycle – passenger kilometres by public transport, per inhabitant and for basic needs each year.
Policy Direction:	Reduction of unnecessary use of motor vehicles, reduction of enforced mobility and improvement of accessibility. The EC's study on Car-Free Cities (EC 1992) indicates that there is a maximum number of private cars that cities can afford.
Subindicators:	Enforced Urban Mobility Indicator (EUMeq, mainly for commuting). Relevant subindicators may be developed according to trip purposes (tourism, work and study, leisure, business, freight) and according to transport means.
Components Data:	Total number of trips (and their length) by private car and number of trips (and their length) for commuting and basic needs/inhabitant/year.
Remarks:	The increase/decrease in the length of pedestrian areas and cycle paths over time is also a useful indication of the city's policy to promote less unsustainable mobility.

Figure 11 EUROFOUND Urban Mobility Indicator (Voula Mega and Jorn Pedersen, EUROFOUND, 1998)

4.2.6 TOD

TOD or Transit-Oriented Development promotes sustainable urban development in public transport places. The primary goal of TOD is to overcome automobile dependence by using land use and transportation models in development of sustainable urban environments. Wells and Renne

researched the success of Transit Villages in New Jersey and doing so they developed a list of indicators for the evaluation of these villages. The TOD framework is based on measuring economic activity, environmental and transportation activity, institutional changes and community perception. Due to the lack of data they found that economic activity, travel behaviour and public perception were the easiest to find measurable data for.

The findings in New Jersey impelled a national study "*Transit-Oriented Development: Developing a Strategy to Measure Success,* (2005) funded by the National Cooperative Highway Research Program of the Transportation Research Board. The 56 found indicators were grouped in five categories : travel behaviour, economic performance, environmental performance, the built environment and social benefits. Because the study found that there were only few data available for the investigation of the indicators they sought to investigate which indicators were easiest to find and which were the most useful.

Indicator	*Percentage as 'Very Useful'*	*Category*
Qualitative rating of streetscape (i.e., pedestrian orientation/human scale)	77	Built environment
Pedestrian activity counts	77	Travel behavior
Number of transit boardings	**70**	**Travel behavior**
Population / housing density	67	Built environment
Estimated increase in property value	63	Economic
Public perception (administered survey)	63	Social diversity / quality
Number of bus, ferry, shuttle, or jitney services connecting to transit station	**63**	**Travel behavior**
Number / square feet of mixed-use structures	**60**	**Built environment**
Number of improved intersections / street crossings for pedestrian safety	**60**	**Built environment**
Estimated amount of private investment	57	Economic
Number of parking spaces for residents	53	Travel behavior
Number of shared parking spaces	53	Travel behavior
Number of convenience/service retail establishments (i.e., dry cleaners, video rental)	**53**	**Economic**
Employment density (i.e., number of jobs per acre / square mile)	53	Economic / built environment
Estimated amount of private investment by type of land use	52	Economic

Note: Bold indicators were also reported as easy to collect (see Table 3)
Source: Renne and Wells, 2005, p. 19

Figure 12 Indicators rated very useful for TOD by at least 50% of the respondents (Renne, 2007)

4.2.7 Systems in Spain

A group, under the guidance of Agustín Hernández Aja of the Herrara Juan Insitute of the University E.T.S. de Arquitectura de Madrid investigated in 2004 the influence of different indicator systems in different parts of Spain. Their aims were: investigation of the influence of Agenda 21, organization of the process, participation of different actors, amount of indicators and classification of these indicators

A chart was drawn up to see how many indicators are used in the different urban systems, showing a significant difference between the used amount of indicators. This shows the use of

different criteria for indicator selection, despite the proposal to homogenize the different Agenda 21's of the municipalities.

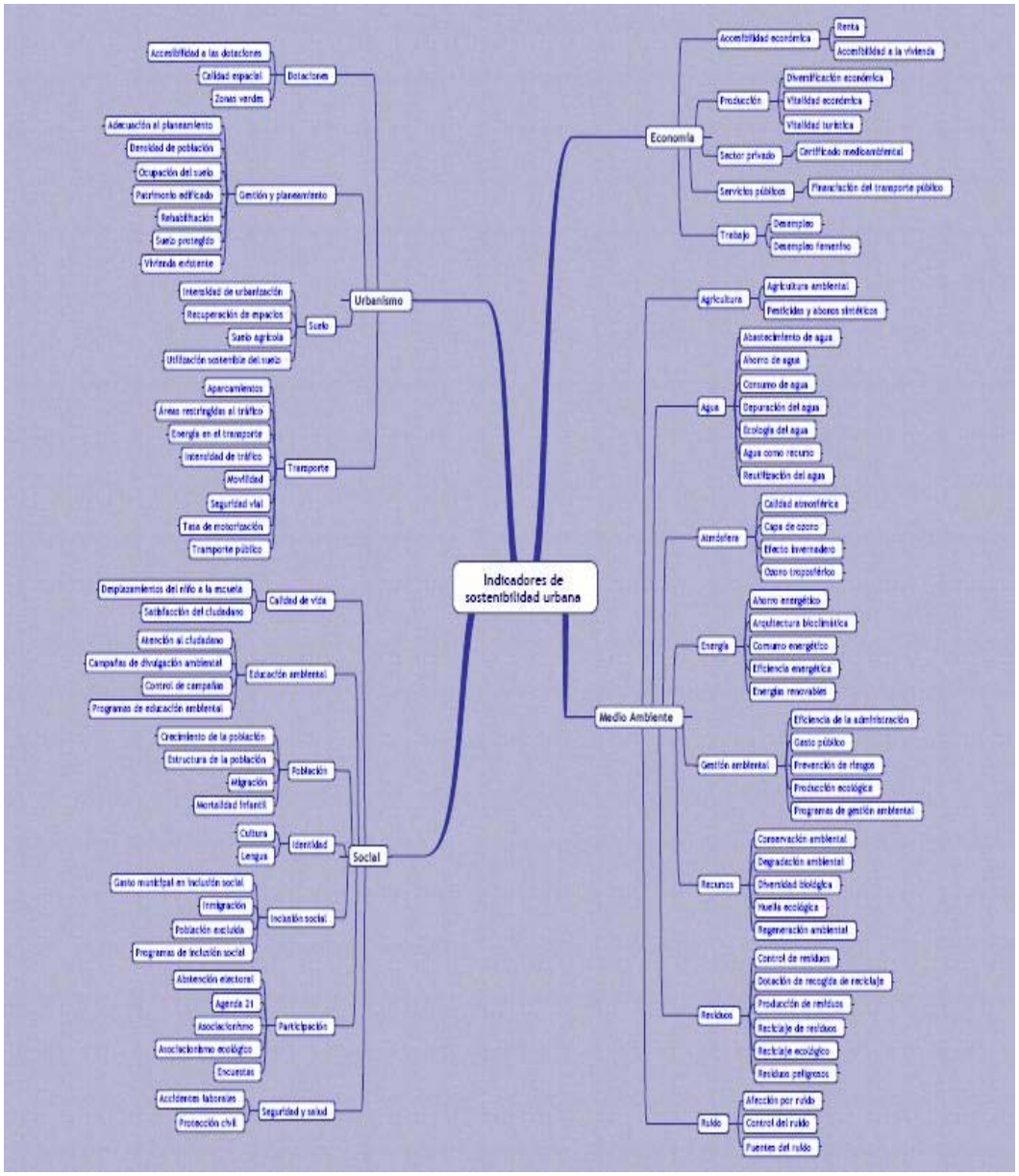

Figure 13 Organisation of the indicators, based on "El Grupo de Trabajo sobre indicadores de sostenenibilidad", 2004 (Fernández Sánchez, G., 2008)

When classifying the different indicators found, we see more proof of the lack of correspondence. They found a total of 1.273 indicators in all the different municipalities, later classified and homogenized into four different groups; economical, social, urban and environmental indicators all subdivided into smaller groups. (Figure 13) These groups however aren't equally represented in the total amount of found indicators; the environmental group takes up 55% of the total amount of indicators, the urban one takes up 22%, the social one 16% and the economical one 8%. (Fernández Sánchez, G., 2008)

Transport is a subindicator of the Urban form and consists of descriptive indicators such as Traffic Intensity, Energy of transport, Road security and Parking places. Financing of public transport can be found under the Economical dimension whereas Nuisance and Atmosphere (Ozone, atmospheric quality, etc.) belong to the Environmental Dimension. None of the TR indicators however are placed under the Social dimension.[29]

4.2.8 Other SI systems

Investigating other SI systems together with analyzing the Case Study, related literature and databases helped to select the most important indicators, to add some and to classify them. These other SI systems are: 'Plan Especial de Indicadores de Sostenibilidad Ambiental de la Actividad Urbanistica de Sevilla (2007)', 'Panel de Indicadores de Sostenibilidad de Donostia-San Sebastian', 'Sistema de Indicadores de Sant Joan D'Alacant', indicator system proposed in (Grupo Interministerial para la Revisión de la Estrategia de desarollo sostenible de Union Europea, 2007)and EUROSTAT.

4.3 Producing Sustainable Indices

Once we have selected our indicators, classified them into an indicator system, all that is left to do is analyzing the entire system to result in a single sustainability index.

A single sustainability index should tell us whether or not the city is going in the direction of more sustainability. The way from a thematic indicator to a numerical (or colour) index for sustainable policy making is everything but a straightforward task. The indicators have to be weighted according to their contribution to sustainability levels and all the previous levels of aggregation have to be taken into account.). (Voula Mega and Jorn Pedersen, EUROFOUND, 1998, p. 5) We must also make sure that there is not any multiple counting of a single thematic indicator.

Indices are constructed in three steps: generating the 'raw' indicator values, valuing, and weighting them. The generation process produces values that do not have any common unit. Therefore we use value function to appoint a standard unit to every indicator. Later we need to assign a weight to every indicator that determines its importance with reference to the other indicators; this way we determine the effect on the index value caused by a change in the indicator value. (Lautso K. et al., 2004) The only thing left is then to weight all the indicators resulting in a single digit.

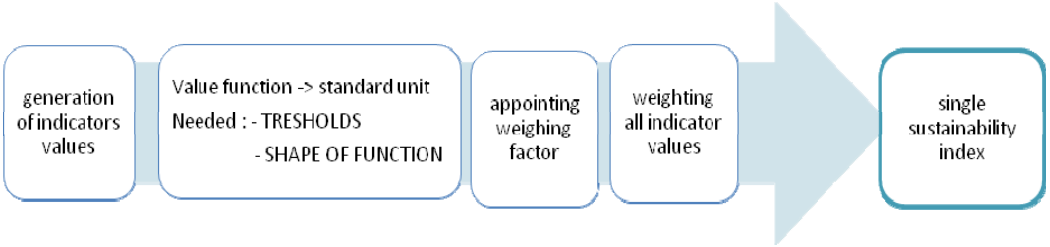

Figure 14. Producing Sustainable Indices

[29]However the transport indicator under the Urban dimension already contains the social aspects.

4.4 Proposal of SI- system

While defining, creating and evaluating (self evaluation, experts input, literature) this proposed system we encountered some problems. By examining these problems and putting every indicator into question we make an auto-control of the system and are able to make a final, better proposal.

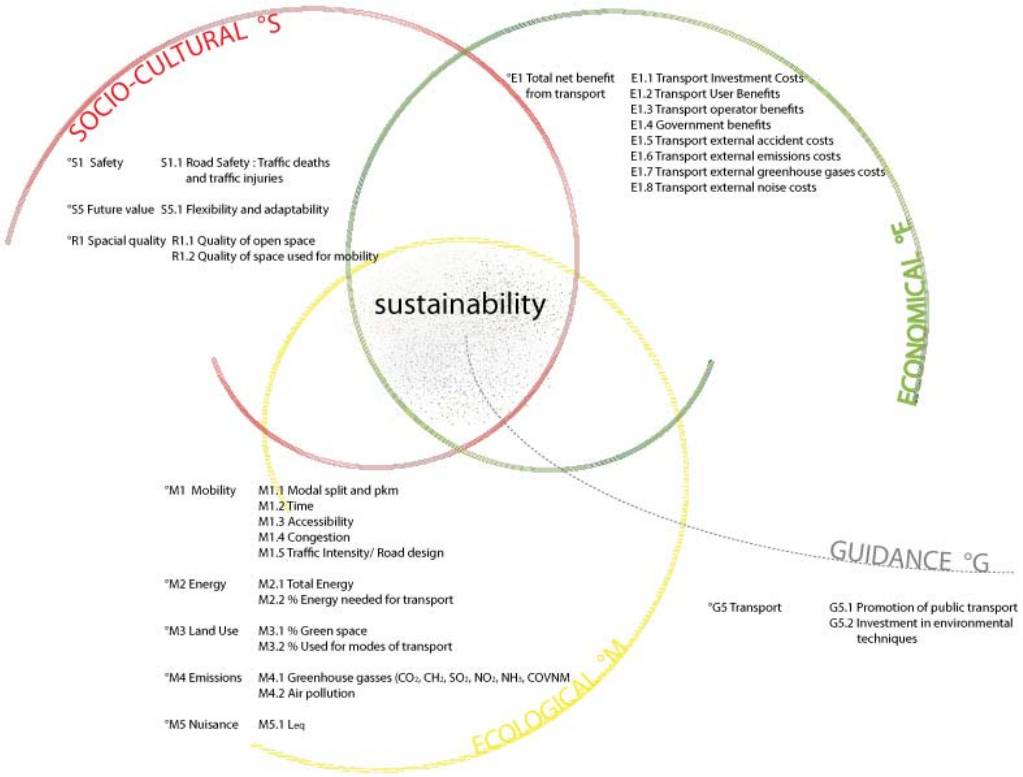

Figure 14a First proposal of SI system

Spill over

When measuring for example the total transport volume of a certain area, in order to say something about congestion etc., we encounter a problem because a project might induce an increase of traffic in that area but at the same time produce a decrease in other areas and hence improve the traffic volume in the direction of a more sustainable urban form. How can we deal with this problem, or how can we measure this 'spill-over' in the indicator system. One way to deal with this is introducing different scales, this means that we analyze the sustainability of the project (MICRO scale) and design a set of indicators for this scale; the influence however of the project at the higher scales will be included in the indicator set corresponding to these scales. In the end all the scales can be analyzed and by fast representative means(spider diagrams for all the scales or put together, a coloured matrix etc.) or by a one-index outcome (a final cipher or colour) a total measurement of the project or situation can be measured.

Although it might seem like the problem is solved, some other problems might come to the surface when actually using this method. First of all the amount of scales brings along another problem: the lack of time or data. When we say that we want to solve the spill-over problem by introducing different scales, the question arises where we can stop with this spill-over. If we take the example of the Case Study (OC) and its international train station, we can introduce 7 urban scales; OC, Almendra Central, Madrid City, Madrid Province, Spain, Europe, World. However we can not stop with this division, we must also incorporate the smaller scales of the neighbourhood, building or even the building component. For these 7 scales one must put together a SI set, find data for all the different indicators on all the different scales and analyze them. Which brings along three problems; it is really time consuming, there is a possible lack of data and information, and we face the impossibility or ambiguity of the scale boundaries. These obstacles are unwelcome when making a quick diagnosis.

It might be better to search for a solution in another direction. One proposal is that we incorporate an indicator saying something about the scale above, so we are not going to make different sets of indicators but we are incorporating different scales in one set of indicators. It would be a very interesting method when one wants to get a swift reply for decision making or when one wants to make a quick comparison. The problem with this method however is that it is not so accurate because a specific feature of sustainable Urban indicators is that they depend on the investigated urban form and on the actual implementation of this higher-scale-indicator inside the basic indicator set. The second proposal will be more accurate and structured, but when we make indicator systems for different scales we have to make a weighting system and an evaluation system for all of them together.

Summarizing, the first proposal is more accurate but the second one easier to use. As a middle course we can introduce a third proposal that combines both. A basic indicator set is made for the scale on which one can take decisions. In addition to this basic indicators set, which is highly detailed, others are made for the further scales but less detailed (less work or data needed)

In this thesis, only the basic SI set will be created, which can function as a framework for other investigators.

Placement of nucleus of Transport

The first question that we must ask is, where does transport belong in the sustainability idea? By looking at examples, we see that everyone places transport with another dimension, some even with all of them. Therefore we can conclude that Transport is an actor that belongs to the three dimensions of sustainability. (dialogue with Professor Pozueta, of ETSAM, expert in transport-urbanism and he also says that for him transport lies in the three, were for him the social aspect is a great influence, for example the health of the citizens in relation with use of public transport is important)

Classification of indicators

Classifying all the indicators under the right dimension, theme and sub-theme is anything but a straightforward task. In the studied SI examples the system serves different goals therefore the indicators will be classified in another manner.

Spatial requirements of Land Use-Transport model

As discussed in (Wegener & Spiekermann, 2007) a Land Use-Transport model cannot directly capture the basic aspects of urban sustainability because of the coarse spatial resolution. They can only represent indicators such as total CO_2 emissions, total energy consumption or total resource use. However phenomena such as noise propagation, land coverage, landscape fragmentation, require a much higher spatial resolution. Therefore they introduced a Raster Module that evaluates the local aspects on a disaggregated representation of space.

4.5 Valuation

4.5.1 Methodology

Using examples, a framework is put up for finding the thresholds and pointing out the shape of the value function. Future research, finding these data for all indicators, can be based on these examples.

The following actions must be taken (Figure 15):

- Placing the indicator value on the x-axis, with the dimension of this indicator, with increasing sustainability in the positive direction.
- Investigating the maximum and minimum value of the indicator, i.e. investigating what the situation of minimum and maximum sustainability is.
- Finding the shape of the value function.

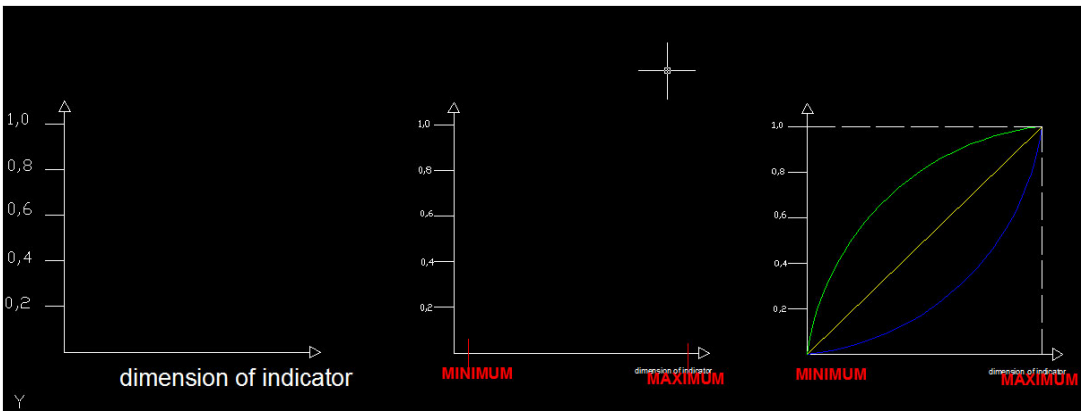

Figure 15. Tresholds, value function

As the minimum threshold we take the situation in 1990 (Van den Dobbelsteen 2004, Kyoto-protocol 1997) or the present situation stated by the law (De Troyer). We put this threshold as the situation, based on the context or law of 1990. By doing so we can see how the building situation has evolved since 1990. (Vandevyvere) The situation in which no action whatsoever is undertaken to tackle the sustainability problems, can also be seen as the minimum threshold.

Defining the maximum threshold, i.e. perfect sustainability, is anything but a straightforward task. This perfect sustainability is hard to define but in theory it should be the perfect sustainable situation. This could be defined by zero-emission or perfectly closed cycles (Vandevyvere). In practice however this situation would be very difficult or impossible to achieve.

4.5.2 Example: Greenhouse Gasses

Indicator	M4.1
Indicator name	Greenhouse Gasses
Description	The indicator expresses the Greenhouse gases emissions caused by transport, i.e. combustion of petrol, gas and diesel in vehicle engines.
Brief background	"The increasing concentration of carbon dioxide in the earth's atmosphere is the main cause of global warming. In Europe, the consequences of climate change are likely to include more frequent or more intense storms, raised sea level, effects on agriculture productivity and changes in water availability." (Lautso K. et al., 2004) Therefore this indicator is a measure for *Global Climate Control*.
Calculation method	Multiple tons of CO_2 equivalents per thousand inhabitants a year
Influences	Traffic flow, speed, vehicle type, technological deveopments, environmental regulations ((Lautso K. et al., 2004)
Trends	See http://themes.eea.europa.eu/IMS/ISpecs/ISpecification20040909113419/IAssessment1220277858018/ view_content
Bibliografy	(EEA - European Environment Agency , 2008), (EEA-European Environment Agency , 2009), (Lautso K. et al., 2004)

For defining a reference scale for the performance of the indicator, we have to encounter the best value possible for Greenhouse Gasses caused by traffic. In order to find these data, we could look at two sources; Kyoto protocol and the 20-20-20 rule. As discussed in the former chapter, the Kyoto protocol for Spain allows an increase of 15% of the greenhouse gasses in respect to 1990 (protocol for 2008-2012). However this standard is not enough for a "clean-atmosphere", in order to realise this we should have a reduction of 50-70% on European level. (EEA,2002 as cited in (Lautso K. et al., 2004)) Therefore we are not using the Kyoto protocol as the Idealistic value, however we will turn us to the 20-20-20 rule that states that we have to have a reduction of 20% in 2020. "The Eu's 20-20-20 by 2020 Energy Climate Package sets overall reduction targets for greenhouse gases and highlights the need for the transport sector to contribute actively to achieving them. There are no sector-specific goals in the Package, however, and the transport sector's contribution has not yet been defined. Positive steps have been taken, such as the recent inclusion of aviation in the European Union Emissions Trading Scheme, but it is still not clear how all other necessary reductions are to be achieved." (EEA-European Environment Agency , 2009, p. 16) Based on the data of (MARTÍNEZ & MONZÓN DE CÁCERES, 2008) this would be 52,32 $MTCO_2$ eq./year.

We can not take the situation of 1990 as minimum threshold because of the characteristics of the indicator. In 1990 the amount of Greenhouse Gases were a 65,4 $MTCO_2$ eq./year in Spain but because of the rising traffic the values in 2004 were risen with an increase of 66% or 108 $MTCO_2$ eq./year (Source : Minesterio de Medio Ambiente, 2006).If we would take the data of 1990 as a reference of the worst sustainability scenario, we would end up with a ridiculously good sustainable value. Consequently it is better to take the worst case scenario of the to measure year as the mimimum value. This worst case scenario would be if there was no change, and the evolution of the increase of Greenhouses Gases would go at the same rate that it is going today. This would be 193,3

$MTCO_2$ eq./year in 2020, or an increase of 196% (in respect to 1990) which is an increase of 157% above the level of the Kyoto Protocol for 2020 (in respect to 1990) (Source : (MARTÍNEZ & MONZÓN DE CÁCERES, 2008)) Thus, we have found our MINIMAL THRESHOLD : 193,3 $MTCO_2$ eq./year in 2020.

The shape of the function will be hyperbolic because of the fact that the 20-20-20 rule is an utopic value and will be impossible to achieve. The Kyoto protocol for Spain will not be possible to achieve, therefore a reduction of 40% more will even be more impossible to achieve. A situation where remarkable reductions of greenhouse gasses are fulfilled, but is still a long way from the utopic value would be penalized if we ought to make it a lineair curve. Therefore a hyperbolic curve seems to be the best assumption. However the exact shape of the function is unknown and relies on basic instinct.

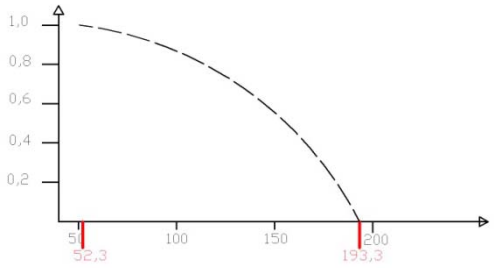

Figure 16. Reference scale for M4.1

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"Are you proud to live here?" A residents oriented place marketing audit (attachment, self-esteem and identity)

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This paper aims to develop a new insight into the relevance of the measurement of place attachment, self-esteem, commitment (self-efficacy), place continuity and place related identity in order to provide public policy makers with performance indicators of (focused to residents) place marketing strategies. Gaia is the second most populated city in Portugal, located on the river Douro's south banks facing Porto. A programme of one hundred events, named 'Gaia 100 years old', was planned by the municipality in order to celebrate the 100th anniversary of one of its many sportive clubs - the F C Gaia. A survey with 107 residents was conducted to measure the pre-programme diagnostic which will allow a comparative analysis within a longitudinal study. Findings showed that city's quality of life attributes and residential time positively influence place attachment, social identification, commitment, self-esteem and active citizenship behaviour. The structural equation modelling revealed that city's quality of life attributes, comprised in seven dimensions, and the residential time have a significant effect on place attachment, social identification and self-esteem. Findings also showed significant correlations between self-esteem and self-efficacy and active citizenship behaviours.

Keywords: place marketing audit, place attachment, self-esteem, city identity, performance indicators.

1 Introduction

Nowadays, when basic needs are satisfied, expectations and demands about intangible aspects become more important to city inhabitants. From environmental psychology literature we realise that the attachment and self-esteem towards the cities where we live are important to our mental health.

According to Kotler et al (2002, p.183), *place marketing* means 'designing a place to satisfy the needs of its target markets. It succeeds when citizens and business are pleased with their community and the expectations of visitors and investors are met'. Therefore, public policy makers should recognise the role of a city's brand as a strategic developmental tool that can help to clarify a city's identity, to enhance a city's image and positioning and to increase residents' perceived sense of belonging and self-esteem. When people states 'yes, I love to live in this place' they are stating their overall satisfaction with these public policies.

This article aims to contribute to the relevance of using measurement instruments of sense of belonging, self-esteem and identity and to provide decision-makers with a set of indicators that can be used to assess the success of their policies and strategies amongst residents.

It is an important strategic decision for a place to start systematic place marketing in order to increase its competitiveness aiming to attract scarce sources of wealth such as human resources in particular, those that are highly-skilled. When creativity, innovation and dynamic growth are flourishing in a place, it is likely that the town/city in question will attract new, young, active residents. This means more consumers, and an increasing demand for new products and services, which is likely to sustain the virtuous cycle. On other hand, as claimed by Freire (2007) local people is an important dimension in the destination image formation because consumers use this factor to evaluate differences in destinations and to support their decisions about tourism consumption. He

concluded that much of a place's image is likely to be created by stereotyping the 'typical' local people.

In this context, the hosting of high profile cultural and sporting events such as worldwide exhibitions, the Red Bull air race, the European Culture Capital City, or large infrastructure buildings (e.g. the Guggenheim museum in Bilbao, or Porto's House of Music - *Casa da Música*) develops an identity, while providing leverage in terms of self-esteem and the sense of belonging.

Gaia (also known as Vila Nova de Gaia) is a city located on the river Douro's south banks facing Porto; it is famous for its Port wine cellars (see Figure 1); it has a population of 310 086 people (2007), an area of 168,7 Km^2, and 24 parishes, and it is the second biggest municipality of Portugal (density of 1783/ km^2) – see Figure 2.

Gaia already existed under the Roman Empire as the city of *Cale*. The origin of the name *Cale* (or *Gale*, since in Classical Latin there was not always a clear distinction between the letters 'g' and 'c'). The river itself has a presumably Celtic name, Douro (*Durus* in Latin) maybe after Celtic '*dwr*', water. The name of Porto, in high medieval times Portus Cale, thus stood for the harbour ('portus' in Latin) of the city of Cale. This is the origin of the name of Portugal country nation. The first reference to a place called '*Gaia*' is in a document published by the Portuguese King Afonso III in 1255. The area of Gaia, as we know it today, resulted from the fusion of two villages in 1518: 'Gaia' and 'Vila Nova' (already born in 1288).

It is interesting to analyse the richness of the different meanings that are embedded within the word *Gaia*: a) *Gaea* (crater), a crater on Amalthea, a moon of Jupiter; b) Gaia (mythology), the primal Greek goddess of the Earth; c) Gaia hypothesis, an ecological hypothesis that considers the earth's ecosystem as a single organism; d) Gaia mission, a European space mission due for launch in 2011; e) Gaia Movement, an international network promoting a more sustainable Earth; Gaia philosophy, a concept that living organisms on a planet will improve their environment.

A programme of events set program which started in September 2008, named 'Gaia 100 years old' was carried out in order to celebrate the 100th anniversary of one of its many sportive clubs – the F C Gaia. This events program designed by Gaianima E M (a public organisation from the municipality) and Slogan Ads (an advertising consultancy firm), comprises 100 sportive events (of many different modalities) scheduled during 2008 and 2009, promoted by 100 celebrities (in several areas) all born in Gaia. One hundred major local and national firms sponsored the programme by paying a fee that included offering at least the construction a basketball net, and some cases the construction of a basketball court too; these facilities will be located in schools, gardens and public squares.

This paper describes a diagnostic study that constitutes the measurement of pre-event evaluation variables. The study aims to assess and measure several dependent variables prior to the completion of events (pre-event): perceived city image (identity, associations); place related identity; residents' place attachment and self-esteem. Later at the end of the programme (the post-event) the research project will assess the evolution and impact resulting from 'Gaia 100 years old' programme.

The measurement of place marketing and public policies performance indicators has been assessed by several approaches through audit studies, namely: the *State of European Cities Report* (2007) and *The Survey on perceptions of quality of life in 75 European cities* (2007) which is based

on the European Urban Audit (www.urbanaudit.org), coordinated by Eurostat with National Statistical Offices; *The Gallup Soul of the City* program (www.gallup-europe.be/soulofthecity) also measures and tracks the political, economic and social well-being of over 250 cities globally, based on how residents view their city's performance in providing healthy living and working conditions. It is based on the Flash EB 194 (Urban Audit Perception Survey 2006).

Figure 17. Gaia Riviera and Port wine cellars

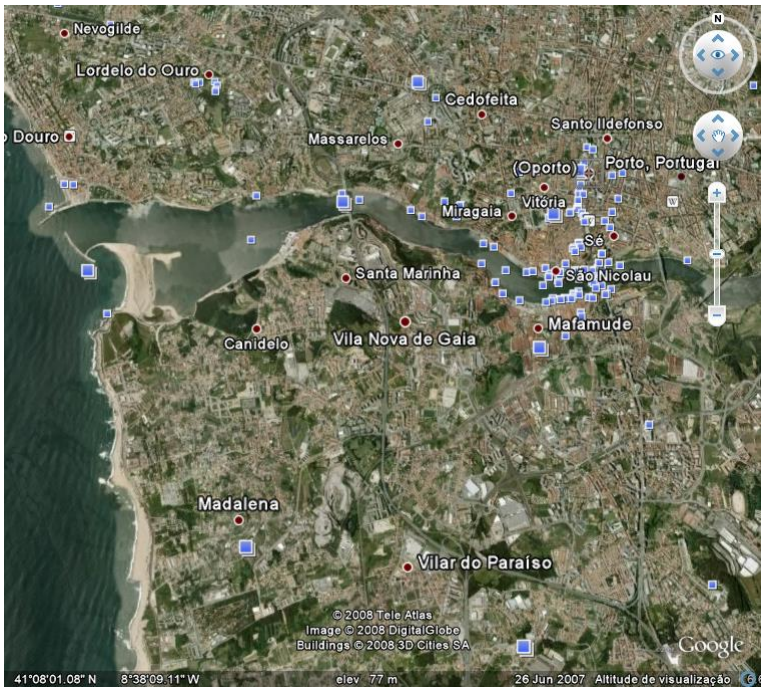

Figure 2.View of Porto (river Douro north banks) and Gaia (south banks). Source: Earth Google

2 Literature review

A place is a "nation-state, a geopolitical physical space; a region or state; a cultural, historical or ethic bounded location; a central city and its surrounding populations; a market with various definable attributes; an industry's home base and a clustering of like-industries and their supplier; a psychological attribute of relations between people" (Kotler et al, 2002, p.4)..

The term “place” is used to refer to all kinds of locations like cities, city-regions, regions, communities, areas, states and nations. There is now a consensus about the suitability of marketing for places, and that places, indeed, should be marketed as efficiently as firm’s market their products or services (e.g.; Hankinson, 2007; Kotler et al., 2002; Rainisto, 2003). As Shurmer-Smith and Hannam (1994, p.13) state: “Place is a deceptively simple concept in geography though; we want to make it difficult, uneasy. We want to show that places do not exist in a sense other than culturally and as a result that they can appear and disappear, change in size and character ...according to the way in which people construct them. Places then have no objective reality, only inter-subjective ones”. For Shields (1991, p.260) place and space have “certain meanings and associations, any examination which involves place therefore also necessitates an exploration of its ‘emotional geography’”.

Hidalgo and Hernandez (2001) sought to clarify some confusion in terminology and diversity of approaches either at theoretical or empirical levels. In the literature there are many similar terms such as “community attachment” (Kasarda and Janowitz, 1974), “sense of community”(Sarason, 1974; Mannarini et al., 2004), “place attachment” (Gerson et al, 1977), “place identity”(Proshansky, 1978), “place dependence” (Stokols and Shumaker, 1981; Williams and Vaske, 2003), “sense of place” (Hummon, 1992), “place meaning” or “place motivation” (Kyle et al, 2004), etc.. As Hidalgo and Hernandez (2001) pointed out, sometimes a broad concept embraces others. According to Lalli (1992), “place attachment” is a component of “place identity”. On other occasions some authors use both without distinction, as if they were synonyms (Brown and Werner, 1985).

“Place attachment” is defined as “an emotional connection between people and specific places” (Hidalgo and Hernandez, 2001, p.274). Shumaker and Taylor (1983, p.233) suggested an alternative definition: “a positive affective bond or association between the individuals and their residential environment.” Hummon (1992, p.256) considers it as an “emotional involvement with the places”, while Low (1992, p.165) describes it as “individual’s cognitive or emotional connections to a particular setting or milieu.” Sarbin (1983) also highlighted the tendency of people to prefer to stay near specific places and the propensity of human beings and other animals to seek out the location where they were born or where they feel comfortable and safe.

Although authors acknowledge implicitly that people can develop an attachment towards other places with a larger scale such as a city or a region, these are rarely investigated except in a study of Altman and Low (1992). “Places are repositories and contexts within which interpersonal, community and cultural relationships occur” (Altman and Low, 1992, p.7, quoted by Hidalgo and Hernandez, 2001), and “it is to these relationships that people are attached”, not only in relation to the place itself per se.

Lynch (1960, 1976), the pioneer for the study of city image, stated that this concept comprises three components: the identity (the distinctiveness of a place, the qualities which distinguish it from any other place), the structure (the mental representation, spatially outlined) and the meaning (subjective feelings linked to physically separate places).

Félonneau (2004, p.43) suggested that “the individual’s general attitude towards living in the city could underlie his or her spatial identity”. This author suggests the hypothesis that individuals, who identify with their city of residence, will also develop a favourable position regarding urban life

more generally, and, conversely, that people with less likelihood of identifying with their city of residence will have negative feelings regarding experiences in daily urban life.

This is why Félonneau (2004) introduced the concepts of “urbanophobia” and “urbanophilia”. The first is a pro-urban construct, while the second is characterised by an anti-urban attitude, reflected in the definition of an “ideal city” being one with the absence of pollution, cars and violence, in favour of green spaces and designing the city as an area of opportunity for exchange, entertainment and meetings.

2.1 Place and identity processes: building the city related identity

The relationship between the individual and the place they live has been a subject often studied within the field of social psychology and, in particular, of environmental psychology. In the 1970’s, the theory of social identity was developed by Tajfel and Turner (1979); this suggested that social identity of an individual is achieved and maintained through membership of groups. A person’s self-esteem increases and a positive social identity can be achieved through stressing positive characteristics and mitigating the negative characteristics of the group to which he/she belongs.

Identity levels, associated with the basic process of social categorisation, can vary between more specific (local identity) or more inclusive and comprehensive (regional or national identity) and each level of identity may mediate significantly perceptions and judgments.

The concept of local identity refers to the idea that identity can be linked to the context and environment in which we live (Proshansky et al, 1983) and it can meet the biological, psychological and social needs of an individual. Local identity is a complex construct comprising different dimensions and aspects of person-environment interaction and may be referred to various environmental and social levels (Lalli, 1992). The local identity can not be reduced to a simple identification with connection to a place.

Breakwell (1986, 1992, 1993) developed a model of social identity based on the studies of Mead (1934). Breakwell (1986) proposes that identity should be defined as a biological organism that dynamically evolves with time, and develops in a process of accommodation, assimilation and evaluation of the social world.

This process is governed by four principles that define the identity structure: distinctiveness, continuity, self-esteem and self-efficacy. “The three prime principles are evident: the two processes work to produce uniqueness or distinctiveness for a person, continuity across time and situation, and a feeling of personal worth or social value.” (Breakwell, 1986, p. 24).

Distinctiveness is the individuals’ desire and need to feel unique and special. The fact that one person lives in a particular place, may serve to differentiate this subject from others. Continuity refers to the fact that there must be a connection in space and time between the past and present; it is this driving force that makes the relationship between these two moments.

Self-esteem is related to a positive assessment of oneself or the group to which a person belongs, a sense of worth and social value; it can be driven by the qualities of a place. Later Breakwell (1992) added a fourth principle, self-efficacy, defined as an individual’s belief in their capabilities to meet situational demands of the environment in which they live.

Twigger-Ross and Uzzell (1996) notes that despite the fact that social theory suggests that self-esteem is the only motivation for action with regard to identity, the list of four principles is not yet closed. Past research into settlement identity (Feldman, 1990) and community identity (Hummon, 1992) has focused on the perception of the distinctiveness of a “city” or “country” considered in terms of human characteristics. An investigation by Twigger-Ross and Uzzell (1996) suggests that distinctiveness defines a lifestyle and characterizes the individual as having a specific type of relationship with their environment, which is clearly distinct from any another type of relationship.

Association to a place related self-referent (e.g. a certain part of the city) also contributes to a differentiation from residents in other areas (Lalli, 1992, p.25). The literature suggests several factors that may contribute to distinctiveness building or place identity positioning. For example, Canter (1977) proposed three key aspects to define a place: physical aspects such as shape and space, a pleasant environment to walk on foot - walkability (Sepe, 2007); functional aspects (activities); and psychological aspects (emotion / cognition; meanings assigned).

Knez (2005) highlighted the negligence of a key aspect in this approach, the climate, defined as the spatial or geographical variation of weather data, based on a period of 30-40 years. These and other microclimatic parameters such as temperature and humidity may also influence our perception of comfort (Nikolopoulou et al, 2001). As Gaia is on the south side of the river and on a north facing inclination, exposure to the sun is less, with increased levels of shadow and humidity that may induce a preference for people to buy houses on the Porto side of the river.

Breakwell (1986) suggests that the desire to preserve the continuity of self-concept is the second motivator to action. It is defined as continuity in time between the past and present self-concepts. Two distinct types of self-relationship with the environment that affect the maintenance and development of continuity are discussed in the literature: place-referent continuity and place-congruent continuity. These relations are not mutually exclusive, and it is suggested that they are related to different patterns of residence.

Korpela (1989) and Lalli (1992) showed that places are used as references for past actions. For some people, maintaining a connection to a place provides a sense of continuity to their identity. Speller (1988) proved that place continuity maintenance is important for the psychological well-being. Forced relocation breaks the principle of continuity and can cause a long duration reaction of mourning or loss.

Place congruent continuity differs from place referent continuity, because the latter refers to the continuity maintained through specific locations that have emotional significance for one person, while the former refers to the maintenance of continuity through local characteristics that are generic and transferable from one place to another. For example, a person may seek a place congruent with their self-concept or that best represents the values that they advocate, or alternatively a person can try to change the place where he/she lives in order to establish continuity with the self-concept.

Self-esteem results from concern with a sense of personal development and social value. The desire to maintain a positive conception of oneself has been regarded as a key motivator (e.g. Gecas, 1982) within the context of social identity theory (Tajfel, 1978). Korpela (1989) showed how favourite environments can support self-esteem. By living in a historic city, a person can feel a sense of pride in that association (Lalli, 1992).

The self-efficacy concept results from learning theory (Bandura, 1977) and is regarded as high when a person believes that he/she can complete a task, which is important for their psychological well-being (Leibkind, 1992). Feelings of self-efficacy are maintained if the environment facilitates or at least does not harm a person in going about their daily life.

Winkel (1981) introduced the concept of a “manageable environment”. This is an area where residents feel they are capable of organising information within a social and physical environment. They can develop a predictive system which will enable them to assess whether there is an environment conducive to achieving their objectives and purposes; people want to feel self-efficient in their daily lives.

When people are attached to a place with a strong commitment feeling, they may engage active citizenship behaviours in order to contribute to a better overall quality of life. For instance, people may be willing to make sacrifices for the city (e.g. cooperate in voluntary community work).

3 Theoretical framework

A theoretical framework was developed in order to describe the causal relations between independent variables (individual characteristics, residential time and quality of life attributes) and dependent measures (place attachment and place related identity) (see Figure 3).

Several hypotheses were formulated based on literature review:

H1- (This hypothesis will be validated only in further research): The “Gaia 100 years old” programme will have a positive impact in Gaia’s residents in terms of perceived city image (identity, associations), place related identity, place attachment and self-esteem.

H2a- Quality of life attributes will be positively correlated with respondent’s age.

H2b- Place attachment dimensions will be positively correlated with respondent’s age.

H2c- There is no gender effect on quality of life assessment.

H2d- There is no gender effect on place attachment dimensions.

H2e- Natives will evaluate quality of life attributes more favourably than non-native residents.

H3a- Quality of life attributes will be positively correlated with the residential time.

H3b- Place attachment dimensions will be positively correlated with the residential time.

H4a- External evaluation items will be positively correlated with the quality of life attributes.

H4b- General place attachment will be positively correlated with the external evaluation.

H4c- General place attachment will be positively correlated with quality of life attributes.

H4d- Social identification/distinctiveness will be positively correlated with quality of life attributes.

H4e- Commitment/self-efficacy will be positively correlated with quality of life attributes.

H4f- Self-esteem will be positively correlated with quality of life attributes.

Based on assumptions made by Twigger-Ross and Uzzell (1996) on the Breakwell’s model (1986,1992,1993) and the model validated by Knez (2005, p.216), some additional hypotheses were stated:

H5. There will be a positive correlation between social identification and place attachment.

H6. Place attachment will promote both place-referent and place-congruent continuity.

H7. Respondents who are attached to the local area will express positive self-esteem from that attachment. Therefore self-esteem will be positively correlated with place attachment.

H8. Place attachment will be positively correlated with commitment and self-efficacy.

H9. Those people who are attached with high level of commitment will be prone to engage active citizenship behaviours.

4 Methodology

This paper describes the attachment profile of Gaia's residents in August 2008, in terms of commitment/self-efficacy, social identification, self-esteem and place-continuity, considering the moderating influence of the residential time (the period that respondents had been resident) and other residents' demographic characteristics. The level of analysis was defined as the "city of Gaia" geographically, limiting its meaning to the urban centre of the city and its frontiers (river and beach coast), because there are some asymmetries between the urban centre and some rural parishes (see Figure 1 and 2).

4.1 Sample

A total of 107 subjects (29,9% male and 70,1% female) answered a self-administrated questionnaire. Respondents were selected among Gaia population using a convenience method that included mainly: 1) working undergraduate students (with wide range of jobs and occupations) attending a university located in Gaia; 2) employees of a major hypermarket. The subjects were aged between 18 and 54 years old (M=34,1; SD=9,19). In this sample, 55,1% of respondents are natives of Gaia, while the remaining 44,9% were born mainly in Porto (26,2%) or the surrounding areas. The residential time varied from 6 months to 52 years (M=25,9 years; SD=12,62).

4.2 Measures

Based on instruments of Félonneau (2004), Hidalgo and Hernandez (2001), Knez (2005) a questionnaire was built comprising three sections:

Section A: city's quality of life attributes- subjects were asked to evaluate the city using 25 items (see Table 1) using a Likert scale (1-nothing to 5-very good). They also evaluated the overall quality of life using a scale of 0-10.

Section B: place-related identity processes were measured with 27 items/statements (see Table 3). According to "Ideal city" questionnaire of Félonneau (2004) this section included several items to measure: the external evaluation, the general attachment, the commitment and social identification. For example, respondents were shown the following phrase: "I really feel like a native of Gaia" subjects and were then asked to respond on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree).

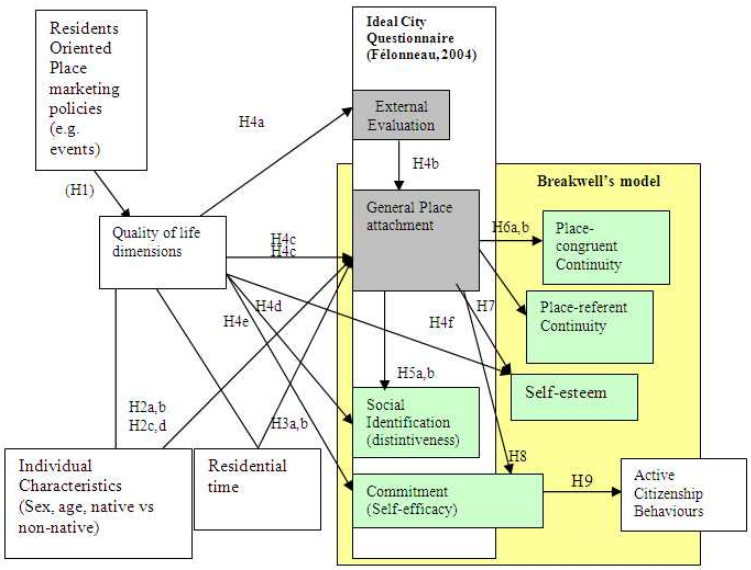

Figure 3. Theoretical framework modelling the impact of a programme of events on the sense of belonging, self-esteem and place related identity.

Table 2. Perceived Gaia's quality of life attributes (means and standards deviations)

	M	SD
CE1 Cultural activities (theatres, exhibitions, etc.).	3,19	,917
CE2 Green and recreational spaces (parks, gardens, etc.).	3,45 (Na>Nn)*	,827
CE3 Cleanliness of the streets	3,36	,816
CE4 Animation	3,10	,776
CE5 Tranquillity/calmness	3,21	,913
CE6 Good to make friendships and social relationships with people	3,38	,832
CE7 Environmental pollution (water and air)	3,14	,863
CE8 Architectural heritage (historic monuments)	3,08 (Na>Nn)*	,847
CE9 Traffic jams	3,42	,972
CE10 Fun to walk on foot (walkability)	3,54	,974
CE11 Security on the streets	2,98	,812
CE12 "Gaia is fashionable"	3,21	,933
CE13 Good for shopping	3,58 *	,938
CE14 Solidarity: people in need are helped by other people / organizations	3,03 ** (F>M)**	,806
CE15 Cosmopolitan (with people of various nationalities)	2,95 * (F>M)** (Na>Nn)**	,817
CE16 There is equal opportunity for all genders, ages and ethnicities	2,92	,739
CE17 Welcoming / friendly	3,56 **	,803
CE18 Sport activities	3,41 **	,868
CE19 Going out (go to restaurants, movies etc.)	3,49	,945
CE20 House Construction	3,11	,945
CE21 Conditions that encourage creativity (art, technological innovation…)	2,82 * (F>M) *	,766
CE22 Good infrastructure in education (kindergartens, primary schools, university)	3,11	,747
CE23 Good infrastructure in health (hospitals, health centers, pharmacies)	2,99	,841
CE24 Public transportation (train, bus, underground, tram)	3,39	1,071
CE25 It is a city that has evolved and developed over recent years	4,10	,788
Overall Quality of Life (1-10 scale)	7,08	1,41

Legend: M –mean; SD- Standard deviation;
* ($p<0,05$) and ** ($p<0,01$) positive significant Spearman correlation coefficients with time of residence
(F>M) - *($p<0,05$) ** ($p<0,01$) significant means differences by independent samples t tests ($M_{females} > M_{males}$).
(Na>Nn) - *($p<0,05$) ** ($p<0,01$) significant means differences by independent samples t tests ($M_{natives} > M_{non-natives}$).

5 Discussion of Results

The majority of respondents when asked to describe the city to a foreign friend, they elicited 53 different associations which almost all were positive, such as: “welcoming” (13,3%), “beautiful” (11,1%), “pleasant” (6,5%) “nice”(3.7%), “excellent beaches” (2,8%), or with “wine cellars” and “river Douro banks” (2,8%). The respondents also described Gaia as “a person” with the following attributes: “nice” (19,4%), “young/renewed” (6,5%), “welcoming” (6,5%), beautiful (4,8%); while a high percentage of them (11,3%) even associated Gaia to the person of the Mayor himself.

In terms of city’s quality of life attributes, it is evident that Gaia received a positive evaluation, accounting the perceived dynamic resulting from “recent development”, “good for shopping”, “welcoming/friendly” or “walkability” (see Table 1). There are some slightly negative aspects pointed out by respondents such as security (M=2,98) conditions for creativity (M=2,82) or health infrastructures (M=2,99).

Table 3. Factor Analysis Rotated Component Matrix.

	Component							
	Factor 1 Walkab.	Factor 2 Basic Infrastruct.	Factor 3 Creativity	Factor 4 Hospital.	Factor 5 Going out	Factor 6 Traffic	Factor 7 Urban Chaos	Factor 8 Green Spaces
CE10- Walkability	,738							
CE5 – Tranquillity	,728							
CE12-Fashionable	,644				,306			
CE7- Polluted	,560						,477	
CE25- Economic Development		,746						
CE24- Public Transportation		,744						
CE22- Education		,637	,371					
CE23- Health		,610	,338	,383				
CE21- Creativity			,778					
CE1- Culture			,731					
CE4- Animation			,538		,377			,317
CE18- Sport activities		,318	,483	,378	,367			
CE16- Equality				,752				
CE17- Hospitality				,704				
CE11- Security	,331			,598				
CE6- Social relations	,315			,496				
CE19- Going out					,815			
CE13- Shopping					,649			
CE9- Traffic						,700		
CE8- Heritage			,318			,608		
CE15- Cosmopolitan			,327			,569	-,335	
CE14- Solidarity						,511		
CE20- Urbanism							,804	
CE21- Green Spaces								,859
CE22- Cleanliness	,468						-,304	,559

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 10 iterations.
Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0,802.
Bartlett's Test of Sphericity: Approx. Chi-Square=936,915; df=300; p<0,001.

A factor analysis of city's quality of life attributes (see Table 2) produced the extraction of eight factors which explained 66,9% of variance: 1-"Walkability"; 2- Basic infra-structures; 3- Creativity; 4- Hospitality; 5- "Going-out"; 6- Traffic; 7- Urban chaos (related to buildings construction); 8- Green spaces.

The Table 3 describes the statistics of place attachment measures. Generally, scores are satisfactory, in particular the self-esteem item "I like to live in Gaia" (M=4,04) or the place attachment item "I really feel at home" (M=4,00), which reveals a very good performance of recent public policies.

Only two measures have a negative score mean: "people who live in this city are like me", which means a certain low level of distinctiveness; and the item "I would give too much of my self, if I move out".

There are positive significant Spearman correlation coefficients between respondent's age (thus supporting H2b): with the "very strong feeling that he/she belongs here" (R=0,247; p=0,010); in the self-efficacy items like "the important role played by Gaia in the plans for the future" (R=0,200; p=0,040), the "close link between the future and Gaia" (R=0,215; p=0,026), and the "willing to make sacrifices for the city" (R=0,28; p=0,003). People who are older, besides having more residential time, probably they are resigned or, at least, they are not considering the scenario of a new life in another place. "Fashionable" (R=0,208, p=0,033) and "environmental pollution" (R=0,216, p=0,025) are the only quality of life attributes that increased with respondent's age (Hypothesis H2a partially supported).

There is a gender effect (H2c rejected) because women evaluated more favourably the perceived "solidarity", "cosmopolitan" and "creativity" (see Table 1). But there is no influence of residents' gender over place attachment measures (Hypothesis H2d validated).

The results showed that the residential time is positively correlated with some quality of life attributes (H3a validated) such as "good for shopping", "solidarity", "cosmopolitan", "welcoming" and "creativity" (see Table 1).

The time of residence is positively and significantly correlated with the perceived overall quality of life; and also with almost all place attachment items (H3b validated), except social identity items like "people who live in this city are like me", and the place congruent attachment item "I would regret that people I appreciate in my neighbourhood would changed to another place", which revealed not significant correlations. Place-congruent continuity scores are explained by the social relationships which may be developed in a short run period.

There are significant differences between natives and non-natives in some scores, as proposed in hypothesis H2e, namely, "green spaces", "heritage" and "cosmopolitan" (see Table 1). In Table 3, significant differences between natives and non-natives in terms of place attachment measures are highlighted. Besides the logical differences it is interesting to see that the external evaluation and the self-esteem are more favourable amongst native residents.

There is a Spearman positive correlation coefficient between overall life quality and the external evaluation (R=0,61; p<0,001, hypothesis H4a validated); this can be explained by significant positive correlations with all quality of life attributes, except the ones in which Gaia seems to loose in

a comparative analysis with other cities (in this case, cultural activities, environmental pollution, traffic jams or urban chaos).

Table 4. External Evaluation, Place Attachment, Commitment, Social Identification, Self-esteem, Place-continuity (congruent/referent) and Citizenship descriptive results.

	M	SD	Cronbach Alpha
External evaluation	**3,64**	**,613**	**0,785**
EA1 - Gaia is seen from outside as a city with prestige	3,52 *	,781	
EA2 - Compared with other cities, Gaia has many advantages	3,68 **	,760	
EA3 - Gaia is a city that receives tourists in a good manner	3,78 **	,717	
EA4 – There are many things here that are envied by other cities	3,56	,871	
General Place Attachment	**3,48**	**,837**	**0,926**
PA5 - I really feel like a native of Gaia (distinctiveness)	3,80 ***	1,185	
PA6 - I really feel at home in Gaia (place referent continuity)	4,00 **	,905	
PA7 - This city is like a part of myself (place referent continuity)	3,56 *	1,011	
PA8 – Many things in this city do remind me of my own past and childhood. (place referent continuity)	3,45 ***	1,290	
PA9 - I can not imagine living in a different city because I would give up too much of myself (place referent continuity)	2,92	1,245	
PA10 - I see myself as a resident in Gaia (distinctiveness)	3,93	,978	
PA11 - I had so many experiences in Gaia that I'm becoming intimately bound up with city (place congruent continuity)	3,50	1,022	
PA12 - I know Gaia so well that I would recognize the town on a photograph taken at any time (place referent continuity)	3,12	,997	
PA13 - When I walk the streets of Gaia, I feel very strongly that I belong here (place referent continuity)	3,04	1,063	
PA14 - Actually, this city is very familiar to me. (place referent continuity)	3,63 *	1,036	
Commitment/ self-efficacy	**3,27**	**,902**	**0,893**
C15 - I'd like to stay indefinitely in Gaia	3,11	1.084	
C16 - Gaia plays an important role in my plans for the future	3,33	,913	
C17 - My personal future is closely linked to Gaia	3,33	,998	
Social Identification	**2,99**	**,582**	**0,664**
SI18 – The fact that I live in this city conveys an image of myself to others (distinctiveness)	3,27	,896	
SI19 - On the whole, people who live in this city are like me (distinctiveness)	2,80	,884	
SI20 - People who live in Gaia are more civilised when compared with the inhabitants of other cities (distinctiveness)	2,71	,962	
SI21 - Sometimes it bothers me when people refer to me as a "person living in Gaia"(inverted question) (distinctiveness)	2,81	1,083	
Place congruent continuity (social attachment)			
PCC23 – I would be sorry if people who I appreciate in my neighbourhood would move out	3,14	,926	
Place referent continuity (physical attachment)			
PRC22 – I would be sorry to move out of my neighbourhood	3,22	1,099	
PRC24 - I would not mind moving to another city (inverted question)	3,13	1,125	
Citizenship behaviour			
CB26 - I am willing to make sacrifices for the city (e.g. cooperate in voluntary community work)	3,14	1,032	
Self-esteem	**3,84**	**,834**	
SE25 - I am proud to live in Gaia	3,64 *	,882	
SE27 - I like to live in Gaia	4,04 **	,931	

*(p<0,05) ** (p<0,01) significant independent samples t tests ($M_{natives} > M_{non\text{-}natives}$).
M- Mean; SD- Standard deviation

In terms of place attachment measures, as presented in Table 4, all aggregated place attachment measures, except city referent continuity, are positively correlated with the external evaluation, thus supporting hypothesis H4b. There is a Spearman positive correlation coefficient

between the overall quality of life and the general place attachment (R=0,61; p<0,001, hypothesis H4c validated).

The explanation lies in a repetition of the same pattern verified with the external evaluation. Significant (p<0,01) correlations coefficients between place attachment and social identification (H5 validated), place congruent continuity (H6 validated), self-esteem (H7 validated) and commitment/ self-efficacy (H8 validated) confirmed the Breakwell's model and Twigger-Ross and Uzell (1996) hypotheses (see Table 4). Commitment is also correlated (R=0,365; p<0,001) with citizenship active behaviour (item CB26) which supports the hypothesis H9.

A multiple linear regression model (R=0,812; R^2=0,659; $F_{5,92}$=35,36, p<0,001) confirmed that place attachment is explained by residential time (β=0,403) and overall life quality (β=0,372), in particular by "dynamic evolution"(β=0,220), "opportunities equity"(β=0,165) "urban chaos" (β =0,141) (see Table 5).

Finally, a factorial analysis of place attachment measures (see Table 6) extracted six factors which explained 73,99% of total variance: Factor 1 – General place attachment; Factor 2- Social identification and commitment; Factor 3- Place congruent continuity; Factor 4- External evaluation; Factor 5- Distinctiveness; and Factor 6- Active citizenship behaviour.

Table 5. Spearman Correlations coefficients matrix between place attachment measures

	Social identification	Self-esteem	Commi t-ment	Place-congruent Continuity	City referent Continuity	Neighbour-hood referent Continuity	External Evaluatio n	Overall Quality of life
General attachment	,562(**)	,747(**)	,738(**)	,392(**)	-,343(**)	,662(**)	,505(**)	,607(**)
Social identification	1,000	,512(**)	,593(**)	,288(**)	-,321(**)	,523(**)	,423(**)	,423(**)
Self-esteem		1,000	,673(**)	,471(**)	-,256(**)	,581(**)	,576(**)	,657 (**)
Commitment			1,000	,493(**)	-,472(**)	,734(**)	,470(**)	,540(**)
Place-congruent Continuity				1,000	-,215(*)	,519(**)	,220(*)	,529(**)
City-referent Continuity					1,000	-,328(**)	(n.s.)	,379(**)
Neighbourhood-referent Continuity						1,000	,323 (**)	(n.s.)
External evaluation							1,000	,612 (**)

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 6. Beta standardized coefficients obtained by a multiple linear regression model.

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	B	Std. Error
(Constant)	-,758	,384		-1,972	,052
Overall life Quality	,225	,044	,372	5,152	,000
Residential time	,027	,005	,403	6,044	,000
CE25- evolution	,238	,071	,220	3,343	,001
CE16-equity	,195	,078	,165	2,522	,013
CE20-urban chaos	,125	,055	,141	2,280	,025

a Dependent Variable: Place attachment; Durbin Watson=1,983

6 Conclusions and further research

This paper aims to provide public policy decision makers with a set of indicators to assess the impact of policies and strategies of place marketing among residents. This article described only the first step of an impact evaluation study of a programme of events – "GAIA 100 years old". The results have generally confirmed the hypotheses postulated, because the subjects revealed their attachment or sense of belonging, and expressed social identifications, maintaining a consistent continuity. They expressed also a positive self-esteem and high capacity for managing the environment. Respondents also highlighted the importance of this new centrality and pole of attraction in the Porto metropolitan area. The recent urban upgrading of the ocean coastline developing excellent quality beaches has implications for tourism development and for the repositioning of a city as a destination for leisure.

This study will be complemented with a survey (to be conducted at the end of the programme of events), in order to evaluate the impact of this project on four target audiences: 1) the residents, 2) the student population (who attend the schools which will receive basketball nets), 3) sponsors/partners of the project; 4) and non-residents/tourists.

Table 7. Rotated Component Matrix of the factor analysis of place attachment measures

Item code	Factor 1 General Place Attachment	Factor 2 Social Identif./ Commitment	Factor 3 Place Cong. continuity	Factor 4 External evaluation	Factor 5 Distinctiveness	Factor 6 Citizenship
PA7	,817					
PA6	,785					
PA14	,784					
PA5	,761					
PA8	,739					
PA10	,669		,348			
PA13	,622	,572			,316	
PA11	,606	,374	,326		,317	
PA12	,553					
PA9	,551	,475	,341			
SE27	,550		,503	,352		
SI18	,535	,533	,334			
SE25	,509		,485	,338		
SI19		,798				
SI20		,678				
C16	,338	,585	,464			
C17	,382	,565	,541			
PRC24		-,553				,540
C15	,486	,526	,424			
PCC23			,785			
PRC22	,398	,469	,578			
EA3				,800		
EA1				,737		
EA2			,303	,715		
EA4				,700		
SI21					,909	
CB26			,324			,733

Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization.
a Rotation converged in 14 iterations. Kaiser-Meyer-Olkin Measure of Sampling Adequacy= 0,891.
Bartlett's Test of Sphericity: Approx. Chi-Square= 1920,961; df=351; p<0,001.

Finally, in Figure 1 of Appendix A is presented the structural equations model with the beta coefficients estimated by Full Information Maximum Likelihood procedure with LISREL 8.72 version (Jöreskog & Sörbom, 1993). The model describe the influence of a reduced set of 21 quality of life attributes comprised in seven dimensions, age and residential time, as observed independent variables, on place attachment and the influence of this latent dependent variable upon self-esteem and social identification. The fit indices (χ^2=531,43; df=338; RMSEA=0,073; p<0.001) indicate that the model satisfactorily fit[30] the data.

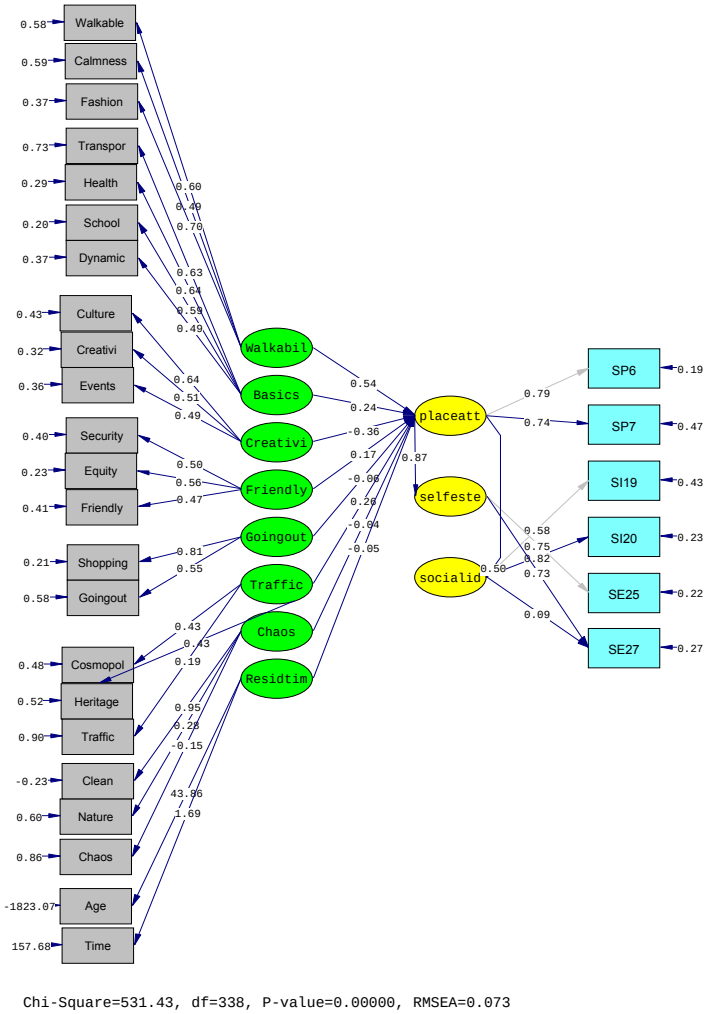

Figure 4. A model of place-related identity, showing the grouping of 21 quality of life attributes plus residential time and resident age (manifest or observed independent variables, X) in 8 latent (ksi) variables representing the quality of life dimensions and residential time and 3 endogen variables (eta) such as place attachment, place-related self-esteem and place-related social identification measured by six manifest dependent variables (Y). The paths represent significant (p<.00) standardised estimates; i.e. regression coefficients (LISREL 8.72 version of Jöreskog, & Sörbom,1993).

30 χ2values (low values indicate better fits), degrees of freedom, number of cases and corresponding p values; RMSEA values which above .10 indicate a poor fit, below .05 indicate a very good fit (Steiger, 1994) and up to .08 a reasonable fit (Browne & Cudeck, 1993). The RMSEA model fit index is not sample-size dependent and it takes into account a model's parsimony (McDonald & Marsh, 1990).

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Why is it important to achieve a representative participation in the debate of our cities?

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Do technicians, politicians and citizens have the same model of city? And if not, can we, without the public participation, be certain that our cities reflect the aspirations of all? Using semi-structured interviews we cross-examined our target sample (politicians, citizens and technicians that participate in the urban rehabilitation of Vila Nova de Gaia, Portugal). Questions focused on the importance of the public participation in urban planning and if people got involved in planning issues in general. The answer to the 1st question tended to be – 'yes' and to the 2nd question tended to be – 'no'. In a second stage we asked about the importance of different indicators of urban life quality (both politicians' and technicians' point of view, from a quantitative approach) and the concept of ideal city (politicians, technicians and citizens, from a qualitative approach). In the quantitative methodology, politicians and technicians are inclined to answer within a theoretical model, stating that public transports, environmental quality, green spaces, or even security feelings are much more important than proximity or sociability. However, when confronted with quantitative questions about urban life quality both technicians and politicians stress the importance of factors such as proximity (home – work, home - equipments of support, home – commercial places) or other components like sociability and sense of neighbourhood, i.e., parameters that assume great importance for our citizens' panel, which allow us to consider that this could be a more urban friendly model and to confirm why it is so important to improve the discussion within the public sphere.

Keywords: Public participation, urban planning, urban life quality, city model

1 Introduction

Cities are the result of endless complexity of appropriations: the people who live in cities (men, women, elder and youth, literate and illiterate, poor and wealthy, a mixture which has attracted people to urban areas. According to 'The State of the World Population' report (2009) urban population represents 50% of the total world population and 75% of the total population from developed countries.

However urban planning is done by a small group of "citizens" (the ones that are technicians) who rarely matches the diversity of the people living in the cities, as well as by politicians, mostly elected through a representative democracy, which have by this way the right and duty to decide the policies that shape the urban planning of our cities, under the umbrella of an electoral program, seldom discussed and seldom assimilated by ordinary people.

These findings lead us to our hypothesis: do technicians, politicians and citizens have the same model of city? And if not, can we, without the public participation, be certain that our cities reflect the aspirations of all?

2 What led us to this hypothesis?

Cognitive sciences have demonstrated that the phenomenon of consciousness is individual, i.e., each individual obtaining a single picture of reality (Damásio, 2000) and that reality interpretation is influenced by cultural and social phenomena (Hall, 1986). Further, there have been studies showing that there is an acculturation taste during the education of architects (Hershberger, 1988). At the

same time we know, from the study “Architect Profession” by Cabral and Borges (2006) that in Portugal the “endogamy” of the social recruitment of the architect’s students is only being exceeded by the young medical students, but also that each group acts according to his professional culture, which makes the city – when without public participation – the ideological product of architects and politicians only i.e., the ones who plan and run cities.

Current urban theories point to the need to reshape the urban planning in order to attend people´s needs: Ascher (2007); the New Charter of Athens – European Council of Spatial Planners (2003); and the New Vision for Planning – Royal Town Planning Institute (2003).

The call for citizen participation in decision-making is one of the strategies of European Union policies since the Treaty of Amsterdam (1999): "decisions are taken in a manner as open as possible and as closer as possible to the citizens", to the recent Green Paper of Territorial Cohesion (2008) which states " the objective of territorial cohesion could probably be achieved only if the corresponding policies are defined and implemented in a more involved way".

In Portugal the right to participation is provided in the Portuguese Constitution (1976), in the Code of Administrative Procedure and in various instruments of spatial planning, but the percentage of people participating in the discussion of planning issues is scarce. One example is the citizens’ participation in the National Plan of Territorial Planning Policies – PNPOT, according to the “PNPOT - Results Report” were 109 individuals suggestions registered (Portugal has 10.617.575 residents (INE, 2007) and a total of 189 suggestions, including Local Authorities, Associations, Universities, Public Services, etc.. In Vila Nova de Gaia, our case study, during the period of initial suggestions to the Vila Nova de Gaia Master Plan – PDM only 1.317 citizens’ gave any input out 310.086 inhabitants (INE, 2007).

According to Oliveira (2004) public participation is important because: can cover Administration's lack of reality knowledge on which they have to decide, therefore can serve as a means of collecting additional information; fosters dialogue between the Government and individuals, which brings an improved acceptance of decisions of the Administration from its recipients (even if the solutions are unfavorable), can be seen as an instrument of social peace; serves also as a mechanism of Administration transparency; works as a way of control of Administrative decisions with the advantage, in relation to the mechanisms of judicial control, to operate *a priori* (i.e., before the decisions have been taken) and not, as those mechanisms, the post (after the decision); and finally is a way of promoting the democratic spirit.

The democracy concept, hallmark of modern societies, implies the obligation of listening to popular will. During last decade there has been an increase of people abstention in elections. For example in Portugal[31], with rare exceptions, the participation in elections has declined. Since the index record from 1979 (a democracy peak, Portugal had lived until 1974 in a dictatorship government), when was counted one abstention rate of 28.26% in local elections, and a national record in 1980 with an abstention rate of only 16% for the Assembly of the Republic elections, the current levels of abstention rate are running about 40%. Regarding European Parliament elections the results are even more constraining: it comes from one abstention rate of 27.58% in 1987 and moved to an abstention rate of 61.40% in 2004.

[31] Data collected from the National Commission of Elections – Portugal.

Although there are no statistics showing the citizens alienation in relation to the administrative problems it is common sense that people have no interest and moved away from this thematic, which consequently reduces the possibility of their needs and aspirations being addressed in political discourse.

The debate on public participation is extremely important, among other reasons because we know now that planning is not neutral (Greed, 2003) and (Madariaga, 2006). Therefore it is urgent to think about: “Who does the planning?; Who is the team policy?; Which groups are taken into account into the act of planning?; How are the statistics made, which groups are included?; What are the key values, priorities and objectives of the plan?; Who is consulted and who is involved in the process participation?; How are evaluated plans’ proposals? And by whom?; How are urban policies implemented, monitored and managed?; and last, if the issues of gender mainstreaming are being fully integrated into all policy areas?”[32].

On the other hand we know from demographic trends that there is a marked increase of population age. According to the Eurostat report: "Population and social conditions" (Giannakouris, 2008), over 40% of the population will be 65 years old or over by 2060. Furthermore, we know that elderly people are one of the groups most dependent from the care support traditionally provided by women and meanwhile as it is shown in the report "The life of women and men in Europe: a statistical portrait" (2008) women are each day more present in the labor market, an achievement with serious social implications, such as the decline in birth rate and reduction of family support (children and elderly).

3 What has been done to solve the problem?

In order to determine the most appropriate city´s models for the population's needs, several studies have been conducted mainly under the theme of urban life quality. One of the main problems of these studies, from our point of view, is the fact that comparisons between the different groups are rarely established, i.e., those who live in the cities (citizens), the ones who decide the spatial planning (technicians), and the ones who have the power to make the urban policy (politicians). Furthermore, quantitative approaches are predominantly used.

4 Materials and methods

4.1 Citizens, technicians and politicians (the sample)

Our sample is composed by citizens, politicians and technicians which were part of one urban intervention called “Program Polis” accomplished between 2000 and 2008, in Vila Nova de Gaia. The “Program Polis” is a territorial intervention launched by the Portuguese government, with financial support from the European Community, the central government and the local authorities. The main aims were: creation of new urban centralities within the metropolitan areas; reconstruction and upgrading urban and environmental qualification of urban spaces and creation of factors leading to new identities; strengthening and consolidation of a balanced urban system in

[32] Our own adaptation from Gender Equality and Plan Making: Gender Mainstreaming Toolkit. London: Royal Town Planning Institute. Greed, Clara and others (2003).

national terms, based on the network of medium-sized cities, which ensure quality of life and environmental conditions.

The city of Vila Nova de Gaia is located on the south bank of Douro River, with the city of Oporto on the north. It was one of the 18 Portuguese cities that joined the government initiative in 2000. In the specific case of Vila Nova de Gaia, the intervention involved the preparation of 4 detailed urban plans which covered one area of 210 hectares with very different territorial situations: clandestine areas, densely populated areas and expectant areas, and also several projects such as the improvement of accessibility to the riverside, including the creation of a bicycle path and the construction of small local facilities to support fishing and typical outdoors community laundry.

In the selection of our sample we chose to inquire a group of 100 students belonging to the 12th grade (the year preceding university in Portugal) from Inês de Castro High School, which is the only school of this educational level in the area. A significant portion of students (62%) have 17 years. There is a predominance of girls (60%), versus (40%) of boys. The ages of 16 and 17 years represent the core of the sample with 50 girls (83.4%) and 34 boys (85%).

Taking into account the politicians and technicians group we chose to inquiry all the technicians and politicians involved in the program. The total sample population was 81 individuals. Of these, 26 were classified as politicians, due to their political profile and role in “Program Polis”. It included all the elements of the GaiaPolis Management Board (the local company that managed “Program Polis”) i.e., the representatives of the Regional Development Coordination Committee-North – CCDR-N (the department from the government that runs the territorial policies in the north of Portugal), the one representing Parque Expo (the company that was appointed by the government to do the “Strategy Plans” of the 18 cities, and was chosen to manage 10 local interventions), and a representative of the chairman of the Vila Nova de Gaia City Council. It also includes the Presidents of the 4 local Parishes cover by the area of “Program Polis”, the 3 National Coordinators of the “Program Polis, the 3 chairmen of the Parque Expo and some experts from the Vila Nova de Gaia City Council.

In the group of technicians (N=55) we included the authors and collaborators of the 4 detailed urban plans, the architects (some from the GaiaPolis projects and others contracted by the owners of the main lots), junior architects contracted by GaiaPolis to do technical support, some technicians of CCDR-N and the City Council, and also the GaiaPolis technicians team.

The ages of these two groups ranged between 28 and 70 years. There are no women in the group of politicians and 38.3% women representation in the technicians group. The education level of these two groups is equal or greater than the university degree; however in the group of politicians there are three cases lower than that the university degree.

The academic field predominant in the technical group is architecture (80, 9%), and in the political group is civil engineering (47.6%).

Almost half of our sample lives in Oporto city (42.6%), one quarter lives in Vila Nova de Gaia (29.4%) city, 14.7% live in Lisbon and 13.2% in other locations.

The sample was collected in 2 periods, the first covering the 100 students surveys in the High School Inês de Castro, held in the months of October and November 2007. In the second period we interviewed politicians and technicians, started in November 2007 and finished in June 2008.

4.2 Methods

Given our hypotheses there are three approach possibilities to select the universe´s population: (1) examine the entire population, (2) study a representative sample of the population, (3) study a not necessarily representative group of population, but a group that can have the characteristics of our population. Each of these approaches has its advantages and disadvantages. We chose to study groups, not necessarily representative, but whose characteristics are relevant to our hypotheses. According to Quivy (2005) this is undoubtedly the most common formula. If the researcher diversify the profiles of the respondents will inevitably get through the moment of saturation, where for more interviews he does it will be difficult to achieve additional relevant information.

When formulating our survey we took into account comments from the pre-test we had previously made in the neighborhood. In this phase had been detected some problems with style language, which cannot be attributed to lack of education degree of respondents, but may be related to the socio-professional and age differences.

Given the above we choose to make our surveys with a less academic language to be certainly that all range of people will understand questions. At the same time, to safeguard any deviations in the interpretation of responses from students and once we had at our disposal rooms with terminal Internet access, we asked students to illustrate their answers through images collected in Internet.

For the set up of the questionnaire script for the technical and political group we also made a pre-test, which has been shown to be too large and general content. Given this, we chose to build a directed interview, consisting of an equal proportion of open and semi-closed questions. It was also possible, since the time of administration of the survey to the technical and political group took place at a later stage, to carry out and use some preliminary results from the citizens' surveys.

Both questionnaires intended to obtain the perception of respondents on 3 topics: Urban Life Quality, Public Participation and City Models preferences, but the formatting of each survey was quite different.

We also used in both surveys filter questions, taking as reference the dialectic between the city and our case study. For example, in relation to the survey given to students of the High School we used the city of Vila Nova de Gaia and for the survey applied to political and technical group we used questions concerning the "Program Polis" in Vila Nova de Gaia.

5 Results

The percentage of individuals who answered our survey was 80% (politicians) and 85% f (technicians). Given our total sample population of 81 individuals we can ensure that the number of responses received is extremely significant.

5.1 City Model - urban life quality and the ideal city

In order to check the existence of different city´s models, we used and crossed two complementary methodologies, qualitative (analysis of speech content) and quantitative (statistical frame), for example, we used in our first approach 27 parameters of urban life quality which allowed us to

identify which are the less and more important parameters to the technical and political group which give us a statistical frame about the concept of urban quality. To complement it we used a different approach (qualitative) asking for the description of the ideal city, what can be seen as a utopian vision.

Preliminary results show that people describe (qualitative approach) as being a good quality residential area when: it is quiet and peaceful, including the lack of cars' noise, is a secondary street, etc ... and with proximity to support equipments, shops and services but also good road access and proximity to public transportation, green spaces for enjoyment in terms of leisure but also as a landscape view; less important but also worth to mention is the importance of "socialization and sense of neighborhood."

On the opposite a residential area is classified with bad urban life quality if the requirements above are not meet i.e., it is very noisy, has no green spaces and do not meet criterion of proximity.

Through another question (quantitative approach) we ask our panel of politicians and technicians about the importance of 27 parameters of urban life quality. Given the mean and standard deviation we obtained the parameters that tend to be considered "more important" and inversely the ones that tend to be considered "less important" (Table 1 and 2).

Table 8. More important parameters

Technicians	Politicians
1. Infrastructures	1. Public Transports
2. Public Transports	2. Infrastructures
3. Green spaces	3. Urban security
4. Mobility	4. Environmental quality
5. Environmental quality	
6. Urban planning	
7. Urban waste collection	
8. School equipments	

For both technicians and politicians the two most important factors converge: infrastructures and public transports. Taking in account that we are dealing with the same reference score we also can see that technicians tend to have a more spread vision about urban life quality than the politicians. We also can note that environmental quality is referred as being 'more important' for both groups even thought it is hierarchically more important to politicians than to technicians.

Table 9. Less important parameters

Technicians	Politicians
1. Sociabilization and sense of neighborhood	1. Proximity "home-equipments-services"
2. Parking	2. Sport equipments
3. Proximity "home-work"	3. Citizens support services
4. Industry	4. Sociabilization and sense of neighborhood
	5. Proximity "home-work"
	6. Industry

On table 2 we see that politicians tend to think that there are more "less important" parameters than technicians. On the other hand there is a convergence of: proximity "home-work" and industry.

There is also a convergence of “sociabilizacion and sense of neighborhood” anyway being less important to politicians than to technicians.

In the second stage we placed the issue of the "ideal city" asking to describe it through a specific example situation or a utopian idealization. For reasons of pragmatism we chose to submit the question from the classical functions defined by Athens Charter: the space to live, to work, to shop, for leisure, etc.

To start with, 52% of students (citizens) referred to their preferred house types. For the ones living in multifamily housing, more than half (52.5%) talk about an ideal single house type and only 10% expressed themselves in favor of multifamily housing i.e. where they live. On the other hand, half of residents in single houses reported favorable statements to this kind of housing. In contrast, our technical and politicians group rarely indicated preference about housing types.

Furthermore the technical and political group makes, in the qualitative approach, a clear statement to the need of mixing functions (proximity criterion), which contradicts the results of the quantity approach of this group, but coincides with the description of a good urban life quality residential area for our citizens panel.

Despite the presence of shops (commercial places) which is defined as one important factor for the urban life quality in the residential area (proximity criterion), citizens’ preferences for commercial places indicate clearly the search for large commercial areas, like malls (70%).

With regard to leisure the most curious results are the clear preferences for green spaces such as gardens or river paths, sometimes associated with sports. The proximity is again enhanced by our technical and political group regarding leisure time, but above all, leisure places should be disseminated in order to be closer to residential and workplace areas.

5.2 Public Participation

The issue of public participation was introduced in our initial hypothesis given its relevance in the current discussion of cities. In fact how can we be sure that our cities reflect the needs and aspirations of all citizens if they are not present in public sphere debate?

In this sense it was important to analyze whether those groups shared the same view in relation to: (1) the importance of public participation, (2) if they had the same perception about the fact that public participation is enough or not; (3) the reasons that lead to low citizens’ participation and finally (4), what to do to increase participation (question only posed to technical and political group).

(1) Regarding the importance of public participation we found that this is considered to be relatively more important for the political and technical group than to the citizens. Approximately 92% of citizens consider this important, against 98.5% to technicians and politicians that feel the same way.

The justifications (qualitative analysis) by the citizens are: the assumption that, as users, they have more knowledge about their needs and preferences, and in some situations, a different vision from who decides. On the other hand because participation is one right and one duty in a democratic society, and as it is repeatedly said "Cities are for all". Furthermore it helps to stimulate a sense of

belonging and place identity. Finally citizens consider public participation as a mean of increasing their city's information.

For people that consider public participation indifferent the main reason is related with dissatisfaction, the presumption that their participation is not going to have practical consequences, but also the assumption that the urban decisions are issues that only concern the elected politicians.

Politicians and technicians consider that public participation is important because: the city is a collective phenomenon, where citizens as users can have a privileged knowledge of their needs and aspirations; because it can act as mediator between the desires/needs of the population and the political and technicians point of view; can also be assumed as a way to stop any decisions that reflect distorted perceptions from reality, and / or also can play an important role by avoiding some citizens disagreement from politicians or technicians decisions, later on;

On the other hand politicians and technicians stress the principle that public participation can not be understood as a linear phenomenon so should be subject to a kind of filter between the desires / aspirations of citizens and the urban plans proposals.

(2) About the fact if there is enough participation or not, the answers differ. Politicians and technicians believe that people in general do not participate (94%). 50% of citizens answered that participation is not enough, 40% don't know and 10% consider that it is enough. There is a high percentage of citizens which answer is "don't know." The reasons given are clearly representative of the lack of knowledge on the subject, never heard of, never talked about, etc.; half of our citizens sample states that participation is not enough. Through speech analysis content we can give 3 main reasons: They are discontent, because participation is not encouraged and, moreover, be inconsecutive; The self-indulgence and indifference of the population; But curiously, a part of our sample representing 30% of those who said that citizen participation is not enough, answer this because they think people knowledge is not enough to decide about urban planning issues so according to them the decisions must be supported by experts.

What are the reasons that lead people not to participate, according to our citizens sample are essentially: who decides do not want to know the views of citizens and that people are not interested in those issues, which together represent almost half of the answers. But also that: people do not have sufficient information to be able to participate; people are selfish and conformed; people find that their participation has no practical consequences; people do not have time to participate; people are not encouraged to participate; people think that they do not have enough knowledge to do so, people do not know that they may participate, but also, that people think that planning issues are for political and technical decision.

(3) The reasons that lead people not to participate, according to our panel of politicians and technicians are: main reason, the competent authorities are not interested in encouraging citizens participation in that sense they do not inform citizens about the opportunity to participate, they omit and limited crucial information, at most, they meet the required periods of public participation just because they have to do that due to legislation. On the other side but with a lower weight, politicians and technicians consider that the population has no civic consciousness, they move away from this kind of issues, they don't see the city as a collective phenomenon (when they participating, they do so in order to assert only their individual needs).

(4) What to do to increase participation: First disseminate information by any means, beginning by informing citizens that they have the right to participate but also with a wider dissemination of technical proposals and political decisions. And also clarify when and how citizens can participate. On the other hand, perhaps the time established in legislation to public participation is not the most appropriate.

Decentralizing the debate, approaching to the public, either through the organizations of the discussions by neighborhood, by city block, parish, etc., or stimulate a debate in steps (thus avoiding that public will question the central government about their individual problem, which could be important for their neighborhood but certainly not appropriate in a larger scale), last but not least, the need to bring the technical language closer to citizens talking.

Also, increasing the civic culture of the citizens, something that should begin in the basic education, and whose fruit probably will be found only in next generations, but also giving citizens some training activities that allow them to: understand the technical language; understand the city as a collective phenomenon, etc. Although the lack of civic culture and citizenship is basically pointing as people´s problem it is also a question that we should think about do to some politician attitudes.

Other factors are mentioned, in particular, the necessity to be consistent with the citizens proposals, or that people participation absent is also determined by the lack of feedback, and last, the necessity to consider the principle of "user-payer", which imply that the costs of bad policy decisions were allocated to beneficiaries of such action, situation which is not required by actual urban legislation since such cost is diluted among all taxpayers.

Given the attributed importance of public participation measure by our politicians and technicians group, we questioned our panel if, sometime he/she had participated on urban planning discussions, as an anonymous citizen or as a technician/politician.

In fact as anonymous citizens only 47.1% answer that had already participated. As technicians or politicians, 75% answered that they already did it. Furthermore most politicians (95.2%), against only 66% of technicians state that they already participated.

The reasons which can justify that 52.9% of our panel of technicians and politicians don’t participate are: the self-indulgence, indifference, and some inhibition motivation. Not being able to distinguish themselves between technicians, politicians and anonymous citizen, i.e. they always state one opinion they are doing it being a technical / political actor. In opposite direction, we have some answers saying that they do not consider that their position as technicians (majority from people with technical jobs in local government offices) is compatible with the assumption of a public position contrary to their public positions; but also, never felt directly injured or feeling directly touch for some situation; feel it is inconsistent to participate, but also afraid to participate because he/she can "suffer" the consequences of such participation; or even consider that "as anonymous citizen" would be not relevant i.e., not consider their participation; and finally not knowing what to do or where to go.

At the same time we asked our group of politicians and technicians if they had any time participate as a technician or politician and request examples of such participation, the most cited examples are: doing their professional tasks, related to take decision on urban planning (different from doing it as an individual initiative); through public meetings, debates and conferences, which does not imply its own initiative because the invitations for speaker are mostly related to the position

of "decision" held under the professional charge (although not all conform this pattern); Through the press, public events and petitions, but also a curiously answer from someone (a politician man) that says, “as decision maker rather than participate I had to decide"; finally when participating on SAAL (Local Support Service Clinic for social housing) and social housing cooperatives, a exclusively Portuguese phenomenon that occurred in 1975 at the begging of democracy in Portugal.

6 Analysis and discussion

It is very difficult to consider politicians and technicians as a separate group. Some of our politicians don’t classify themselves as being that, when they are appointed by the central government (example the chairman of DGOTDU or the vice-presidents of CCDR-n). This could be related with a non-friendly image that people tend to have about politicians but also from certain confusion between roles. Politicians tend to think that they have skills to decide technically. This can raise problems for comparative process. However we must stress that there is a clear difference of ages and gender between those groups.

Taking into account our preliminary results we can advance some hypotheses: For example, when talking about urban life quality, mobility seems to be more important to women than to men which lead to our technician preferences, as this group include 38,3% women. On the other hand the importance due to “urban security” by the group of politician could be related with the fact that mainly they live in Lisbon city (42.9%).

Another interesting result is the importance that our politicians and technicians group give to public transports. Meanwhile if you asked them about the quality of public transportation they tend to answer that they don´t know because they don’t use it. In contrast women have much higher rates of public transport knowledge. In fact the statistics show that the rate of use of public transport for women is higher than men and that the routes of travel are different for both sexes. Again these results suggest that the results obtained in the question "urban life quality" (quantitative approach) represents a theoretical model (or a professional common sense model) which is far from the local needs and real life conditions.

Regarding the convergence of industry as the less important parameters of urban life quality we can justify it taking into account technicians and politician description of the ideal city, where industry is the only non-mix function and which should be far from the city. Concerning the classification of proximity “home-work” as being less important we should mention women´s justification “we don’t need to work near home if we have good mobility and other support commodities”, but we also should mention a comment for one of our respondent who qualified proximity “home-work” as not being such important even so he lives, just five minutes by foot from his work. At some point looks coherent to see industry as less important due to the fact that it is a working place. On the other side, in the utopian vision living and working close seem important but industry is something that politicians and technicians tend to want far from the city. Do they consider industry a working place?

Other unexpected results were the lack of importance (quantitative approach) that parameters such as proximity “home - equipments and services”, equipment for elderly people, socialization and sense of neighborhood, place identity or even parking.

Proximity to home-work, home- equipment of support, commercial places, services, etc. is one of the shortcomings identified by current planners trying to incorporate the issue of gender in city planning (Madden, 1981) (Greed, 2003) (Madariaga, 2006).

The constant increase of elderly people is seen as one of the biggest "problems" for the future of our societies. Given the meaning of planning, by definition something that should be done for the future, how can we explain that technicians and politicians group considers this parameter as not being such important?

The socialization and sense of neighborhood can be a mean of encouraging public participation and is also a way to use public spaces. So how to explain this low valuation which is central to the place identity, another parameter surprisingly devalued by our technicians and politicians group? Are we condemned to the neutral city suburbs?

It looks to be a connection between de importance of public transports and the “less important” of parking. In a theoretical frame politician and technician believe that is important to improve public transport and a way of doing that is to build less parking. Anyway technician and politicians, more the last group, ignore public transports quality and also as the national statistics show (INE-2001) the use of private transportation is improving.

On the other side it seems that the ideal city as described for our technical and political sample would clearly fit the concept of "neighborhood, heavily based on proximity criteria’s including, in some cases, the mix of light industry as a way to reduce travel-home work, i.e., this describe a city built against a functionalist vision and fair from the results of our quantitative approach. Meanwhile we must highlight that commercial places seem to have a double feature for citizens, They want shops near home but they like to go to malls because of the variety and comfort and above all due to the assumption of those spaces as places for recreation and leisure. On the other hand, politicians and technicians assume, in some situations, one "intellectual opposition" against what they consider to be the citizens` taste, expressing their total disregard for those ‘consumption cathedrals’, nevertheless which they occasionally refer to be users of.

When talking about public participation, our respondents believe that a significant part of their participation is made as technician or politician and not as anonymous citizens. We think that this could be due to 2 reasons: the "confusion" among the role of anonymous citizen and as someone who has a professional statement whether as technician or politician. Indeed it appears that a significant share of participation under the professional role is considered as public participation: The second reason is related with the confusion between being a “public person”, and the belief that as being that any statement could be understood as a public participation. In our sample 95% of politician’s states that they participated in the context of their professional role, but only 65.9% of the technicians answered in the same direction. That is, being a politician means greater opportunity to participate when performing such charge (sig = 0,008).

The statistical results allow us to realize that the percentage of men who claims to have already participated as anonymous citizen is 50% against 38.9% of women. On the other side men politicians and technicians who have participated are 84% against only 50% of women. Again to be woman means less possibility of participation in their professional job as a technician (sig = 0,013). Furthermore, we know that the technicians group as got a wider range of ages and also female

elements, which are not present in the politicians group. So to be woman means less chance of being in a political positions (sig = 0,001).

In terms of age groups the anonymous participation increases with age, 5.9% up to 35 years old, 55.6% up to 47 years old, 61.1% up to 58 years old, and 66.7% from more than 59 years old. The results allow us to conclude that being young and under 35 years means less chance of ever having participated as a anonymous citizen. (sig = 0.001). There is also a relationship between being a young person (<35 years) and gender (being a woman) and the deficit of public participation. On the opposite side, the presence of men in leadership positions (as politician or technician) is perceived by themselves as a form of public participation and as part of their professional duties.

But only "in theory public participation is important"; expression that appears *verbatim* in some of the speeches of our respondents, indeed "public participation" appears as something neutral (not very important and not unimportant in our quantitative analysis). A superficial reading of the various justifications confronts us immediately with the difficulty in establishing parallels between the speeches.

Technicians and politicians unlike the citizens don´t talk about public participation as being one right in democratic countries an also don't mention the sense of belonging and place identity, which could arise from that. On the other hand, the awareness that people may not have enough technical information to participate or to be stimulated in this direction is rarely mentioned, and the same happens with the people's feeling of uselessness of their participation, i.e., technicians and politicians could not be sensible to the necessity to give people training to participate in order to stimulate debate because there is a false perspective that all (citizens, technicians, politicians) have the same background about the issues debate.

Other unexpected result was the statement of some of our technicians saying that they don't participate because they not know what to do or where to go. Why is participation so eclectic that even some technicians ignore how to procedure?

At last, we should not forget the questions raised by some politicians, "do citizens have the duty and right to participate when they elect democratically their representatives? On the other hand "do politicians have to hear the citizens' suggestions outside the periods specified in current urban legislation?". Those questions pointed by who has got the power to decide can define our actual democratic frame.

Anyway, the reasons pointed for citizens, politicians and technicians are not so different and are focused primarily on the fact that competent authorities are not interested in fostering participation. It´s easy to feel that way as the 3 respondents who believe that there is enough citizens' participation justifies their response by the fact that authorities respect the public participation periods as defined by law, so people have full freedom for participation if they want to do so.

We should not forget that the concept of public participation may have been differently understood by each of our respondents, so it is possible that this affected our results. Paradoxically this may also be reported as one of our conclusions: the concept of public participation is not well defined, being still relatively new and not enough widespread.

At last we should mention that we are working with a general scenario using citizens` perception and analyzing mainly the technicians and politicians as a whole group. Further studies

will include gender perception, professional background, living places, age ranges and cross results between the different questions.

7 What are the implications and utility of these findings? Some conclusions

The results show the different parameterizations or the different linguistic discourses of our 3 groups about the “ideal” city. But also that technicians and politicians admit different positions when faced with the same question from a professional perspective or from a utopian point of view. Why is there a gap between these two realities? A superficial observation of Portugal urban planning leads us to say that our urban plans reflect the professional vision of our politicians and technician group: what reasons lead to this occurrence?; is it a matter of "professional culture"? Or could be the result of legislative straitjacket that determines the development of town plans?

Our results seems to confirm one of the criticisms outlined by our panel of technicians and politicians concerning the lack of awareness of “the city as collective phenomenon” as a reason for low participation by citizens, for example, people tend to speak mainly about the kind of home they prefer without taking into account their surrounding, in clear contrast with technicians and politicians speech, and secondly, the need for decentralization of the debate, as we know that people participation is highest when the situation is directly concerning people needs. This confirms the logic of the highest rates of abstention in elections to the European Parliament than in local elections, or the smallest participation in a national level urban issues, like PNPOT, when compared to a local participation in urban planning issues like the PDM of Vila Nova de Gaia.

We believe that one of the greatest utility of this study stems from the premise of the architect social role (Portas, 1982) (Brandão, 2005), which implies, among others, the obligations to listening to the needs and aspirations of the city´s users.

On this point we should underline two situations: firstly the different discourses and different city’s models, mainly in relation to theoretical assumptions made by the politicians and technicians group; in a second stage the absence of public participation, that could be the cause and consequence of the first situation (different groups don´t talk because they have different speeches which can deliver to different city´s models because the absence of talking).

Although our preliminary results cannot allow us to draw final conclusions yet, we can confirm that the daily routines vary in terms of gender which imply different needs in organizational structure of urban space. We also know, and our study confirms it, that women are absent from the public sphere, through the practice of citizenship, such as public participation, either because they are not in decision places positions, so it will be difficult to them to impose models and attitudes. In this regard it is urgent to find mechanisms to offset this unbalance since this group represents half of our "clients" and a means to "hear" the voice of the youth and the elderly, whose care, education and monitoring are traditionally made by the female sex. Meanwhile, as we know that women don’t participate, is important to ensure that our cities reflect women needs, hearing their voices and supporting urban planning in theoretical studies about gender issues.

Finally ours results show that different actors have different perceptions about the level of citizens` participation, why people don’t participate and why is important to participate. This is a clear statement about the lack of discussion around those concepts which could be connected with the

absence in “public participation”. There for we can assume that the city is not discussed, which suggest that our cities do not reflect the aspirations of all citizens, so the city is not for all. How can we achieve a territorial cohesion if we don’t have a social cohesion?

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Planning Discourses in Small Islands

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Research on small islands has been interdisciplinary. However, up until now, planning on small islands has not been a popular research topic in academia. Drawing from a literature review on the general field of 'island studies', this paper unveils the perspectives and discourses surrounding the study of small islands and analyses the main planning challenges faced by these territories.

Keywords: small islands, island studies, islandness, planning.

1 Introduction

Academic research has not been traditionally focused on the study of small islands. Rather, it has taken continental areas as prime objects of analysis. In the context of Europe, Bailey (1998) reminds us that «When students in British and continental European schools study Europe they usually concentrate on the continent's heartland. (…) Rarely do they have the chance to consider the situations of those other Europeans who live along the continent's Atlantic margins in island and island groups such as Faroe, Shetland, Orkney, the Hebrides, Madeira, the Azores and the Canaries» (p. 309).

It was only in recent decades that academia has started to focus on the study of islands from an interdisciplinary point of view. It appears that today «… is possible to identify a positive need for island experience – and island imperative – in whole sectors of society in developed countries» (Péron, 2004, p. 326). Some suggest this interdisciplinary field to be labelled 'Island Studies' (Baldacchino, 2004, 2006a).

However, despite this recent interest in Island Studies, «the question of what constitutes an island is not conclusively settled, and what constitutes small islands is a particular contested issue» (Hay, 2006, p. 20). The diversity of island situations is perhaps the reason why no universal definition of 'small island' has emerged. Furthermore, the inexistence of an unambiguous size threshold is a particularly changeling issue in island studies, as is not clear what constitutes 'small' (Royle, 2001). It is outside the scope of the present paper to discuss in any detail the meaning of 'small island'. For the purpose of this paper 'small island' will be defined as «… those specks of land [surrounded by water] large enough to support permanent residents, but small enough to render to their inhabitants the permanent consciousness of being on an island» (Péron, 2004, p. 328).

From the other side, despite the interdisciplinary nature of the field of Island Studies, there are still a number of important issues that remain to be investigated. Apparently, neither planning has been a central issue in the field of island studies, nor small islands have been taken as key territorial units in planning research. And whenever planning research has focused on island realms, it has invariably viewed these 'small pieces of land surrounded by water' along the same lines as other continental areas, rather than approaching them in their own terms.

The apparent inexistence of research on the issue of planning in small islands constitutes the core motivation of this paper. The specific objectives are to: i) uncover the ways in which the general field of Island Studies sheds some light on the main planning challenges faced by small islands; and ii) disclose if the very 'islandness' of small islands – a term which used to denote island qualities, including geographical, socioeconomic and political elements – creates distinctive planning challenges.

The remainder of this paper is organised as follows. First, an outline of the paradoxical nature of small islands, in which lies a great deal of its distinctiveness, is shown. Second, an attempt is made to understand the structural features of small islands. A number of development and sustainability challenges facing small islands are identified. Third, attention is given to the meaning of sustainable development in the context of a small island. And finally, it is analyzed the extent to which islandness is a variable to take into account in planning and policy-making.

2 Islands as Paradoxical Places: Competing Discourses in Island Studies

As Baldacchino neatly puts it, small islands are 'nervous dualities' (Baldacchino, 2005, p. 248), «paradoxical places which lend themselves to smug subordination via different discourses» (Baldacchino, 2006a, p. 5). The main competing discourses in Island Studies are examined in the following paragraphs.

First, there's the issues revolving around the notion of edge, the permeability of boundaries and the extent of isolation/connectedness (see Hay, 2006). A first strand of the literature clearly highlights the discrete essence of islands. It is argued that insularity and, in particular, the term 'island' carries strong connotations of «isolation, containment, boundedness, closure, in contrast to exchange, conduction, connection, and openness» (Clark, 2004, p. 287). A second strand of the literature stands for the view that connectedness describes the island condition better than isolation. Island boundaries are seen as permeable; and the sea is seen not as a barrier which prevents connectivity but rather as an element which connects the island to the rest of the world (Beriatos, 2007; Olwig, 2007). Nowadays some authors start to believe that «(…) being open and/or closed is [perhaps] the most significant determinant and feature of an island's ontological status» (Jackson 2008, p. 47).

Secondly, different interpretations regarding the nature of the island dimension can be found in the literature. For some authors, islands are seen as replicated versions of what can be found in the continental realm (Quammen (1996), cited in Clark, 2004; Greenhouse, 2006). The view of islands as laboratories has been fuelled by the perception that small islands are closed and bounded systems and that «observing and comprehending myriad interlinked economic, social and ecological changes, among other things, taking place in small islands, and their consequences, is relatively straightforward» (Nagarajan, 2006, p. 295). For other authors islands harbour distinctive features which differentiate them from continental areas (Baldacchino, 2004; Hay, 2006). The concept of islandness is, in fact, taken to mean the set of island qualities that determine and condition «physical and social events in distinctive (...) ways» (Baldacchino, 2004, p. 278).

Thirdly, given that islands and island groups make up the great majority of the world's small states, a question that is usually debated in the literature is the extent to which the development

challenges faced by small islands are associated with the fact that most of small states are islands or, conversely, with the fact that most island states are small. A first strand of the literature states that what's at stake is smallness rather than islandness. It is argued that many of the disadvantages faced by small islands, such as small scale and remoteness, are also shared by small states (Dommen, 1980; Selwyn, 1980). A second strand of the literature views islandness as a relevant analytical variable. Despite problems such as «remoteness, smallness, isolation, peripherality, etc., can also affect, singly or together, mainland areas, (...) they are more notable in their effect on the bounded landmasses that are islands» (Royle, 2001; p. 1). In particular, it is argued that the very insularity of small islands means that they suffer the added impediment of a water barrier which must be surmounted to achieve access.

Fourth, much of the island literature is fuelled by the idea that small islands are faced with a set of vulnerabilities (Briguglio, 1995; Dommen, 1980; Sanders, 1997; Selwyn, 1980), resulting from the interplay of features such as smallness, remoteness, geographical dispersion and openness. The main arguments in favour this vulnerability thesis are that: i) the islands' small size implies a poor natural resource endowment, a limited labour force and a small domestic market; ii) their openness to international trade renders them more exposed to economic and non-economic exogenous shocks than larger states; and iii) their remoteness implies higher transport costs, as well as a lower accessibility to services and markets. However, empirical evidence shows that small islands seem to perform better than continental areas (Armstrong and Read, 2004; Baldacchino, 2000). Thus, in opposition to the debate of small islands' vulnerability there's the debate of small islands' resourcefulness (Baldacchino, 2000, 2006b). The main arguments in favour of the resourcefulness thesis are that: i) through emigration, employment and education, small islands expanded their economic space, drawing in resources from the outside; ii) small islands use their isolation as a means of extracting power and resources from larger jurisdictions and attracting offshore investment; and iii) small islands exhibit high levels of social capital.

And fifthly, small islands are arenas of migration par excellence (Connell and King, 1999). From one side, islands have always been subject to high rates of emigration, which have been mainly instigated by economic factors, such as the decline of crop production and problems of access to land in the 19th century, or the lure of modern and wealthy economies elsewhere and demographic pressures in the 20th century. People usually leave because of the constraints imposed by insularity. From the other side, small islands are increasingly becoming places of immigration. Whereas in the past these inward movements of people have been driven by colonialism, which has instigated the settlement of new population in island territories, more recently it has been a result of the tertiarisation of island economies, which has generated some return migration, as well as inward retirement migration to small islands (Connell and King, 1999; Lazardis et al., 1999).

3 A Portrayal of Islands: Structural Features of Small Islands and Emerging Development Challenges

Effective planning is not possible without a full understanding of the structural features of small islands and the main challenges they are faced with (Beriatos, 2007). This section reviews some of

most important features of small islands, in particular those which have straightforward implications in the design of planning policies in small islands.

3.1 The Geographic Setting

Small islands are usually understood as distinctive geographic spaces.

First, they are viewed as 'places' in the full holistic sense of the term, contrary to mainland areas, which are likely to be thought as part of larger landmasses (Péron, 2004). The view of a small island as a whole calls for a more holistic planning approach.

Secondly, the sea-land interface not only bestows small islands with a geographical determinism, related with the existence of clear boundaries, but also fuels much of the literature on the islands' distinctiveness (Jackson, 2008). From one side, the existence of such interface, together with a small size, means that a large amount of land area is coastal. In fact, islanders are coastal people par excellence and most of islands' economic, political and cultural activities take place in the coastline.

From the other side, the water barrier leaves islands isolated to some extent, forcing islanders to use sea and air transport in order to cross the imposing water barrier. The inexistence of a sizable population, coupled with the lack of competition between transport operators, creates further constraints, such as a reduced number of transport routes and low service levels. Altogether this means that small islands have to deal with low levels of accessibility (Bailey, 1998).

Thirdly, for archipelagic settings, fragmentation emerges as an additional feature creating distinctive challenges for small islands (Beriatos, 2007), such as a further reduction of the domestic market, additional transport costs and increased spatial imbalances.

Spatial fragmentation also creates problems of inter-island mobility. The sea barrier prevents the use of private transport, which means that travel needs must be met by public transport (Luis, 2002). Inter-island public transport faces challenges similar to those of mainland public transport. The main difference is the lack of competition from private transport.

Fourthly, small size means the existence of space limitations, which bring about increased conflicts over land uses (Douglas, 1997; Péron, 2004; Pugh and Potter, 2000). In fact, not only small islands face the constraint of space limitations, but also of limited usable areas, in that many islands are mountainous.

Finally, insularity seems to plays a major role on the urban organization of a small inhabited island (Bodin and Dufay, 2004-05). A first example comes from volcanic islands, where difficult topographic conditions has largely forced islanders to settle in the coastal areas (see the case of the Caribbean Islands in Pugh and Potter, 2000). Another example comes from the Aran Islands of Inishmore, Inishmaan and Inishere, where there lack of no running water, resulting from the permeability of limestone rock formations, has led traditional housing to be positioned in relation to the appearance of the clay where water was available (Royle, 2001).

3.2 Spatial Incidence of Development

The model of spatial development of small islands is characterized by two salient elements: i) a strong coastal occupation; and ii) a clear core/periphery dichotomy.

In fact, from one side, in small islands the presence of people, transport infrastructures and tourism activity is usually stronger in coastal areas (Connell and Lea, 1992; see also the case of the Caribbean in London, 2004; of Yap in Perkins and Xiang, 2006). It is curious to see that those areas that attract development the most also happen to be the most fragile to natural hazards: the coastal areas (Boruff and Cutter, 1997; London, 2004).

From the other side, nowhere is the core/periphery dichotomy, with the resulting gaps between 'urban' and 'rural' areas, more evident than in small islands. Here development is usually oriented towards the main cities, whereas growth in other regions is somewhat neglected (Storey, 2006). In archipelagic systems, in turn, such dichotomies are usually expressed between the dominant island and the off-islands.

This dichotomy has been increasingly sharpened by internal movements of people from peripheral to urban areas. In some islands, it has resulted in the abandonment of the most traditional land uses in rural areas. In other islands, in turn, it has led to a systematic conversion of traditional agriculture uses into tourist-related uses, associated not only with the transformation of rural housing into secondary houses for retirement migrants (see the case of Corfu, Greece, in Lazardis, et al. 1999), but also with the emergence of up-sale leisure amenities such as resorts, villas, timeshares, residential subdivisions or golf courses.

The abandonment of traditional land uses in peripheral areas has been matched by migration to major cities, thereby increasing the pressure on land in urban and peri-urban areas and propelling higher densities of urbanization in islands' main urban centres.

In some cases, a further model of spatial development, characterized by movements of people from the major urban centres to their surrounding countryside, has emerged in recent decades in some islands. This exodus is fuelling urban sprawl, which is bringing about a number of planning problems. From the one side, sprawling is instigating a fast consumption of land for urbanization. This trend is incompatible with sustainable development aims, given that it crashes with the need of containing development in territories with limited usable areas (see the case of Malta in Bodin and Dufay, 2004; McCarthy, 2004). From the other side, migration away from major urban centres increases the rate of residential vacancy and instigates the deterioration of the urban fabric (see the case of Malta in Chapman and Cassar, 2004).

3.3 The Demographic Setting

The very smallness of small islands should not be taken to mean that «population issues are unimportant, or that population problems are minimal» (Haberkorn, 1997, p. 220). Distinctive demographic dynamics create distinctive challenges for planning.

First, on average small islands are four times more densely populated than continental areas. High population densities inevitably entail an environmental price and bring to the fore a number of planning and urban management problems (Chapman and Cassar 2004). Some of these problems are related with the amount of pressure on land and other resources. Others include rising levels of domestic wastes, increased pressure on infrastructure and services and a general decline in living conditions.

Second, as previously stated, small islands show an uneven spatial distribution of population. Internal migration, from rural to urban areas and from outer to inner islands, has come to deepen these asymmetries (Royle, 2001; Storey, 2006). In the outer islands, and generally in rural areas, there's the risk of out-migration taking the population below the minimum threshold needed for the community to remain viable. In central islands and capital cities, internal flows of migration may exacerbate the problems of overcrowding and pressures on the environment and infrastructure.

Third, small islands are often subject to high demographic fluctuations, with increases and decreases well beyond the parameters of natural change and birth (Connell and King, 1999). Most of these fluctuations are due to migration. Others seem to be a result of the peaks and troughs of tourism. Demographic fluctuations bring about profound alterations in productive organization of small islands, as it is the young and working-age population which usually take part of migratory movements (Connell and King, 1999; McElroy et al., 1987). From the other side, these fluctuations impact the demand of basic services, such as education, health care and elderly care.

3.4 The Socio-cultural Setting

Small islands harbour distinctive socio-cultural features, such as a strong sense of community, a high level of awareness regarding island issues and a strong and unique identity and local culture. Much of these features seem to be produced and defined by the very physical containment of small islands (Hay, 2006; Stratford, 2006).

A powerful sense of community, mainly dictated by the geographic boundedness of small islands, is often felt by island peoples (Conkling, 2007; Hay, 2006). In fact, intense face-to-face relationships and social ties give rise to an island life which is extremely communal (Péron, 2004). Strong communal ties favour stability and the maintenance of islands' culture and identity.

In some cases, decision-making on an island also reflects this communal dimension, giving rise to a 'clientelistic' relationship between government and citizens, which not only reduces objective decision-making, but also carries important implications for planning in small islands (Conkling, 2007).

Despite this strong sense of community, island populations are also said to be internally fragmented by deep divisions between 'we' and 'them' which are often based on the provenance of island peoples from different parts of the island (Connell and King, 1999). From a political point of view, this internal divisions usually lead to intense political rivalry between parties, giving rise to institutional fragmentation and, as such, to a waste of social capital.

From the other side, island peoples seem to be generally well informed about the issues facing their islands (see the case of Malta in Camilleri, 2004). A combination of smallness, insularity and peripherality may incline island peoples to question the course of island development (Stratford, 2006). However, despite these high levels of awareness, islanders' voices are often excluded from the development and planning process (see the case of Barbados in Pugh and Potter, 2000). In fact, it is very common to see island governments' hold over the course of development of island territories.

Finally, small islands are usually said to harbour a distinctive identity and culture. As Billot (2005, cited in Jackson, 2008) remind us, there appears to be a «recursive dynamic between

physical boundaries and social and cultural characteristics» (p. 395, see also Clark, 2004; Hay, 2006).

However, a number of relatively recent events have brought about cultural shifts in island realms. For example, colonisation and globalisation have impelled islanders to adopt the lifestyle of the industrialized/modern world. From the other side, it have compromised the traditional practices of conservation and of resource management, which have been sustained for centuries (see the case of Yap in Perkins and Xiang, 2006).

Migration, in turn, has increasingly exposed islands and accelerated ecological, economic and social changes (Stratford, 2006). The intense movement of people, ideas and resources between home and diaspora communities usually leads to the emergence of a 'meta-culture' which embodies elements of each of it. Immigration, and particularly the replacement of islanders by wealthier people seeking a second home or retirement migrants, may also generate serious concerns about the dilution of the island culture. In the case of Corfu (Greece), for example, there's evidence that even in a context where retirement migrants live scattered in rural areas and have not tried to organize social clubs to cater for their needs, commodification of the place has still arisen (Lazardis et al., 1999).

3.5 The Institutional and Political Setting

Small islands' political realm is often characterized by a sense of powerlessness. «Isolation, together with scale, often distances islands from the political power» (Royle, 2001, p. 43) and renders them to be dependent on decisions taken elsewhere. In an European level, as Europe's organizations become more and more centralized, small islands appear to be suffering increasing disadvantage compared with populous core, as decision-making is concentrated mainly in core locations and political interests mainly benefit such core locations (Bailey, 1998).

However, despite marginality in political agendas, small islands, and particularly those which have not achieved political independence, have managed to develop a sort of political resourcefulness, which is usually used as leverage for securing budgetary and legislative benefits, developing remittance relationships and extracting other special advantages (Baldacchino, 2000, 2006b). In fact, with respect to those islands which enjoy a political regime of autonomy without sovereignty, such as colonized small islands, as well as island provinces or states which are part of larger continental states, this political regime allows them to benefit from the best of two worlds: providing many of the benefits associated with political sovereignty while delegating responsibilities to a larger political unit (Baldacchino, 2006b).

Small islands' political space is also characterized by a fragmented institutional setting. Development is regarded as a simple 'sum' of sectoral programmes (see the case of Greek Islands in Beriatos, 2007). A context of institutional fragmentation creates a number of challenges for the sustainability of small islands, as sectoral policies may prioritize different development directions.

In particular, planning policy is usually fragmented between different government departments. For example, in the case of Pacific Islands, «policy and planning takes place in a context which is fluid across space and fractured in terms of in terms of authority and accountability» (Storey, 2006, p. 2). And in the Canary Islands there appears to be any general over-arching policy for the whole region, bringing together all the different laws and regulations pertaining to land use.

3.6 Access to Services and Facilities

In small islands living conditions are usually constrained by a lack of services and facilities, as well as by its uneven distribution over the island territory.

The provision of services in small islands is obviously constrained by scale and isolation. The inability of exploiting economies of scale in the provision of services means that access to such services is very difficult and costly. In particular, small islands have inadequate health care facilities and face a lack of educational facilities. Regarding the former, even where there's a sizeable population for the provision of health care facilities, there may not be enough demand for a number of specialist services. Thus, the demand for this kind of services must be met off the island. Regarding the latter, even though a local authority may be willing to keep a primary school, even where there's not an island population with sufficient size, due to the parents' reluctance to send their children off island for educational purposes, the same is not usually true for secondary and tertiary education (Royle, 2001).

From the one side, the unbalanced spatial development that characterizes small islands means that the provision of services and facilities is usually restricted to one or two cities. Remote areas, in turn, are not usually able to meet the minimum population threshold needed to ensure the profitable operation of a service. This leads to problems of social exclusion of those peoples living in rural areas (Douglas, 1997; Storey, 2006).

3.7 The Economic Setting

As stated earlier, small islands are usually viewed as facing a number of insurmountable economic vulnerabilities. From one side, the very smallness of small islands carries a number of implications, such as a poor natural resource endowment, a small domestic market and the resulting limited capacity to produce and to consume, an inability of achieving economies of scale, an oversized public sector and a poor human resource endowment, which may be further reduced and distorted as result of the proneness of islanders to emigrate (Bertram, 1986; Hess, 1990; McElroy et al., 1987).

The existence of a water barrier, and the associated constraints of using sea or air transport for the movement of goods and people, means, in turn, that transport costs are higher in small islands than in continental destinations. These costs are aggravated by diseconomies of scale of transport provision, transport monopoly difficulties, diseconomies in loads and routings, and the asymmetric nature of on- and off-island flows (Briguglio, 1995).

From the other side, openness to international trade, coupled with the small size of domestic market, means that the resulting trade economy will not have the capacity to influence market conditions and that it will be a price-taker both in imports and exports sides. It also means that a highly competitive trading regime is forced upon small islands, wiping out uncompetitive firms, and giving rise to monopolistic of oligopolistic markets (Armstrong and Read, 2004).

The combination of these set of economic vulnerabilities gives rise to a number of additional problems. Dependency is perhaps the most serious of these problems. From the one side, island governments usually exhibit a high level of dependency on outside aid. In fact, many islands, namely those which are an offshore part of a mainland state, benefit from income transfers from the central

government; and other islands, even if part of an independent insular nation, depend for much of their revenues upon budgetary support from former or actual colonial powers (Bertram, 1986; Briguglio, 1995).

From the other side, small islands are among the countries most dependent on oil imports, given the lack of viable alternative electricity generating systems in the past, as well as the absence of indigenous commercial energy (Weisser, 2004). The danger of becoming too dependent on imported energy is that development of sustainability cannot be assured, particularly during periods of energy shortage and high energy cost. The increasing trends of energy consumption in small islands, namely in tourist-oriented islands, exacerbates small islands' dependency on energy imports, introducing additional problems.

Islands are also dependent on few economic activities. The combination of a small domestic market, openness to outside world and a limited resource endowment inevitably leads to the need for a greater degree of specialization to achieve profitable economies (Cobb, 2001; McElroy et al., 1987). These high levels of specialization are mainly due to the crowding effect of a booming sector in a resource constrained economy, which sooner or later undermines other productive activities (see the case of tourism in Royle, 2001; of the provision of offshore financial services in Cobb, 2001; or the case of economies highly dependent on the influx of high levels of remittances in Olwig, 2007). The degree and types of economic specialization are very varied: from one side, there's the case of economies heavily dependent upon external rental income, derived from the sale of licences from fishing and other resources, budgetary support grant, philatelic sales and tourism, and worker remittances (see the cases of Cook Islands, Niue, Tokelau, Tuvalu and Kiribati in Bertram, 1986); from the other side, there's the case of islands which depend on the exportation of natural resources, such as oil (see the of Shetland Islands in Butler and Nelson, 1994; of Orkney Islands in Bailey, 1998) or fish; and finally there's those economies that rely on the services sector, namely on tourism (see the cases of Malta in Chapman and Cassar, 2004; and of Balearic Islands in Royle, 2001) and financial services in an offshore context (Cobb, 2001).

3.8 The Environmental Setting

From an environmental point of view, small islands are usually believed to face a range of natural and anthropogenic vulnerabilities (Boruff and Cutter, 1997; Briguglio, 1995; London, 2004; Sanders, 1997).

Regarding the natural vulnerabilities of small islands, it is possible to state that «Simple observation dictates that biotic components of small islands are more vulnerable than their continental counterparts» (Giavelli and Rossi, 1990, p. 120). These vulnerabilities are not only related with the small size of these type of territories, which account for a limited range of resources (in particular, of freshwater resources, which in some cases may aggravated by a small islands' general limited water-retaining capacity and the scarcity of annual precipitation) and a low terrestrial biodiversity (Giavelli and Rossi, 1990; Nunn, 2004), but also with their delicate ecological balance, which may be even exacerbated by the complex nature of island ecosystems, composed of closely linked terrestrial and marine ecosystems interacting with and feeding back upon socioeconomic dynamics (Hess, 1990; McElroy et al., 1987).

The anthropogenic fragilities of small islands, in turn, are mainly a result of the relentless drive of globalization and international economic growth. Small islands are increasingly confronted with the environmental consequences of agriculture and tourism intensification, rapidly increasing human populations, increasing urbanization and changing expectations on way of life. These new trends in development are leading to impacts such as high pressure on natural resources, namely on freshwater resources, deforestation and erosion, along with pollution, degradation and depletion of island ecosystems, mainly coastal and marine habitats, and loss of biodiversity.

In particular, small islands are vulnerable to the impacts from climate change and sea-level rise, namely to inundation from sea-level rise (Deschenes and Chertow, 2004; Douglas, 2006; London, 2004). The risks are higher for small islands, in particular to low-lying islands, due to their limited capacity to mitigate and adapt to the predicted changes.

However, as Royle (2001) reminds us, «the rise in sea level does not actually have to put small islands underwater to render them inhabitable» (p. 39). In fact the prospect of accelerated sea-level rise will lead to shoreline erosion and, therefore, to the reduction of the already limited usable areas of small islands, increasing thereby the competition for scarce land. It will also lead to a substantial reduction in agricultural production and a loss of a number of natural resources, therefore reducing the few areas which sustain island economies. Perhaps more significant will be impact over the freshwater resources, in that the increased likelihood of inundation may lead to increased groundwater salinity, reducing thereby its potability (Connell and Lea, 1992).

4 Sustainable Development in Small Islands

Little is known about the meaning of sustainable development in small islands. But despite this, small islands are usually viewed as useful laboratories to test theories of sustainable development (Deschenes and Chertow, 2004; Hay, 2006; Hess, 1990). In the next sections an attempt is made to uncover the main sustainability discourses in small islands.

4.1 The Interplay between the Different Dimension of Sustainable Development in Small Islands

Development dilemmas, arising from the tensions between development paths forged on competitiveness issues and those addressing the requirements of sustainable development, are perhaps nowhere more evident than on small islands.

A first planning sustainability challenge faced by small islands is to bridge the need of environmental protection and the impetus of economic growth (Chapman and Cassar, 2004). As Deschenes and Chertow (2004) clearly point out, «Many unique problems arise where the close, fragile island environment is coupled with open, global economic systems» (p. 203). A paradigmatic example of this tension is the collapse of the Easter Island, which is usually viewed as a classic case of the human societies' dependency on their environment and of the devastating consequences of irreversibly damaging it. According to Nagarajan (2006), the pressure that an increasing population placed on the environment in the course of the island development was immense, and when the land could no longer withstand such pressure, the society collapsed.

From the other side, sustainability discourses in small islands hardly take into account the social dimension of sustainable development (Douglas, 2006). In fact, sustainable development

agendas in many islands seem to be mainly centred on environmental issues, such as coastal, marine and land-based environmental protection, as well as on damage limitation strategies. However, as argued by some authors, policy agendas centred on the promotion of an environmental-based sustainable development may not be adequate to address the challenges of social sustainability faced by small islands. For example, environmental policies aimed at regulating the usage of natural resources may exclude low-income groups in rural and coastal communities whose survival is dependent upon the short-usage of 'near to hand' resources (Douglas, 2006).

4.2 The Special Nature of Sustainable Development in Small Islands

Small islands are often regarded as special cases in development, in particular in sustainable development (Jackson, 2008). But «(...) why are (...) [small islands] (perhaps singularly) intriguing in relation to questions of sustainability (...)?» (Stratford, 2003, p. 495). A number of possible answers are presented as follows.

First, the vulnerabilities faced by small islands translate into serious implications for their ability to plan for economic growth, social development and environmental protection (Deschenes and Chertow, 2004; Douglas, 1997; Hess, 1990). For example, dependency is usually regarded as a singular impediment to sustainability. And given that islands would not survive without drawing in resources from a hinterland beyond, «speaking of sustainable development is a contradiction-in-terms» (Baldacchino, 2006b, p. 46).

Second, small islands have an already limited array of options for development, which means that they face further difficulties in planning for sustainable development. In fact, even where environmentally and economically sustainable options can be implemented, they may conflict with social expectations and local cultures (Hess, 1990).

Third, the planning horizon for sustainable development is shorter in small islands than in continental areas. While in continental areas there's still place for a wait-and-see policy, the very smallness of small islands means that the need to find solutions for sustainable development is much more immediate for insular settings (Bodin and Dufay, 2004-05; Deschenes and Chertow, 2004; Nagarajan, 2006).

Finally, traditional concepts of sustainable development are said to be inappropriate for small island territories (Bodin and Dufay, 2004-05). This leads Cambers (2006) to argue that small islands should not concentrate on the unreachable targets of sustainable development. Instead, attention should be given to the concept of 'sustainable island living', which focus on the on the 'next generation' rather than on the 'future generations' (Cambers, 2006).

4.3 Principles for a Sustainable Development in a Small Island Context

The arguments outlined above call for a new approach for sustainable development in small islands. But how can sustainable development be achieved in a small island setting?

From an environmental point of view, many authors clearly point out that environmental planning and management is a precursor to and a part of sustainable development in small islands, in particular of the resource-poor ones, given that it can help to control, reduce or minimize the occurrence of undesirable impacts in the environment. In particular, of utmost importance for small

islands is the need to implement a rational and integrated management, control and protection of water resources, and its expansion beyond those provided by nature. Furthermore, the conservation of endangered species of flora and fauna, and protection and conservation of existing sensitive areas must also be promoted.

From the other side, the interconnectedness of island ecosystems leads some authors to state that 'industrial ecology' presents small islands' with new methods for tackling their main sustainability problems (Deschenes and Chertow, 2004). The guiding principle is that of recycling and reuse. For example, the concept of 'industrial symbiosis', which considers cooperation between traditionally separate industries in close geographic proximity for the exchange of materials, water, energy and by products, promotes the efficient use of islands' scarce resources and the reduction of waste through material cycling (see the case of Puerto Rico in Deschenes and Chertow, 2004).

From an economic point of view, small islands' best response to sustainable development may lie in managing of their vulnerabilities and building resilience. This implies, among other things, increasing-self-reliance (Hess, 1990), diversifying the economic base of small islands and developing renewable, sustainable forms of energy (Douglas, 1997).

On the other hand, development in small islands must be defined in terms other than those of traditional economic growth (Hess, 1990). In particular, activities operating outside the constraints of scarce natural resources should be promoted. Examples of such activities are export-oriented light industries, some forms of agriculture, fisheries and aquaculture, or the rental of EEZs and service activities. Furthermore, due to small islands vulnerabilities, and given their shortages of tangible resources, a good part good part of the island's economy could be based on intangible assets, such as culture and knowledge, since neither depreciate nor erode over time (Medina et al., 2007).

Finally, from a socio-cultural point of view, interesting sustainability questions concern the notions of minimum and maximum thresholds of island population (Connell and King, 1999). Note that a criterion for the achievement of sustainability in small islands is that of population control, for it means a controlled pressure over the island resources and further improvements in the islands' standards of living.

From the other side, the uneven spatial distribution of population in island settings, with much of it concentrated in one or two major urban centres and the remainder scattered across rural areas, and the associated social iniquities that are created by such a development model, brings the issues of providing an equitable distribution of existence and future resources to the forefront of sustainability debates (Douglas, 1997; Hess, 1990). Information and Communication Technologies (ICT) are said to play an important role in offsetting islands' social imbalances, in that they may help them providing certain services, such as administrative services (tele-administration), health consultation services (tele-medicine) and educational services (tele-education) (Beriatos, 2007; Royle, 2001).

Achieving sustainable development also departs from the recognition that customary practices can provide the basis for a sustainable use of resources (Hess, 1990; Lowenthal, 2007). In fact, as far as planning is concerned, there's the need to be aware of island customary practices in order to effectively plan for the preservation of island peoples, their cultures and environments. An example of

preservation of customary practices comes from Bermuda, where roofs are still used as water catchments which help islanders meeting their needs for freshwater resources (Royle, 2001).

Finally, more emphasis needs to be placed on strengthening the communities (Storey, 2006). Note that different islanders have different demands, different expectations and aspirations regarding the island future, and that such demands should be taken into account when making resource management decisions, planning for tourism development, etc. (Nunn, 2004). The high levels of awareness of island peoples with regard to sustainability issues may certainly facilitate their engagement in participatory processes.

5 Discussion: The Nature of Planning Challenges in Small Islands

In the sections above it was shown that research on small islands has been subjected to diverse discourses and approached from different perspectives. We believe that these discourses and perspectives, which have been derived from the general field of island studies, provide a backdrop to understand the main planning challenges faced by small island territories. We also believe that even though some of these challenges are also shared by continental areas, they seem to be felt more remarkably in the context of a small island. A discussion of these challenges is carried out in the paragraphs below.

First, planning in small islands must deal with the constraints imposed by smallness. A small scale implies a limited range of land resources, a low natural resource endowment and shortages in human resources, which seriously constraint their development. A small scale also means that small islands are confronted with issues space limitations, which may be exacerbated by a difficult topographic setting, such as in the case of volcanic islands. Space limitations make land use conflicts more problematic in small islands than in continental areas and call for a rational approach to planning. Moreover, it is also worth noting that sea-level rise may lead to a substantial reduction of land area and a loss of other natural resources, introducing further constraints to planning in small islands.

Secondly, the imposing presence of a water barrier, together with isolation, gives rise to problems of accessibility. Note that access to small islands must be met by sea or air transport. And that, the limited transport frequencies, derived from the inexistence of a sizable population, coupled with high transport costs, seriously constrain access to small islands. From the other side, in archipelagic settings, geographic fragmentation creates additional problems of inter-island mobility. A major challenge for planning is therefore to increase the general levels of island accessibility and inter-island mobility.

Thirdly, resources in small islands are often under high pressure. Such a high pressure is a result, on the one hand, of the high levels of population density in small islands. Note that the concentration of a disproportionate high number of people in a small piece of land gives rise to an overwhelming pressure over natural resources, public facilities, infrastructures and other goods and services, which threatens the sustainability of small islands. Moreover, the existence of intense core/periphery relations, together with the increasing trends of migration from rural areas to urban areas, means that much of these pressures take place on the already over-populated core cities, many of which are located near the shore, where environmental vulnerabilities are higher. Planning

should therefore be focused on implementing a rational and integrated strategy of resource management, deeply grounded on customary practices of resource utilization and conservation. It should also address the increased urban and infrastructural pressure on the coastline and focus on the improvement of coastal zone management.

On the other hand, the limited number of development options in small islands has led many of them to engage in a number of economic activities which are highly dependent on their natural capital and that, thereafter, produce significant impacts on island environments. Tourism, which has became the most important sector of many island economies, is perhaps the most pervasive of those activities, generating a number of impacts such as increased land consumption (mainly of coastal land), changes in land uses (in agricultural lands or greenfield sites), changes in island traditional landscapes, depletion of freshwater resources, among others, which challenge the very sustainability of island territories. In particular, tourism ranks among the major causes of sprawling in small islands, calling for a policy of urban containment.

Fourthly, planning in small islands must be focused on the improvement of the living conditions of island communities. Note that the issues of scale and isolation constrain the provision of services and facilities in small islands, in addition to access to housing and employment opportunities. Moreover, islanders' intense engagement in migratory movements brings about high demographic fluctuations that are not only accountable for profound alterations in small islands' productive organization, but also for changes in the demand for services, housing and employment opportunities. ICT are seen as a potential solution to much of these problems, in that they may help small islands increase their general level of access to basic services and other opportunities.
From the other side, internal movements of migration from peripheral to central areas, as well as from rural to urban areas, may take the population levels below the minimum required to sustain a small rural community. A further challenge for planning in small islands is therefore the need to provide for the basic needs of the small communities scattered throughout the islands.

Fifthly, in many small islands, planning policy is fragmented between different government departments. An interesting case of sectoral integration of planning and development policies comes from Malta. In fact, one of the most fascinating features of the "Development Planning Act" was the creation of a Planning Authority – the Malta Environment and Planning Authority, which was aimed at integrating environmental and spatial planning policies and implementation. However, as Chapman and Cassar (2004) stress, integration of policy and actions remains a difficult task in Malta, in that the interplay of sectoral interests still gives rise to policy conflicts.

Sixthly, planning in small islands must address the high levels of economic dependency exhibited by island economies. In particular, efforts should be made to diversify the structure of such economies. For example, planning policies should encourage the development of activities operating outside the constraints of the limited range of tangible resources, such as knowledge-based activities, in close cooperation with some of the islands' traditional economic activities. Moreover, the sustainable exploitation of small islands' vast marine resources should also be promoted.

Seventhly, small islands are said to house a society with high levels of social capital, resulting from a strong sense of community and a high degree of awareness regarding the issues facing their islands. High levels of social capital may offer an advantage for planning itself, as it facilitates the

engagement of communities in the development process. However, planning process remains highly centralized in many islands, resulting in a lack of involvement of communities in decision-making process.

And finally, integration of socioeconomic development and environmental protection is perhaps one of the most important issues planning seeks to address in small island territories. However, a closer examination of many island plans shows that social and environmental issues take second place to more aggressive policies of economic development (see the case of Barbados in Bunce 2008, Pugh and Potter 2000; of Malta in Camilleri 2004, McCarthy 2004). In fact, as Nunn (2004) underlines, «Sustainable development is fine as a concept on paper but few island governments are prepared to implement potentially unpopular, even 'anti-development', policies for that reason alone. For sustainable development sometimes means stopping ordinary people from doing something to which they have become accustomed while allowing companies with considerable financial muscle to continue with programmes of often rampant environmental destruction» (317).

6 Conclusions

Two main conclusions can be drawn from this paper. On the one hand, despite the apparent lack of research on the issue of planning in a context of a small island, it is possible to state that the research carried out on the interdisciplinary field of island studies has allowed us to identify the main challenges faced by small islands, especially those of particular relevance for urban and regional planning in an insular setting.

On the other hand, the discussion carried in section 5 showed that islandness seems to influence the planning and development of small islands, leading to the assignment of different priorities in development strategies. In fact, it has been shown that some that the main planning challenges faced by small islands are strongly influenced not only by the characteristics of their insular geography and local environment, but also by their very vulnerabilities, environmental features, distinctive human geographies, and local traditions and culture of those involved in decision-making. Thus, it is our contention that the design of planning policies in an insular context must take into account the distinctive features of small islands.

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‘Hybrid city’ urban planning ‘technovation’, scenarios and governance USI for managing urban sprawl

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The paper describes the method, innovative planning-evaluation strategy (IPES) and the results of a study that evaluates the impact of sprawl -urban occupation of the Protective Zone (PZ)-, in Maracaibo’s -hybrid metropolitan archipelago- (HMA) sustainability. The IPES fills the gap of the local urban planning by assuming the principles of sustainable development-management (SDM) by means of braiding the urban planning-management process (UPP) with the Pressure-State-Response Model (PSR) and Geographical Information Technologies (GIT) -satellite images and GIS- to develop urban models, specific attributes and urban sustainable indicators (USI). The IPES (UPP+PSR+GIT) is a multilayered-relational model that works, within the PSR model, developing GIS models and grapping them with the UPP. In this model, the causes of environmental changes, Pressure are correlated with the urban-spatial scenarios, their effects State, with the diagnose synthesis and, the Response with the multilevel government and stakeholders, urban projects, actions and policies, proposed and undertaken to deal with these changes. To reach an ethical decision, a concerted vision of the future scenarios and to build an integral territorial hypothesis for the PZ-HMA, sustainability and governance -stakeholders’ participation- were the key principles of the study. The paper concludes presenting the IPES model (creative technovation), where the GIS models of vulnerability, consolidation, conformity of usage and the model synthesis, environmental and legal conformity-adequation of the urban occupation, serve as specific State Attributes; the envisioned urban-spatial scenarios constituted the Attributes of Pressure and urban governance, measured through three variables, legitimacy by performance, governability and participation, configured the Response Attributes.

Keywords: hybrid city, urban planning technovation, innovative planning-evaluation strategy (IPES), PSR model, USI

1 Introduction

Latin America and the Caribbean is the most urbanized region in the developing world (UNCHS-Habitat, 2001). In 1930 Latin America had just over 100 million inhabitants. Its population is of 519 million, with 75% or 391 million living in cities and the rural population being less than 160 million. It has an urban/rural ratio similar to that of the highly industrialized countries. It is estimated that the percentage of the population located in urban settlements will be stabilized around 81% by the year 2020 (ECLAC, 1999).The proportion of urban population is particularly high in Argentina (89.8%), the Bahamas (88.5%), Uruguay (91.3%) and Venezuela (86.9 %). Moreover, urban agglomerations of Buenos Aires, São Paulo, Rio de Janeiro, Mexico City and Lima are already among the 30 largest cities in the world.

In LA and Venezuela, together with a modern sector, connected with the world market, a marginal sector coexists that grows continuously. This double face of the LA cities (dual city) characterized as "one-two city" by Cilento (2005), highlights the existing socioeconomic inequalities and the spatial-territorial segregation, clear expression of a restricted citizenship, where (super) populated neighborhoods with important deficits of services, basic infrastructure and quality of life coexist together with more established-consolidated urban fragments (hybrid city urban genome). This ambivalent-hybrid phenomena “modernization-marginalization” and the ruptures-fragmentation

of the urban space - which we conceptualized and recognized as hybrid city - are issues that threaten the political stability and governance in the medium and long term. The main challenges of the Latinamerican and Venezuelan cities are the acknowledgment-acceptance of the hybrid condition of its urban fabric -spatial and temporal coexistence of mixed fragments with different genetic codes-, governance and sustainable urban development and management.

Many of the region's urban residents have to deal with societal shortfalls, insecurity of tenure, and inadequate access to affordable transportation, environmental degradation; high levels of violence and increasing social and spatial segregation. The main pressures on the environment and natural resources are poverty, increasing inequality of incomes, informal urbanization, urban sprawl, limited planning and management especially in urban areas and high dependence of many economies on natural resources exploitation. Therefore this reality impacts the urban environment and therefore needs to be evaluated through urban sustainable indicators (USI) to overcome its deficits.

Urban sprawl in Latinamerican and Venezuelan cities derives from uncontrolled urban expansion of the periphery, due to the absence or infringement of geographical and legal restrictions through planned and spontaneous urban occupation (hybrid urbanization). This in turn results from migration and territorial laissez faire; limited urban management capacity and sustainability culture in public, private and community institutions although they perceived and inhabit a precarious environment and frequently protest demanding services, security and houses. For Sempere (2005, is caused by illegal ways of habitat production based on low density and extensive typologies. This urban pattern generates strong pressures against which there is no institutional capacity or will to respond due to political or ideological reasons.

This dispersed-unsustainable model in Maracaibo (capital of the Zulia State, located at the western extreme of Venezuela) has led to the explosion of the city boundaries, and the occupation of the edges of the metropolitan urban corridors, which run from the city across the Protective Zone (PZ). The PZ is a green belt of 20.800 Hectares, decreed in 1989 to act as a policy-container of urban growth by defining the city west boundaries and is in the process of transformation-mutation by urban rituals in expansion. It is the territorial expression of the contemporary forms of making city which result from the practice of the visible management government (VMG) in metropolitan Maracaibo, referred by Ferrer and others (2005) as hybrid archipelago (MAM). The VMG builds city so citizens can inhabit comfortably the hybrid archipelago. In this process the VMG is legitimized by performance and through the improvement of citizen's life quality, creates confidence, social capital and citizen's empowerment, and therefore fortifies local governance. In agreement with the previous statement, the VMG desirable formula is: Government by Policies (G/P) + Good Government [Legitimacy=political marketing and capital] + Governance. For Uvalle (in Ferrer 2003) "to govern by policies" (G/P) implies to respond to civic interests and to recognize the plurality and the competitive character of the citizens demands. The VMG governs by policies, projects and actions and focuses strategically its action in "visible urban structural interventions" to improve the quality of life. For Chaqués (in Ferrer 2005), is also to give visibility to the ideas through public debate, where the degree of idea elaboration is not as important as its capacity of conviction in a context of uncertainty,

in which new solutions to social problems are sought. Following Ferrer (2005) the VMG is = G/P+ GOOD GOVERNMENT (LEGITIMACY) + GOVERNANCE.

The hybrid metropolitan archipelago Maracaibo (HMAM) is the territorial expression of the municipal division policy executed since 1995, in Maracaibo, by the Legislative Counsel of Zulia State (LCSZ) when the city was divided into two municipalities: Maracaibo and San Francisco. This fragmentation-municipalisation process has implied the transformation of "the city of Maracaibo" from an urban continuum to its division in municipality-islands where their local governments -through a visible management- seek to re-create new identities and urban images. This first fragmentation resulted in the concentration of population and activities in the Municipality of Maracaibo. To overcome these asymmetries the LCSZ proposed in 2002 the division of Maracaibo into two new municipalities, Maracaibo East and Maracaibo West. This proposal derived from the need to counteract the growth of Maracaibo - 1.4 million inhabitants and a dispersed urban territory of 15,334 hectares -, to give power to citizens, guaranteeing a "good government", to defeat the economic and social exclusion and the urban poverty of Maracaibo's western periphery (Table 1).

Table 1. New Scenario Maracaibo HMA

Municipalities-islands	Inhabitants	Territory (Hectares)	Activities
Maracaibo East	720.000	7.600	Commercial, financial, governmental administrative, residential, tourist, historic, patrimonial center, airport, port.
Maracaibo West	680.000	7. 833	Commercial, financial, administrative, tourist, residential, recreational. Commercial, financial, administrative, tourist, residential, recreational, governmental. New centralities.
San Francisco	350.000	7.567	Commercial, governmental administrative, residential, wholesale market, industrial park, residential areas, Bridge of Maracaibo.
Total	1.750.000	23.000	

Source: Ferrer et al (2005)

Maracaibo, according to the Local Urban Development Plan (LUDP 1994) registers an average density of 70 inhabitants/hectares and occupies approximate 24.970 hectares, including the areas of the Protective Zone (2.170 hectares). This area is two times larger than the Valley of Caracas and shelters approximately half of the population of Caracas (LUDP 1994). On the other hand, approximately 400 poor neighbourhoods (product of land invasions) occupy 60% of this territory. These poor neighbourhoods are located mostly in the western and northwest periphery of the city and in the Protective Zone. The PZ takes in consideration the protection and the adequate use of the natural resources, as well as the creation of recreation alternatives for the inhabitants of the city (Territorial Ordering Plan of the Protective Zone of Maracaibo 1989: 3). Likewise, they are permitted and favour agricultural uses and other compatible and complementary uses with the natural environment of the zone. Maracaibo's urban sprawl according to the Urban Development Plan (MUDP, 2005), has increased the costs of urbanization and construction; the deficit of infrastructure services (water, gas and electricity), the inequalities-asymmetries in the spatial distribution of the quality of life and access to education, health and recreation. All of which increases the precariousness and unsustainability of Maracaibo's' urban model.

The objective of the paper is to describe the method, innovative planning-evaluation strategy (IPES) and the results of a study that evaluates the impact of sprawl -urban occupation of the Protective Zone (PZ)-, in Maracaibo's -hybrid metropolitan archipelago- (HMA) sustainability.

2 Hybrid city, fragmentation-city archipelago, urban periphery

The paper theoretical frame is based in five key concepts: hybrid city, green belt-PZ, fragmentation-city archipelago and the urban periphery.

2.1 Venezuelan Hybrid City (HC)

The transformation of Venezuela from rural to urban was initiated with the petroleum exploitation in 1917, as well as a particular form of occupation of the territory that remains to the present time and whose genesis goes back to the colonial city. This city was conceived through dynamic forms of territorial occupation involving the "formal" city in grid (following the law of the Indies) and the indigenous spontaneous settlements located in the periphery. An updated version of this form of city building can be traced in the construction of "closed petroleum camps" by foreign companies (Shell, Creole, Standard Oil) in the periphery of existing Venezuelan cities, in places of petroleum production or close to them, around which immigrants, attracted by better incomes developed spontaneous settlements. This form of "city building" is the origin of the contemporary Venezuelan city where fragments of the planned city coexist with fragments of the spontaneous city (*hybrid city*).

Venezuela is essentially urban, with 26 million inhabitants, 86, 9 % live in cities and 75% of them in metropolitan areas; this reality contradicts the territorial national policy and requires urgently the implantation of integrated management formulas (Negron). For Oteiza (1996) the Venezuelan city shows that the greater builders of city are the citizens excluded economically, self-managers that are "building city" more quickly than the planners and Mayors creating the "other city" larger than the "formal" city. Maracaibo, Ciudad Ojeda and Cabimas located all in the Zulia State, centers of activity and petroleum exploitation have the record of population in poor neighborhoods (65%, 55% and 70%, respectively). To plan and to think the Venezuelan city is necessary to include the "other city", a reality for the majority of the population for which is necessary an alliance between the formal city and informal, or to formalized the informality (Salas in Oteiza 1996).

The "hybridization" appears today according to Garcia Canclini (2000) "as the concept that permits plural and open readings of mixture histories and to build consensual projects despoiled of the tendencies of solving multidimensional conflicts through policies of ethnic purification". It contributes also to identify and to explain multiple fertile alliances (governance) according to this author. The few passages-writing fragments of the history of hybridizations have placed in evidence the productivity and the innovative power of many intercultural mixtures. The study cases of Kunst-am-Bau projects (Omlin and Frei 2003) classified as *hybridization*; in this cases the hybrids are *mixtures* that manifest the possibilities of *intervention without hierarchies*; *cooperative* relations and *dialogue* between disciplines granting *equal intervention opportunities*, facilitating decision-making; loosing connectivity caused by unequal power relations, and will required the re-creation and re-interpretation of the functional-social-spatial connections. In this way, we consider that re-thinking the Venezuelan and Latin-American city as a "hybrid city" (HC), will promote its comprehension and -understanding of the permanent transmutation / crossing-border process to which we are all

submitted- and to search for *governance and a sustainable and innovative solutions* to its problems, since its perception and analysis as “one-two city”, formal and informal, planned and spontaneous, has not allow further innovative thinking.

From the previous considerations and adapting to the city what Garcia Canclini (2000) understands by hybridization a "*socio-cultural processes in which structures or discreet practices that existed in separated form are combined to generate new structures, objects and practices*"; we built the concept of "Hybrid City". The HC is the result of the sustainable governance-dialogues between different socio-political city stakeholders and the combination of different forms-urban praxis (*typological genes - genetic codes)* of “building city”. Is a multilevel interaction-communication and co-responsibility between actors and a complex mixture of territorial fragments with different *typological genes* that configure the hybrid city *urban genome* [morphological, socioeconomic, cultural, political-institutional and environmental aspects], that coexist and juxtapose in a re-defined spatial-temporal urban continuum. These different and mixed *typological genes-genetic codes* mutated-evolved -in time- creating a new, more articulate and better structured *urban genome* as the result of the implementation of sustainable re-habilitation urban policies and projects. We agreed with Nair (in Vallmitjana 2005) when he states that "any mixed city is impossible without common values… the necessary condition for a mixed city, far from the racisms and demagogies of the exclusive ownership, fortunately is and will continue to be, the universality of the human being” .

2.2. Fragmentation and City - Archipelago

According to Solà-Morales (2003: 71), we lived a time of fragmentation and dispersion where metropolitan inhabiting is a diversified inhabiting submitted to the absence more than to the presence. Terán (2001: 21), when studying the sustainability of the “compact and diffuse” city models states that the new town planning should assume the diversity, the fragmentation and “*the city as an archipelago*”; in which each fragment can have its own *genetic code*. Stefano Boeri (in Koolhaas 2000), agreeing with Terán points out that the contemporary urban territory seems a multitude of individual manoeuvres not synchronized or a *mosaic of urban fragments*, that reveal the specific social relations self-organization and of the decision making processes.

Following Gausa (in Arraiz 2001:129) Maracaibo can be conceived no longer as an island but as an *assembly of cities inside the city* (city archipelago) and, as any global assembly that develops under the direct influence of diverse factors, results in a non planned succession of events that imply new movements. Empty, large marginal areas and clandestine settlements connected with dwellings that occupy badly structured spaces raised by self construction and that, above all in the third world, arise as a result of large population growth and residential deficits that affect a 1/5 of the population. Neighbourhoods grow without planning or any infrastructural backup. In this context, where the experience of the environment only could be perceived fragmentary, through the segmented spaces which unfold everyday life or its interpretation. Terán (in Arraiz 2001) with whom we agree states that the disjunctive between compact and disperse is more of cultural models than spatial ones. The *city archipelago* is composed of islands or sum of fragments, floating elements in an inexact magma, separated many times by empty or by discontinuities, where each one of the islands can belong to different organizational codes and have different personality (Terán in Arraiz 2001). This reality is

characterized by its fragmentation in pieces, and also by the great heterogeneousness among them, where parts of the compact and diffuse city coexist.

2.3 Periphery and urban growth

The Latin-American periphery, according to Chourio (in Ferrer 2003) is a territory that in general presents a discontinue occupation relatively recent constructions and low income population with numerous deficits in terms of equipment and infrastructural services. On the other hand, the periphery is a place of socioeconomic contradictions, almost incomprehensible space (absent) for the urban policy. In many Venezuelan cities the process of urban development supposes an uncontrolled expansion where the periphery is an option, formal and/or informal, to establish settlements and productive activities. The assumption of this urban growth as a negative factor, in the social and aesthetic sphere, is for Pavia (in Ferrer et al 2005) the most evident example of the fears that invaded the development of the urban discipline. This fear has impeded the analysis of the character of the periphery and the acceptance of its presence as a new and emerging metropolitan condition. Its illegality marks the present weakness of town planning, therefore is rejected to avoid any confrontation or contamination. The refusal to recognize these new parts of the city as an object of reflection conditions the search of its "symbolic utility". The absence of recognition of the different parts of the new periphery reduces the expansion of the city to a development without quality, values and identity.

Following Pavia and Nadal, the Protective Zone of Maracaibo -PZ-, is an edge or border, a space of transition and the third periphery of Maracaibo. In this Study is analyzed, understand and accepted in its precarious appearance; where illegal urban settlements coexist, mixed and confused with the legal ones (Hybrid city) in developments without form or quality. This new and complex reality eludes completely the approach of the traditional town planning. The acceptance of the hybrid city configuration as a characteristic of the Latinamerican and Venezuelan cities, the expansion of the city, the search for urban individuality, the demand to relate development with the participation of stakeholders and raising consciousness from local communities, are elements to incorporate in our theories and present urban management practices. According to Purini (in Pavia 2004), the metropolitan peripheries and the territories urbanized extensively, with its deterioration, its ruins, its loss of quality and meaning, its absence of order and visible centrality, represent today the dominant urban theme. Therefore the periphery is identified with all "existing city".

Maracaibo's Periphery

In the eighties Maracaibo initiated a process of periferization and thereby increasing exponentially the areas of irregular habitat that are a dominant pattern -*genetic code*- of occupation and urban expansion of the city. In 1985, poor neighbourhoods occupied 41% of Maracaibo's territory, ten years later 60% of its territory was occupied by 400 poor neighbourhoods. The second periphery is adjacent to PZ and has with similar characteristics according to Barroso and Mustieles (in Ferrer 2003). Is an urban collage of fragments with different characteristics considering the following aspects: presence of services, employment, density, family income and mobility, related to public or private transportation. The residential occupation of the PZ configures the third periphery of

Maracaibo. The complexity of this periphery derives from its heterogeneousness, diversity and fragmentation and therefore is convenient according to these authors, to formulate different intervention strategies and coordination of initiatives, to obtain positive results in the quality of life and welfare of the citizens (Figure 1).

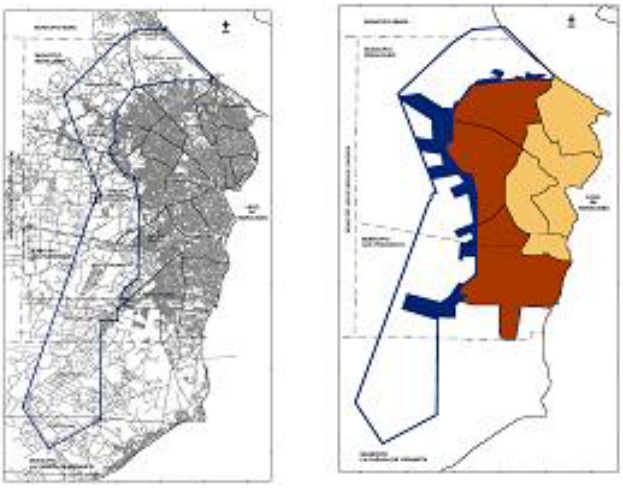


Figure 1. PZ and the 3 peripheries of Maraicaibo (Source: Arquiluz, IFAD, Marn, 2005)

3 Urban planning technovation: innovative planning-evaluation strategy (IPES)

To overcome the absence of territorial and socio-economic information and fulfil the objectives of the Study, an innovative planning-evaluation strategy (IPES) was designed and developed. The IPES fills the gap of the local urban planning by assuming the principles of sustainable development-management (SDM) by means of *braiding the urban planning process (UPP) with the Pressure-State-Response Model (PSR)* with the support of *Geographical Information Technologies* (GIT) -satellite images and GIS- to develop urban models, specific attributes and urban sustainable indicators (USI). The IPES (UPP+PSR+GIT) is a multilayered-relational model that works within the PSR model with the GIS models developed and grapping them with the UPP.

In this model, the causes of environmental changes, Pressure are correlated with the urban-spatial scenarios, their effects State with the diagnose synthesis and, the Response with the multilevel government and stakeholders, urban projects, actions and policies, proposed and undertaken to deal with these changes. To reach an ethical decision, a concerted vision of the future scenarios and to build an integral territorial hypothesis for the PZ-HMA, sustainability and governance -stakeholders' participation- were the key principles of the study. The method was structured in five phases: Phase 1: Elaboration of the Base Map from satellite images. Phase 2: Territorial Diagnosis and GIS models formulation and management. Phase 3: Model Synthesis of Occupation of the PZ. Phase 4: Formulation of alternative Spatial Scenarios and scenario pre-selection and Phase 5: Post-prospective, evaluation of scenarios with the Commission of the PZ and the Ministry of the Environment (MARN). Urban sustainability and the participation of stakeholders constituted the principles of the study for the purposes of reaching an ethical decision and envisioning in a concerted

way, different scenarios and an integral territorial hypothesis for the PZ and the HMAM urban complexity.

3.1 IPES: BRADING Urban Planning & Management with the PSR MODEL

Sustainable development is for Gonzalez and De Lazaro (2005), a philosophy with political, economic and scientific dimensions and sustainability a shared responsibility that requires a progressive learning and a change in the behaviour inertia so that all the citizens participate in its adequate management. Among the initiatives to achieve urban sustainability, according to these authors are: controlling the urban expansion, the recovery of the city, the sustainable management of resources and residues, the protection of the cultural-natural patrimony, the improvement of the accessibility, transport efficiency, within an integrated approach and participation of the stakeholders.

On the other hand, the Pressure-State-Response model (PSR) is a widely accepted framework for the compilation of sustainability performance indicators and has been adopted by the OECD and referred to by the World Bank (WB). The model links the causes of environmental changes (Pressure) to their effects (State) and finally to the projects, actions and policies (Response) designed and undertaken to tackle these changes. Indicators should tell us in what field the city - according to its specific goals- is doing better than in others and if the city is becoming more sustainable. The passage from thematic indicators to a sustainability policy performance for cities is a complex task. In this case of study the PSR model is applied because it includes three key elements: 1. *Focus on local sustainability*, which implies the need of integral indicators, each one combining diverse dimension that reflects different aspects of the city. 2. *Linkage with the political process*, helping the local authorities to follow and evaluate the results of the policy and, 3. *A bottom up approach*, in which the local government assumes an active role in the definition and acceptance of the indicators assuring in this way the acceptance of the end users.

3.2.1 Correlating USI of State with PZ Diagnosis Synthesis

The Model of Environmental and Legal Occupation is the territorial expression of the diagnosis synthesis and results from the superimposition (multilayered) of three Models: Physical-Geographical Vulnerability, Consolidation of the Occupation and Conformity of Usage. These three models are assumed as State attributes in the framework of the PSR. The Model of Consolidation integrates two state attributes: structure of the urban occupation and habitability (Figure 2).

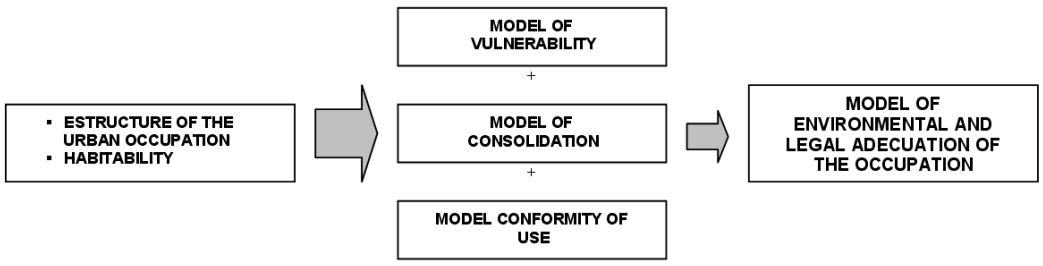


Figure 2. Diagnosis Synthesis (Source: Arquiluz, IFAD, MARN, 2005)

2.2.2. CO-Relation USI of Pressure – PZ Scenarios

The definition of the scenarios results from the combination of the existing pattern of urban occupation (Model of Consolidation) and the Model Vulnerability (Figure 3).

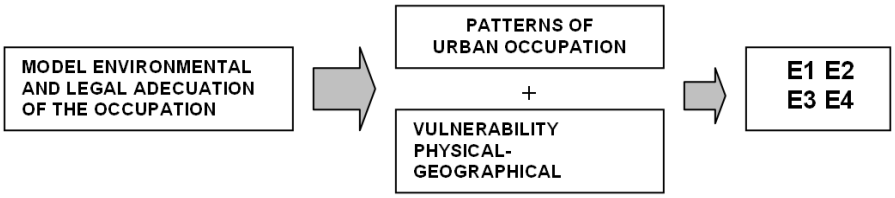


Figure 3. Spatial Organization-Scenarios of PZ (Source: Arquiluz, IFAD, MARN, 2005)

To formulate and evaluate the scenarios two levels of analysis were considered: the expanded and the immediate context of PZ (Figure 4).

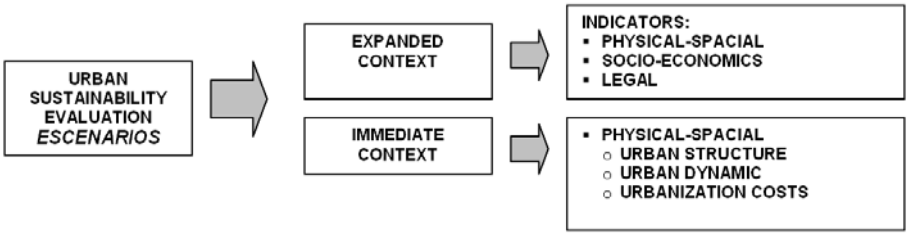


Figure 4. USI of Pressure - Scenarios Evaluation (Source: Arquiluz, IFAD, MARN, 2005)

4 Explanatory framework: IPES = UPP+PSR+GIT

4.1 Diagnosis synthesis

The Territorial Diagnosis is synthesized in three Models: Physical-Geographical Vulnerability, Consolidation of the Occupation and Conformity of Use (Figure 4).

4.2 Spatial scenarios of the PZ = attributes and USI of pressure

The sustainable evaluation of the PZ allows identifying the tendencies of occupation of the territory (USI of pressure) and the different expansion alternatives of Maracaibo. These options are presented as scenarios of territorial occupation and policies for managing urban sprawl. They include different actions seeking to diminish the impact of the process. These corridors cross the Protective Zone (ZP) from Maracaibo in northwest, east-west or east-southwest direction, agglutinating in more or less continuous form residential developments predominantly. The scenarios formulation considered the Model of Physical-Geographical Vulnerability and the Model Synthesis of Legal and Environmental Occupation. With this vision that combines the pattern of existing occupation, the physical-geographical restrictions and the legal and environmental occupation, the following four scenarios were identified (Table 2):

E1: Incorporation of occupied areas.

E2: Corridors of tendencies expansion.

E3: Regularization of the urban continuum.

E4: Incorporation of PZ as area of urban expansion with regularization of usages (Table 2).

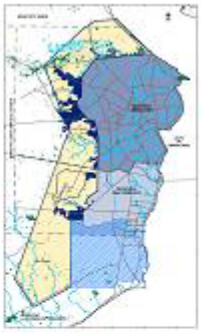
Figure 5. Models of vulnerability, consolidation, conformity of usage (Source: Ferrer, 2006)

Figure 6. Model synthesis – environmental and legal adequation of the occupation (Source: Ferrer, 2005)

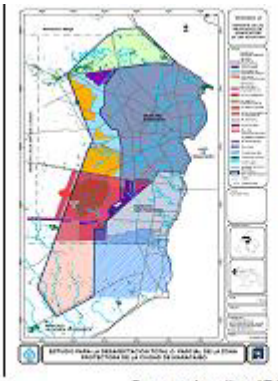
4.3. Scenario's Evaluation

The matrix developed for the evaluation of the scenarios is a simple matrix of cause-effect. The interactive matrix used in this case shows the legal, socioeconomic, and physical-spatial factors along an axis of the matrix and the characteristics of the spatial organization on the territory (Scenarios) in the other axis (Table 3).

Table 2. PZ Spatial Scenarios

SCENARIO	OCCUPATION OF THE TERRITORY OF ZP	SCENARIO	OCCUPATION OF THE TERRITORY PZ
E1 INCORPORATION OF OCCUPIED AREAS Recognizes the existing occupation and incorporates the compatible consolidated uses		**E2: CORRIDORS OF TENDENCIAL EXPANSION.** Normalizes the tendencies of growth that are produced along metropolitan corridors. The areas among the corridors maintain the legislation of PZ.	
E3: REGULARIZATION OF THE URBAN CONTINUUM. Reaffirms the urban use of the corridors of expansion proposed in the E2 and includes an adaptation of the uses of the zones between corridors.		**E4: INCORPORATION OF PZ AS AREA OF URBAN EXPANSION WITH REGULARIZATION OF USAGES.**	

Source: Arquiluz, IFAD, MARN (2005)

E 4A **Occupation of PZ proposed by the municipalities of Maracaibo and San Francisco**		**E4A:** assumes the zoning proposals of the municipalities. The tendency/pressure is towards the extensive occupation of the territory of PZ pertaining to the Municipality of Maracaibo. Officials of the OMPU are applying pressure to achieve total des-affectation.

Source: Arquiluz, IFAD, MARN (2005)

Table 3. Scenarios Evaluation

SCENARIOS INDICATORS OF PRESSURE	E1	E2	E3	E4
BROAD CONTEXT (HMAM)				
Physical –Spatial Aspects				
Socio-Economic Aspects				
INMEDIATE CONTEXT (PZ)				
Physical –Spatial Aspects				
Socio-Economic Aspects				
Legal Aspects				
TOTAL	**-5**	**-12**	**- 33**	**- 53**

Source: Giusti, R. and Ferrer, M. - IFAD/LUZ (2005).

5 Synthesis = IPES (UPP+PSR+GIT)

From the research carried out USI were selected to measure the tendency of the attributes assume from the characteristic of the PZ-HMAM. The attributes proposed are the following:

1. Attributes of State: consider the physical-geographical vulnerability, the structure of the urban occupation, the habitability-consolidation of neighbourhoods and the conformity of the occupation.
2. Attributes of Pressure: consider the pressure of urbanization, habilitation, legalization of poor neighbourhoods and urban transportation.
3. Attributes of Response: consider urban governance, measured through three variables, legitimacy by performance, governability and participation.

The attributes of Response are related to the objectives and policies of the local governments (VMG). They are designed to overcome urban poverty by means of two actions following the National Counsel of Housing policies and praxis (CONAVI 2002), the incorporation of the poor neighbourhoods to the urban structure of the city and the endorsement of the quality of life in the spontaneous neighbourhoods. This **R**esponse or political-answer implies the endowment of services (aqueduct, sewers, electricity, gas and telephone) and the access to employment and to education, health and recreational services, the integration to the urban structure and the improvement of the transport. It also includes actions to legalize the urban occupation (ownership of the land) and the consolidation of the neighborhoods (Table 4).

Table 4. Attributes and USI for the VMG-HMAM (Source: Ferrer, 2005, 2006)

	ATTRIBUTES		USI
	Level 1	**Level 2**	**ASPECTS TO CONSIDER**
VMG-MAM **Good Government** **GOVERNANCE**	**BUILDING CITY** **Share Management**	**- Beating the physical-geographical vulnerability.** **-Urban structure:** toward a more compact city, policentric, and competitive city **- Urban Habilitation:** Integration of poor neighbourhoods to the city; life quality improvement. **- Legal Conformity Urban Occupation**	**Habilitation and integration of poor barrios:** - Access to the periphery, integration of the east and west of Maracaibo with San Francisco. - New centralities in the west and north of the city (employment) and public spaces **Improvement of the natural & built environment:** - Recreational green belts in the north and west - Transport: extension of Maracaibo's Metro - Energy Savings: execution of norms. - Control of the urban limit, density in crease in the periphery and control of invasions.
	LEGITIMACY **By results**	**- Quality of life:** fair distribution of better living conditions **- Social well being - Economic growth** **- Urban Productivity**	- Decrease of the asymmetries in the endowment of infrastructures and services. - Decrease of the deficit of dwelling. - Noise ordinances design - Urban Security: decrease of criminal indices - Efficient-fair distribution of local finances
	GOVERNABILITY	**Opportune & efficient answer to citizen's needs** **Shared vision of the future of the city**	- Management Transparency - Surrender of accounts. - Services of transportation, highway administration and waste disposal jointly with San Francisco. - Urban Management for MAM. - Management Plan of the MAM - Promotion of the local identities and patrimony
	PARTICIPATION	**Empowerment** **Social Capital** **New urban culture**	- Promotion of citizenship - Participation in decision making and local finances - Creation of social capital and cohesion - Assumption of urban sustainability principles (21 Agenda)

Table 5. USI selected for the VMG-HMAM, PSR Model (Source: Ferrer, 2006)

Model PSR	ATTRIBUTES		QUALITY OF LIFE
	Level 1	Level 2	
STATE	CITY BUILDING	Urban Structure	- **Quality of the urban space**: zones consolidated / zones not consolidate. - **Accessibility**: to main services, employment - **Urban Equity**: spatial distribution of services, infrastructures, public-green space.
		Habitabity	- **Urban poverty**: consolidation of poor barrios and quality of life homologation. - **Quality** of the materials employed, state of conservation and distribution of dwellings - **Urban Security**: Homicides, abductions, robberies and traffic accidents reduction
PRE SSURE	CITY FUTURE BUILDING	Urban Transport	- **Urban Motorized Transportation**: noise, air quality, building conservation, energy consumption. - **Public Transport**: New routes - **Mobility**: traffic tendencies.
		Urbanization Pressure	- **Urban Growth:** urban expansion - Density of population. - **Extension of the city**: spatial segregation by the decrease of the accessibility. - **Floor built by inhabitant**.

Table 6. PZ-MAM PSR Model (Source: Ferrer, 2006)

Model PSR	ATTRIBUTES	QUALITY OF LIFE (GIS Variables)	USI
STATE City Building	Vulnerability (model)	- Vegetation - Water courses and topography	**E1**. Hect. grade concentration. **E2**. Hect. occupied courses of water
	Urban Structure (model)	- **Quality of the urban space**: zones consolidated / zones not consolidate. - **Accessibility**: to main services, employment - **Urban Equity**: spatial distribution of services, infrastructures, public- green space.	**E3**. Inhabitants /Hectares **E4**. Hect. consolidate and not **E5**. Km. To public services **E6**. Hect. / Inh. Served and not served by infrastructures
PRE SSURE City Future Building	Habitability (consolidation model)	- **Urban poverty**: consolidation of poor barrios and quality of life homologation. - **Quality** of the materials employed, state of conservation and distribution of dwellings - **Urban Security**: risk areas occupation, Homicides, abductions, robberies and traffic accidents reduction	**E7**. Number of barrios consolidated **E7**. Housing deficit by type. **E8**. Hect. of invasion (Inh/Hec) **E9**. No. dwelling improved. **E10**.Number of homicides, robberies and traffic accidents
	Urban Transportation	- **Urban Motorized Transportation**: noise, air quality, building conservation, energy consumption. - **Public Transport**: New routes - **Mobility**: traffic tendencies.	**P1**. Cars/inhabitant and zone. **P2**. Level of noise / zone. **P3**. Age & quality of the fleet **P4**. No. of routes.
	Urbanization Pressure	- **Urban Growth:** urban expansion - **Density** of population. - **Extension of the city**: spatial segregation by the decrease of the accessibility. - **Floor built by inhabitant**.	**P5**. Density. **P6**. Hect. OF illegal occupation of the Protective Zone. **P7**. Hect per barrios outside the city boundaries (expansion).
RESPONSE / GOVERNANCE	LEGITIMACY by results/response	Urban Planning and Management Measures	**R1**. LA21 Implementation **R2**. # of new owners, land legalization **R3**. # of new urban centralities. **R4**. Hectares of new recreational areas in the periphery **R5**. Control urban boundaries and expansion. **R6**. Promotion of high densities in the periphery.
		Measures for traffic mitigation and accessibility to work, recreational - public-green spaces Measures for contamination reduction	**R7**. Km. new urban transport routes and Metro **R8**. Km from new centres to the urban periphery **R9**. Km & M2 / Inhabit. of public and green spaces. **R10**. Expenses of the municipality in protection of the quality of the air and reduction of noise. **R11**. noise ordinances application. **R12**. Vehicle control
		Measures of environmental education Measures for energy savings	**R13**. Expenses of the municipality in environmental education (IMA) **R14**. Campaigns for environmental consciousness. **R15**. Number of energy savings permits applied.
	GOBERNABITY PARTICIPATION	- Opportune - efficient answer to the needs of the citizens - Shared vision of the city - Citizens empowerment - Social Capital - New urban culture	**R16**. Transparency = surrender of accounts. **R16**. Promotion of local identity. **R18**. Citizenship promotion and formation. **R18**. PNLC and Participatory Budgets application. **R19**. Number of civil societies participating in local management. **R20**. Mancomunity of Maracaibo-San Francisco. **R21**. MAM Management Plan.

6 Conclusions: evaluation of scenarios and posprospective

6.1 Scenarios evaluation conclusions

In relation with the PZ occupation tendency, the research shows that only the12, 24% of the territory of the PZ is occupied by residential developments contrary to the thesis of different municipal actors. 38 % of the residents are located in Maracaibo's Municipality. 21% of this area has medium consolidation, 50, 42% medium-low and 17, 6% low consolidation. On the other hand the scenarios evaluation matrix shows that the impacts of any considered SCENARIO in the sustainability of the HMAM are always negative. In conclusion, the PZ occupation reinforces the unsustainability of the PZ-HMAM- first, because is contrary to the existing regulations established in the Urban Ordering Local development Plan and the Decree of the Protective Zone. Secondly, the new demands of services and equipment of the residential usages in the PZ will accentuate the existing deficits and the low quality of life and the precariousness of Maracaibo's.

Nevertheless the social and human situation in PZ requires normalizing the existing occupations. The regularization in itself does not contribute to organize the territory, but its acceptance involves a series of actions that could modify the occupation to and structured urban expansion. Considering the above statements the Scenario 2 appears the most favourable because it adjusts and controls the existing occupations, creating a vision of the city in which organized penetrations toward the periphery are produced maintaining intermediate areas of protection that function as green belt (PZ).

The urban praxis of the VMG braids "building city" with urban and political marketing, the symbolic economy supported in the intensive usage of the New Information and Communication Technologies (ICTs). The ICTs helps to communicate - trade and "*make visible*" the process of urban building (management praxis) the future vision of the city and according to Chaqués "the ideas". In this way, through *visible management* the Mayor generates *accountability, transparency, and confidence-trust, legitimacy by results, political capital and consequently local governance* (VMG governance model and UGI). For Vallès (in Ferrer 2003) the initiatives of the political actors seek a result through the execution of policies and their effects impact local governability.

The VMG-HMAM governance model considers initially four attributes. *Building city* includes: physical-geographical vulnerability, urban structure, habitability and the legality of the territorial occupation. *Legitimacy* measured through quality of life, social well being and urban productivity. *Governability* considered opportune and efficient answer to citizen's needs and shared vision of the future of the city. *Participation* includes citizens' empowerment; development of social capital; a new urban culture and citizenship building. To overcome the *urbanization of poverty* (urban poverty) and within the attributes considered for the selection of UGI, two key actions arise, the integration of the poor "barrios" to the city and the residents' life quality improvement. This policy implies a fair distribution of living conditions (equity) through the endowment of infrastructures and services in the periphery and citizens participation in the process of policy making.

- Posprospective

This final phase of the Study contemplated the presentation and viabilization of the Diagnosis Synthesis and the Scenarios with the PZ Commission (PZC). To achieve this objective a workshop was planned with the purpose of facilitate the PZC to choose a Scenario -*as policy for managing Maracaibo's urban sprawl*- in a concerted way. Due to the absence of some important stakeholders a debate was carried out instead of the workshop to reach the previous stated objectives. Nevertheless some agreements were reached concerning the areas of the PZ that had to be preserved; the importance of managing and controlling urban sprawl and the informal urbanization and the need to formulate actions to overcome urgently the services deficits in the HMAM. Subsequently a second meting was held with the PZC with the same purpose and the Commission selected the E3 scenario although the MARN (Caracas) agreed with the results of the study.

In this context, Maracaibo's Municipality is making great pressure to achieve the total des-affectation of PZ, under the false premise that having governability over this territory will facilitate the control of the informal sprawl. This statement doesn't consider the incapacity of the municipality to manage and control the spontaneous invasions within the urban area of Maracaibo and the impact of the occupation of the PZ in the quality of life of Maracaibo, which as mention before is already precarious and unsustainable. It is a paradoxical situation. The Urban Development Plan of Maracaibo (PDUM, 2005), made by the Municipal Office of Urban Planning -OMPU- which included the future vision of the city, was approved by the Municipal Council (the municipal legislative body) in January of 2005. A year later, the OMPU due social and political-ideological pressures is trying to modify it. Till today a final decision has not been reached and the debate has not transcended the communities. This situation demonstrates the validity of the thesis of the research. The existence of territorial laissez faire for political and ideological reasons; the inexistence of sustainability culture in the municipalities, other levels of government and private developers and the relation between the VMG forms of building city, the increasing informal occupation of the PZ and the precariousness of Maracaibo's habitat. In this context, Maracaibo tends to configure an archipelago, assembly of municipalities-islands or "*metápolis*" according to Gausa (2001) fragmented, disarticulated and dispersed, where specialized and consolidated areas coexist with excluded and disconnected areas. The expansion of the city has resulted in the illegal and legal -hybrid occupation of the PZ-. The incorporation of the PZ as urban land will duplicate the urban area of the MAM -43.800 hectares- diminishing the density to 41% inhabitants and increasing Maracaibo's unsuitability and precariousness.

According to the results of the Study and the evaluation carried out it is clear that it is necessary an important effort to overcome the PZ-HMAM deficits of sustainability. However a hybrid sustainable urban landscape can be achieved if the VMG is transformed into an intelligent and innovative government VMGI + I and through the application in the HMAM of a joint sustainable urban management. The VMGI+i will be capable of mobilizing the participation of the three levels of government and urban actors to formulate a shared project for the city -Maracaibo-; promote through a creative leadership, partnerships with the enterprising and innovative agents of Venezuela, and transform the HMAM in a sustainable "*Mancommunity*" of cities and citizens.

We agree with Mega and Pedersen (1998) when stating that building Eutopia (Doxiadis) depends in the art of co-governing cities by and with the help of all actors. In this context and according to these authors, institutional innovations and indicators are needed to provide fertile ground for socio-economic improvements and creativity. As pointed before, all actors have a major role to play in this process. It involves establishing a sense of urgency, developing a vision and strategy, communicating the vision of change and proposing new measures for evaluating progress. The VMG must precede empowering people for broad-based action, generating short-term wins, consolidating gains, producing more change and anchoring new changes in culture. According to Mega and Pedersen, cities need paradigm shifts towards a new economic, political and socio-environmental equilibrium.

Building the city of the 21st century in Venezuela is to have a PROJECT OF CITY AND CITIZENSHIP assumed as "instrument of democratic governance". To achieve this objective is necessary a new local leadership and a new political praxis -VMGI+i- that shares the power with the citizens promoting inclusive and sustainable urban policies, that viabilized the enjoyment of the urban and citizens rights for all.

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Large Scale Project: The need for metropolitan articulation[33]

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The paper addresses the urban transformation of Lisbon understood from its open space morphology (1911-2008) as it progressed in time and space. A close examination of the urban formation of Lisbon, in an attempt to understand its open spaces as potential planning and project instruments, unveils the prominent position of its public spaces, not just from an aesthetics and social perspective, but also from the viewpoint of the infrastructure of the city itself and of its future development. The research presents a multilevel approach, ranging from metropolitan to very specific local levels in the Chelas Valley. This topic regarding urban morphology is included in a set of preliminary findings of the research titled "Designing absence. The unoccupied space as morphological and urban project fundament in the metropolitan formation of Lisbon", developed in the Faculty of Architecture – TU Lisbon and in the ETSAB- UPC-Barcelona with the FCT – Fundação para a Ciência e a Tecnologia support.

Keywords: Lisbon, Chelas, metropolitan morphogenesis, metropolitan planning, large scale project.

1 Shaping the city

The Tagus Estuary is a metropolitan central open space that is a catalyst for essential situations that impact on creating the city, morphologically, economically, culturally, and socially. A close examination of the urban formation of Lisbon, in an attempt to understand its open spaces as potential planning and project instruments, unveils the prominent position of its public spaces, not just from an aesthetic and social perspective, but also from the viewpoint of the infrastructure of the city itself and of its future development.

In the context of its own physiography, the urban growth of Lisbon was shaped from opportunities created by the Tagus Estuary, namely the deepest trenches, which determined a marked growth of the area around the harbour. In a stratified manner, the urban formation of the city can be understood as a superposition of complementary layers:

a) Main axis forming a harbour and river waterfront, crossed by a spinal column expanding to the north;

b) An external ring characterised by a rural mosaic in transformation, between the expansion of the sedimented city and its successive administrative borders.

2 A methodological approach

Given metropolitan Lisbon's current urbanistic scenario, a concept for the urban project whose main instrument in characterising identity and structuring growth is the unoccupied space is seen as relevant. This also acts as the agent that articulates the territorial and urban scales. As part of ongoing research (ETSAB-UPC, Barcelona/ FA-UTL, Lisbon), important premises have been defined: a. the potential of unoccupied spaces as instruments for urban control; b. case studies which reveal a certain degree of future impact or an emerging transformation. Specifically, natural and urban areas that are still unoccupied but which will house major infrastructures in the near future were selected:

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the New International Airport of Lisbon, the high speed train, and a new local skeleton network formed by a metropolitan tramway.

The present research stemmed from the need to systematise and further examine a vast number of overarching questions about the morphogenesis of metropolitan Lisbon, and about the forms of territorial intervention which have conditioned and determined its present state of development.

The first part of the research focused entirely on the morphogenic interpretation of metropolitan Lisbon (Morgado, 2005). It was organised in five consecutive periods (1860, 1940, 1965, 1992 and 2001), through the morphological identification of non-occupied spaces in accordance with the same matrix – water, land and artificial creation – and with a thematic cartographic production (scales 1:100000 and 1:25000).

From the late 19th century to the mid-20th century, the spatial configuration created by the infrastructures – railways, national roads, docklands and harbours – inducted significant dynamics in the still incipient metropolitan area of Lisbon. The opportunities created by the development of a system of infrastructures promoted an intensive use of the territory and originated a pre-metropolitan configuration. As a result a productivist land use model and a new urban conceptualization, with metropolitan value, started to be developed.

The cartography of 1965 shows a radial structure converging into Lisbon and the Tagus Estuary, reinforcing its current status as metropolitan centre, national centre and European centrality. Regarding land use, large specialised areas emerged, namely industrial, dependent on a direct link to Lisbon and, especially, on the Port of Lisbon infrastructural ring around the Tagus Estuary.

In the 1990s, a consistent metropolitan structure gains shape combined with the renewing of land use opportunities. Democracy in 1974 and the entry of Portugal into the European Union in 1986 opened new political and economic perspectives. Changes in the productive system promoted the obsolescence of industrial and dock areas in central places, the emergence of new forms of centrality, correlated with a knowledge-based economy, integrated in a highway network.

In the Lisbon Metropolitan Area – a metropolitan association of municipalities institutionalised in 1991 – a polycentric system of alternative urban centre begins to develop, supported and integrated by an increasingly dense transport and road network system.

Thus, the radial structure developed into a network system of motorways, creating opportunities for new growth areas along the main axis built by the train in previous periods. As a result, functional complementarities start to develop, between urban centres and the metropolitan centre – Lisbon and the Tagus Estuary. As a consequence, new land uses and functions, previously located in the traditional urban centres, emerged in high connectivity areas and external rings, together with new dense and specialised uses, such as shopping centres and malls. Under high mobility patterns, dimmer urban tissues gained central functions, competing with Lisbon, and shaping a polycentric metropolitan network.

As the 20th century ends, European metropolises reach an advanced development stage, both in terms of achieving high levels of spatial and functional articulation between centres and promoting innovative uses in their territories. Therefore, from 2001 onwards, Lisbon metropolis gains and consolidates its shape, influence and role in the conurbation of Lisbon-Galicia, along the Atlantic

coast. This new reality points towards even more complex transformations, to include several concatenated metropolitan formations. This increasing and extensive urban growth, together with the integration into higher network systems, determines a drastic decrease of continually unoccupied space. At the same time, a landscape homogenisation gains shape contributing to undifferentiated territories with poor urban references.

Further research introduced new questions which, based on a morphogenetic reading of the pre-established metropolitan scale, led to various case studies on a scale which allowed the constitution of an urban morphology interpretation according to identical criteria, but now adapted to a more circumscribed scale.

In this context, the city of Lisbon, one of the case studies in progress, plays a key role, and a study of its urban formation has already been conducted using new sources (cartography, urbanism and planning).

Research is being conducted on specific areas of Lisbon, namely the Valley of Chelas, in the heart of Lisbon, which will be further examined so that its potential as an urban project can be evaluated.

3 Morphogenesis of the City

This interpretation of the urban formation of Lisbon aims to understand the way the city has been shaped. The work resorted to the formulation of its own interpretative guide, which identified morphologies as they progressed in time and space.

The present research allowed the identification of the following: 1. The processes of transformation of rustic structures into urban ones; 2. The nature of their own transformation; 3. The persistence of pre-existing structures and how they were assimilated by new ones; 4. Their importance in the formation of tissues; and finally, 5. It allowed us to identify distinct morphologies, stressing the morphogenesis of the city from the morphological characteristics of open spaces.

Open space and its different structures can provide a lot of the answers to our understanding of the urban formation of Lisbon, for which reason they lie at the root of our explanation for the formation of their morphology, taking into account the following key aspects:

a. Topography and hydrography: by highlighting the relationship between watercourses and parallel lines and the development of the main infrastructured lines, the configuration of open spaces and of tissues (enclosed monastery areas, parks and gardens, rustic matrices), the importance of the morphology of the land (valleys, hills) and of water (the various coastal lines and the influence of the Tagus in the formation of the city);

b. The transformation matrices: urban and rural plot division of land and different forms of parcels in accordance with the topography, forms of aggregation (namely, of the built space in its relationship with urban fabric and land uses, including – blocks of buildings and other urban units, disperse building); public space layouts (including urban types such as plazas, street boulevards and gardens, as well as other types of open spaces and their correlation with major urban elements and outstanding buildings).

This interpretation goes hand in hand with a reflection on the relationship between the morphologies identified in each period in time (1903-37; 1937-49; 1949-71; 1971-87; 1987-2008, in

progress), urban planning models and the city and architecture theoretical and cultural references, in their various movements, specifically:

a. Rustic pre-existing structures and the form in which they were integrated into the urbanisation process, particularly in the pre-industrial period.

b. Industrialisation and the expansion of the city in the 19th century – the formation of a green belt, circumscribed by two ring roads which set the administrative boundaries of Lisbon, in distinct periods of time, the last one dating from the end of the 19th century;

c. The shaping of the modern city – modernist disjunction, formation of zoning areas and of specialised areas located predominantly in this green belt and whose somehow disperse urbanization results in a landscape of rustic origins which are becoming obsolete, Post-modern period and obsolescence of industrial and rustic uses, abandonment and transformation of central spaces and the search for new programmes for the city;

d. Post-industrialisation and new approaches to collective space; urban projects through public space, the urban and environmental regeneration, miscegenation of uses and technological innovation.

Two axis and a belt

As observed the Tagus Estuary was the major driver for the urban development of the Lisbon metropolitan area, with regard to the location of the various urban settings on its left and right banks and, particularly in the case of the latter, by fostering the creation of an urban formation which shaped the modern configuration of the city of Lisbon.

Therefore, in addition to the interpretative model for creating the metropolitan structure, this work proposed the study of a specific situation arguing that the unoccupied space should be the basis for the articulation between metropolitan planning and the urban project.

The development of new forms of intervention in the city from the middle of the 19th century allowed for the possibility of planned innovation in the city of Lisbon, generally resorting to very interesting urban plans. The several varied urban plans for the city, particularly the plan for expansion to the north and improvements to the harbour (Ressano Garcia, up to 1903), which made clear references to Haussmann's interventions in Paris, allowed an initial qualification of the urban space by including new typologies for public spaces that complemented existing squares and plazas (development of an axis of great architectonic interest between Terreiro do Paço, which limits the city from the Tagus Estuary, through the Old Town – *Baixa Pombalina* - reconstructed by the Marquis of Pombal up to the north, including the new boulevards in *Avenidas Novas* - New Avenues).

At the same time as it attempted to bestow the city with new, more cosmopolitan urban areas, appropriate to a European city, Ressano Garcia widened the area around the port, giving origin to new artificialised areas in the margins of the city which were vital to a major port city and which nowadays constitute privileged ground for urban intervention from the viewpoint of the qualification of public space and urban regeneration.

Nowadays, the Tagus Estuary, which has a major harbour infrastructure appropriate to a city which was, in the past, the capital of an overseas empire, has been subjected to several changes

with the purpose of readjusting its initial vocation to a more urban usage, including leisure purposes, benefiting not only Lisbon but equally other cities with waterfronts.

As a consequence, the qualification of the urban space through new proposals of public space has improved and shaped the Tagus Estuary, which has become an area that is both functional and highly qualified from a landscape perspective, with symbolic and strong identifying features that can characterize it as the *metropolitan plaza* (Morgado, 2005).

A close examination of the urban formation of Lisbon, in an attempt to understand its open spaces as potential planning and project instruments, unveils the prominent position of its public spaces, not just from an aesthetic and social perspective, but also from the viewpoint of the infrastructure of the city itself and of its future development.

The consolidation of knowledge regarding the various forms of urban planning and design is a fundamental objective of the present work, as it aims to provide an understanding of how the different planning models of the city also conditioned, or gave origin to, both qualified open spaces and residual urban voids.

The option chosen for this analysis included essentially the observation and identification of morphologies which could, in a systematic form, highlight transformation processes of the city at specific periods of time. This analysis resorted basically to the production of a thematic cartography in which characteristic areas of a particular functional and formal coherence are identified, and contact points with the main plans for the city of Lisbon are established.

In a preliminary phase that is still currently in progress, several categories of urban forms have been identified, with a view to future conceptualization as part of Theory of Urbanism. In the systemization of the categories, several large scale city structuring elements were taken into consideration, as well as their desegregation into more specific and detailed morphologies.

In the context of its own physiography, the urban growth of Lisbon was shaped from opportunities created by the Tagus Estuary, namely the deepest trenches, which determined a marked growth of the area around the harbour. In a stratified manner, the urban formation of the city can be understood as a superposition of complementary layers:

a. An external ring belt characterised by a rural mosaic in transformation, between the expansion of the sedimented city and its successive administrative borders.

b. Main axis forming a harbour and river waterfront, crossed by a spinal column expanding to the north;

The consolidation of knowledge with reference to the various forms of urban planning and design is a fundamental objective of the present work, as it aims to provide an understanding of how the different planning models of the city also conditioned, or gave origin to, both qualified open spaces and residual urban voids. The methodological approach included the identification of morphologies which could, in a systematic form, draw attention to transformation processes of the city at specific periods of time.

Several categories of urban forms have been identified and it has been observed that the belt is mostly transformed by these following patterns:

a. Characteristic open spaces: spaces with a precise identity that appear as part of an urban design project (such as public gardens), or as part of an 'idea for the city' (such as Monsanto Park), or as single elements in architectonic groups (as erudite gardens in palaces).

b. Rural Matrix: distinct forms of rural parcelling and of related land uses which register their progressive transformation and occupation by the urban space, as well as the features which will influence the formation of urban tissues.

c. Infrastructural lines –forms of linear development in which the role of infrastructuring is fundamental, such as the embankments on the harbour and transportation infrastructures and other public facilities.

d. Specific Uses – areas for specialised and frequently mono-functional land uses, indispensable to the city's structural functioning and with clear morphological characteristics, such as public facilities areas; cemeteries, industrial and military zones.

The axes, in contrast, are mostly impelled by:

a. Urban Fabrics – in their various forms of occupation in the context of the city, expressed through several approaches to urban space, as well as by growth areas that were planned and built.

b. Potential Uses – which are mainly driven by planning in its different types, especially areas that are reserved for future land uses (housing, industry and facilities) and, more recently, areas for urban regeneration.

In the urban formation of the city of Lisbon, mainly through the development of the road system and the intervention of Ressano Garcia in the 19th century, together with the successive external and internal ring roads, the compact nucleus of the city is surrounded by a transitional belt which began to be formed by farms and small towns in the outskirts of Lisbon with two types of fundamental landscapes (Atlantic and Mediterranean), which determines the different forms of land division and agriculture and, consequently, conditions urban development.

The intersection of these axes with the green belt, anchored on an older central part of Lisbon, contributed towards the definition of four sector identities with increasingly more specific characteristics regarding urban form and transformation, and which are regarded as the transition point to the urban areas of adjacent municipalities (Oeiras, Amadora, Odivelas and Loures, respectively):

a) Belém/Monsanto sector;
b) Benfica/Campo Grande sector;
c) Lumiar/Airport sector
d) Olivais/Chelas sector.

Following our interpretation of the urban formation of Lisbon and corresponding identification of the four sectors with their own specific characteristics, we have selected The Valley of Chelas as the object of more detailed study.

Bordering Territory

The Valley of Chelas, which lies both in the transitional green belt of the City of Lisbon and in the potential axis with Barreiro, is a border area of Lisbon and part of the rustic green belt characterised by the urban development of the first half of the 20th century, where the most relevant urban experiments took place.

This belt was included in several city plans, resorting to urbanism concepts related to the City Beautiful movement, and was reserved for infrastructures and Urban Parks and Woods, of which *Campo Grande* (included in Ressano Garcia's plan, but in a shorter version that the one originally planned) was the only park to see the light. Later, the Monsanto Forest, which was part of the De Gröer plan, was created in the late 1930s. In this context, key references, such as Abercrombie's Greater London Plan or Olmstead's innovations in various American cities, such as Chicago, played a fundamental role.

For several reasons, this green belt was never created. Quite the opposite: the differences between the various sectors deepened and widened even further the existing gap, given that the road system benefited mostly the centripetal radial structure of Lisbon, to the detriment of the strengthening of a transversal north/south type of road system, which anyway had been proposed in Meyer-Heine Master Plan for the City (1967-76). The transversal structure was set up in part with the new underground line to the Expo'98 (May 1998) Station and Interface, with the Chelas station and, more recently, it was included again in the Lisbon Municipal Master Plan. This fact was a major contribution to the recognition of this area as being equally part of the city, and it increased accessibility by public transport and by car. This had hitherto been an area of social housing whose residents, of low income and mixed social and ethnic origins, had restricted mobility, a factor which contributed to the strong segregation of this area in relation to the city of Lisbon.

This area to the Eastern side of the city was characterised by social conflict and by the miscegenation of uses and urban forms, which had their origin in the contrasts between an industrial waterfront (Xabregas and Marvila), discontinued spaces between residential and industrial zoned occupations (Chelas) and, over the past 10 years, the latest measures for the re-conversion of industrial areas (Expo Park and Western Urban Rehabilitation Society/SRU - Lisboa Oriental).

In this particular case, research focused on how urban master plans for the city conditioned and gave origin to unoccupied space (vacant, derelict and brownfield areas), mostly comparing the various master plans for the city (Ressano Garcia, 1903; De Gröer, 1948; GEU, 1954-59; Mayer-Heine, 1967-76; Lisbon Council/CML and the ongoing revision) with the Chelas and Olivais urban plans and the implementation of major infrastructures (railways and the future high speed train).

The area under study is located precisely in this *green* belt – rustic space with specific characteristics and whose urbanisation process evolved in an atomised form and resorted to the introduction of new urban occupations which were perfectly delimitated and whose projects revealed specific characteristics (with exemplary references in the context of the history and theory of urbanism, such as the city-garden, modern architecture international congresses/ CIAM and Team X), but which were equally autonomous in an edgy urban territory organised from rustic structures bearing distinct characteristics (common farms as well as leisure farms, with gardens and palaces of high architectonic erudition).

Accordingly, this area stands out in the city of Lisbon due to its special discontinuities, which were basically caused by intermittent urban interventions in the 20th century, although, in themselves, they constitute good examples of the innovation and quality of the projects and of the architects who authored them, and started a certain type of territorial urbanisation which was different from the traditional approach, creating urban continuities of which the axis Baixa (Low Downtown) – Avenidas Novas (New Avenues)/Alvalade, and more recently the Alta de Lisboa (High Part of Lisbon, Airport Area) are models equally relevant in the context of urban experimentation.

The Valley of Chelas has always been considered an infrastructural reserve of the City, as well as a privileged one for industrial type occupations (harbour and others). Presently, several interventions are planned which will certainly lead to major transformations in these discontinued spaces of a sectoral nature.

Nevertheless, the planned interventions, of different impact and characteristics, highly uncertain as to their future configuration or even accomplishment, are, for the most part, independent from each other, and the high structuring of open space, including their infrastructural and open space dimensions, may become the topic of an urban project with a high planning capacity in a fragile area.

Besides, the available spaces surrounding the areas of highest density, which between the 1960s and the 1990s were fully occupied by slums and thus affected by serious safety and social exclusion related problems (due to the rural exodus and the end of the Portuguese colonies in Africa) have been subject to landscape intervention, resulting in the creation of various urban parks with facilities and commerce, hosting important cultural events /such as Rock in Rio Lisbon, although they still lack a global articulation project. The most recent toponomy has recouped the references to the old Estates, as opposed to the more aseptic designations of the second half of the 20th century (such as Zones J, I, N).

Besides these collective spaces and transformations, the following interventions, which may eventually occur, were considered: high speed train, potential new crossings over the Tagus river, like the Chelas-Barreiro bridge and other options, the location of major facilities, such as the Portuguese Cancer Institute (*Instituto Português de Oncologia*/IPO) and the All Saints Hospital (*Hospital de Todos os Santos*) and the potential relocation of the present Lisbon International Airport outside the city limits, expected to be in Benavente.

It is this uncertainty, together with the pre-existing rustic matrix, zoned interventions and infrastructured lines for specific purposes (which were unsuccessfully articulated superimpositions carried out sequentially in time), that originated the poor structuring and lack of urban coherence of the Valley of Chelas, both within itself and in relation to the context of the city.

The Valley of Chelas, which has always been an important reference in the context of architectonic and urban experimentation and innovation, inevitably finds its projects postponed, and the interventions that are actually made are always of a sectoral nature or, on the contrary, of an infrastructural character, in the form of motorways and railways. Above all, it is fragmented and disconnected, which increasingly poses more difficulties for any future truly coherent project, which is always in the pipeline but never actually put into practice. Although of a residual nature as an object of intervention, the Valley of Chelas is also central in terms of its potential in the context of

metropolitan networks, where urban growth occurs by coalescence, stimulated by the development of the Vila-Franca de Xira industrial axis.

Actually, it will certainly become one of the most important metropolitan centralities with the Third Bridge and direct link to the Lisbon's Central Station for high speed train.

This creates a significant urban porosity and encourages a network of available spaces lacking coherence which, in themselves, constitute a major opportunity for urban connections and for continuities through new projects for public space, which, in this context, may be perceived as a major infrastructure of the city.

Conclusions

The present study has allowed us to consolidate the idea that the city of Lisbon has always been, for a variety of reasons (cultural, social, political and administrative), the object of more qualified studies and interventions in the context of national architecture and urbanism. However, from the 1990s onwards, while its metropolitan area underwent a consolidation process, from a functional, morphological and economic perspective, its study was systematically left behind in favour of projects which sometimes served different agendas. Focused interventions on a more metropolitan scale have been preferred, such as in the Lisbon metropolitan area, on other emerging municipalities, which in terms of centrality were alternative to Lisbon. The same applies to the options to study its urban fabrics, which were more qualified from a project perspective, but were already consolidated and relatively old.

The evolution and nature of urban territories in European metropolises, mostly in Southern Europe, have contributed towards this situation, and, as a result of this evolution, so has the lack of adaptation of current urban intervention forms (urban design, urban and spatial planning) to areas whose characteristics are not always clearly of an urban nature, in a context in which the city is not exclusively perceived as a result of the expansion over rural areas.

In fact, and with the exception of a few specific examples (such as Expo 98), over the past ten years Lisbon has not been subject to any structuring urban interventions based on the Idea of the City. In terms of innovation, architectonic and urban space quality, it does not show any specific particularities in recent years, although some examples of regeneration and qualification of interesting public space can be mentioned (the waterfront area, for example).

It has equally been noted that the study of the urban formation of Lisbon, besides focusing on the more compact areas, has left out the city's peripheral territory, which has a rustic basis and presents a mixture of occupation forms of high urban innovation. In reality, the major urban experiences of the 20th century have occurred in green belt and are often rooted in small villages, of which the following are easily identifiable: the social boroughs of the Estado Novo (1933-1974), which followed the city garden model; the new areas of the modern city, such as North and South Olivais; and, in the conceptual transition to more recent interventions, the Chelas and Telheiras Master/Urban Plans. More recently, atomised and discontinued proposals in the form of mega-structures of high metropolitan impact (large buildings and infrastructures or parks) are also examples of the above.

Interventions as part of a process of regeneration of decayed and obsolete areas give back to the city zones of privilege, through land use innovation and qualification of urban space.

Fundamentally, at the external belt of Lisbon identical situations can be identified. Given their morphological characteristics, these areas could benefit the whole city had they not been systematically excluded from the city planning projects' main goals, except when considered as building zones.

At the level of intervention in the city, it is also observed that there is an urgent need for a new kind of town planning approach, of a spatial and design nature, capable of regenerating land use and restoring the landscape morphological coherence. In precise terms, in the context of urban space and planning, this should be achieved through the contraction of discontinuous and residual spaces which could become both anchors and control mechanisms for new projects of urban occupation.

Thus, and mostly from the beginning of the 20th century, the study of urbanistic formation in an urban context, alongside the concepts associated with its production, has demonstrated that architects and urban planners are intervening increasingly less, as they become more conciliatory in a territory whose circumstances extend well beyond the capacity for intervention in the city on a global scale.

Indeed, it was in the period up to the middle of the 20th century that we find the most meaningful and innovative references to the idea of city and which in fact led to new urban forms, whereas, at present, the intellectual effort has been focusing on the attempt to understand the urban phenomenon on a metropolis which goes beyond our capacity for efficient intervention. Within this set of circumstances, innovation takes place mostly through resorting to processes which act at the level of economical, social and infra-structural dynamics, while relying less on the conception of new forms of urban space (for example, authors such as Patrick Geddes, Frank Lloyd Wright and Le Corbusier, who have proposed innovative models based on typological and technological innovation, and authors like Melvin Webber and, much more recently, Edward Soja, Joel Garreau, Indovina, Rem Koolhaas, who presented interpretations of urban phenomena on regional scales). In this context, public space does not always appear as the structuring element of the urban fabrics of conventional cities, or as a support (modernist dialectics figure/background) as in the modern model.

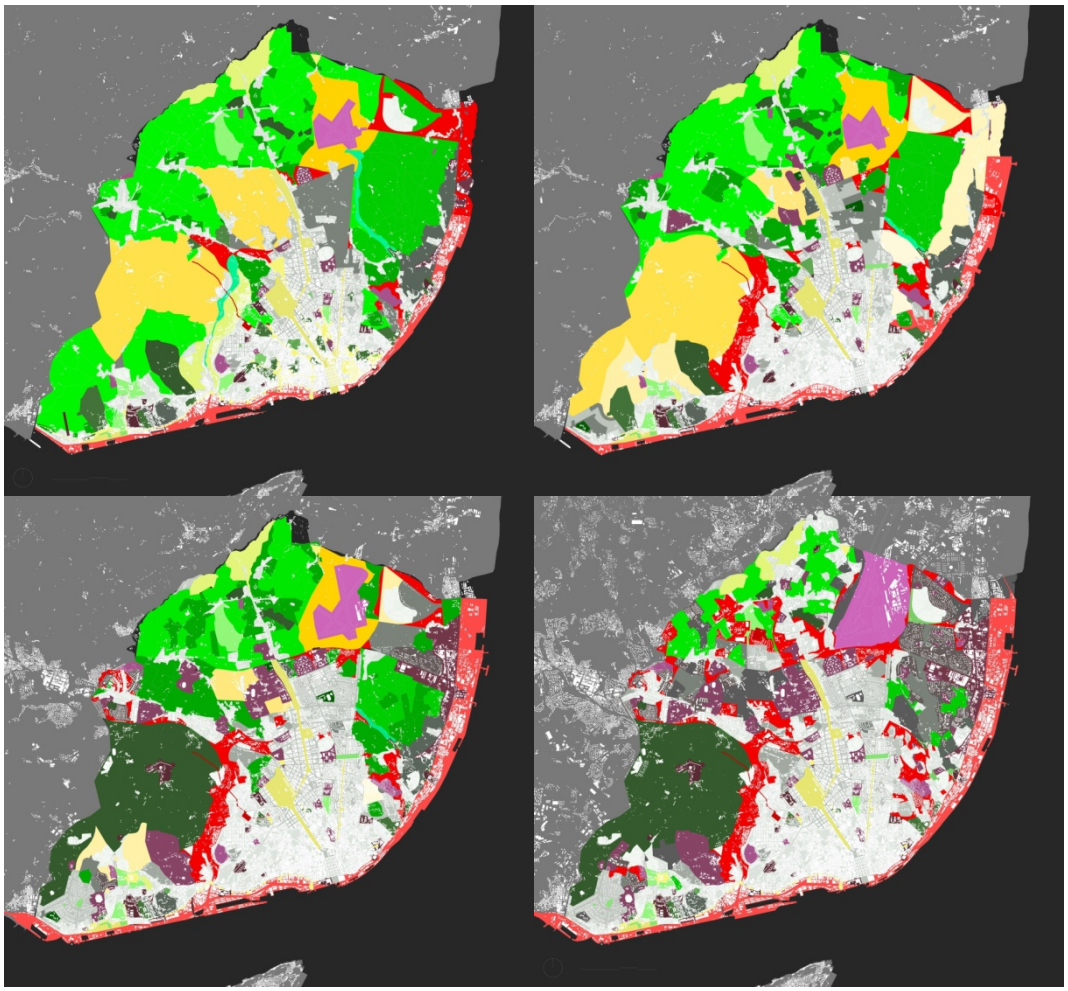
Basically, public space extends as an articulation element which "glues" together urban splinters, forming an extensive patchwork over which, in our opinion, new opportunities for a project and coherence of the contemporary city unfold.

These contrasting phenomena between macro and micro scales, which are generalized in European cities and more specifically in North American cities, can also be found in Lisbon.

Urban intervention, from what can be observed and read, balances between large-scale projects resorting to very abstract models which do not take into account the morphological coherence of the territory – urban, natural, rural (patterns, zoning and infrastructure) – and interventions of urban acupuncture in derelict and extremely central key areas (see emerging topics which include a combination of urban sprawl and urban shrinkage).

Nevertheless, it is also noted that the instruments that are now available (particularly GIS) enable us to intervene on a metropolitan city scale, and resort to a new urban language, using contemporary public space concepts and introducing new scales in the field of Urban Design.

A new idea of city would include innovative approaches in the field of intervention in collective spaces, as a means of improving and defining the articulation between spaces which are predominantly built and the ones remaining clearly open.



Figures 1, 2, 3 and 4. Lisbon 1937, 1949, 1971 and 1994. Source: Morgado, 2009. "Designing absence. The unoccupied space as morphological and urban project fundament in the metropolitan formation of Lisbon", FA-TU Lisbon and ETSAB-TU Barcelona/Preliminary findings.

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Growth versus Shrinkage

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Growth and shrinkage were processes of almost matching importance until the beginning of the modern age. An exceptional phase of urban growth, set in since the 19th century, caused unparalleled urban population growth. Long past the industrial revolution, at the end of the 21st century, this era is expected to come to a close. An increasing number of cities and regions are declining, or rather shrinking, since the middle of the 20th century. Planners and decision makers will be confronted with urban shrinkage as commonly as in earlier periods. This transition will not be done without commotion. In the future, the processes of growth and shrinkage will coexist with climbing inequality, and this will entail reconsideration of the established doctrine of growth. Theoretical debate on urban and regional planning has generally been about successful regions, cities or particular urban areas or alternatively about bringing success, and by this it is usually meant growth, to the least fortunate, unprivileged shrinking territories. Nevertheless, it is obvious that there are disadvantages as well as advantages related with urban growth. Through a literature review, we critically compare both concepts – growth and shrinkage – as phases or patterns of urban development, identifying opportunities and threats associated with each one of them. We conclude that urban shrinkage can be a window of opportunity to tackle various prevailing urban problems.

Keywords: urban development, urban growth, shrinking cities.

1 Introduction

Growth and shrinkage were processes of almost matching importance until the beginning of the modern age. An exceptional phase of urban growth, set in since the 19th century, caused unparalleled urban population growth. Long past the industrial revolution, at the end of the 21st century, this era is expected to come to a close.

An increasing number of cities and regions are declining, or rather shrinking, since the middle of the 20th century, a number forecasted to augment. Bourne and Simmons (2003) emphasize that these demographic pressures are not likely to be cyclical; they will instead become more intense.

While urban shrinkage regains its place alongside growth, planners and decision makers will be confronted with it as commonly as in earlier periods. This transition will not be done without turmoil.

Growth, as shrinkage, is becoming more and more disproportionately distributed geographically. Although urban population as a whole is decreasing in several countries, Oswalt and Rieniets (2006) argue that these imbalances will increasingly be found more within than between countries: “the poles of growth in individual countries are moving closer together, while the peripheral areas dependent or detached from them are deteriorating”.

Thus, geographical polarisation within countries and cities will become even more striking. The authors illustrate: living conditions in Chinese metropolises such as Shenzhen and Shanghai, for instance, are gradually more similar to those of large cities in developed countries like London or Tokyo, while the differences between metropolises and rural peripheries in China are escalating.

If in the future, the processes of growth and shrinkage will coexist with intensifying disparity, this will entail reconsideration of the established doctrine of growth in order to efficiently manage it.

Theoretical debate on urban and regional planning and common practice have generally been about successful regions, cities or particular urban areas or alternatively about bringing success, and by this it is usually meant growth, to the least fortunate, unprivileged shrinking territories. Therefore, the conditions or causes, consequences and patterns of urban development have normally been discussed by referring either to global cities, such as New York, London and Tokyo, or other towns and cities with surprising growth rates such as thriving urban centres in predominantly rural regions or the mega-cities of the developing world; or in relation to the emergence of edge cities (Couch et al, 2005).

Nevertheless, Pacione (2004) identifies four stages of urban development recognized in the literature, namely in Van den Berg et al (1982), and describes them in the following manner: (1) urbanisation when certain settlements grow at the cost of their surrounding countryside; (2) suburbanisation or exurbanisation when the urban ring grows at the cost of the urban core; (3) disurbanisation or counterurbanisation when the population loss of the urban core exceeds the population gain of the ring resulting in the agglomeration losing population overall; (4) reurbanisation when either the rate of population loss of the core tapers off or the core starts regaining population with the ring still losing population.

Van den Berg et al (1982) argue that the definition of the successive development stages should remain broad-spectrum to help to schematize to some extent the process of urban change. Moreover, three broad stages are conceived by the authors as far as economic structure is concerned: first, the transition from a largely agrarian to an industrial society, second, from an industrial economy to a tertiary economy, and third, the growth of the tertiary sector to maturity.

Pacione finds that regardless of evidence of a reurbanisation trend in some metropolitan regions, the process of decentralisation remains a major characteristic of contemporary Western societies.

For all the reasons aforementioned, shrinking cities are a reality which we cannot allow ourselves to disregard any longer, because to do so with be negligence.

In this paper, through a literature review, we critically compare the concept of growth and the concept of shrinkage as phases or patterns of urban development, identifying opportunities and threats associated with each one of them.

The structure of the paper is as follows. Section 2 briefly presents shrinking cities as an important urban and regional planning subject matter. Section 3 discusses planning and the prevalent doctrine of growth both in theory and practice. Section 4 focuses on criticism towards urban growth and points out that growth is not flawless. It seems obvious that there are disadvantages as well as advantages related with urban growth. Section 5 looks at the consequences of population decline, and the characteristics of urban shrinkage. Section 6 relates the latter consequences with the former criticisms and concludes that urban shrinkage can be a window of opportunity to tackle various established urban problems. Section 7 summarizes the debate raised in the paper and puts forward key questions for future investigation.

2 Shrinking cities: in brief

The shrinking cities concept is relatively recent in the planning debate. As one would expect, there are some differences of opinion on what does the concept means at a global level.

The causes and characteristics of shrinking cities are as manifold as cities in general (Rieniets, 2005). Even though urban shrinkage does not follow a homogenous pattern, we will try to abridge the most important characteristics and describe them bellow.

In a broad and most common sense, a shrinking city is a city that is losing population. All seem to acknowledge this demographic characteristic. But the richness of the concept is beyond population decline.

The 21st century shrinkage is a global, structural and multidimensional phenomenon concomitant with visible declining population, declining economy and declining national or international importance (alone or combined), affecting regions, cities, and parts of cities or metropolitan areas.

According to Oswalt (2005), shrinking cities are the places where the losers of the so-called globalized economy live; these cities are also different from small cities: the change in quantity entails a change in quality and an impact on everyday life (Ebers, 2005). At least until planning has a word to say.

In spatial terms, it manifests itself through doughnut patterns (in the centre) or its reverse (in the suburbs) and mosaic or perforation patterns (mixed type). In other words, shrinking might not represent a homogenous phenomenon in a city. Some parts can even grow slightly, while others stagnate or decline, although the latter situations have to be prevalent in relation to the former. Shrinking is usually accompanied by a projection of an image of decline and of potential loss of the traditional notion of urbanity.

From a wider urban and regional planning perspective, it signifies a paradigm change from planning for growth to planning for shrinkage or stagnation.

Shrinkage has been neglected by decision makers and planners, as if it were a dysfunction in development's cycle; however, shrinkage is not a passing phase of urban development, but a part of this development that has been uncared for.

Population decline is not even a recent phenomenon; historically, it has always been an aspect of urban settlement, as foreseeable as growth. Wars, natural disasters, environmental disasters, and epidemics have resulted in threats to the populations of cities as later have the effects of economic, political, and social transformation.

Fertility, mortality and migration are major determinants of change in population. Three factors appear as responsible for out-migration in shrinking cities: economy, planning policies (we like to think) and, to a certain extent, suburbanisation.

Statistics seem to demonstrate that the number of shrinking cities has been increasing constantly throughout the 20th century, especially since the 1950's (Rieniets et al, 2006).

More than one out of every four large cities in the world lost population during the 1990s, and population forecasts suggest that this number will increase, although urban growth will still dictate global population change in the near future (Rieniets, 2005). However, Rieniets et al (2006) find that by 2050, 43 countries will experience a combined population decline of 60 million people.

All of this should be enough evidence to reconsider the prevailing and popular doctrine of growth.

3 Planning and the doctrine of growth

Over the last three centuries, as urban growth became the final goal for regions and cities, and apparently the only way forward for spatial development, growth has been at the centre of urban and regional planning's international debate.

Popper and Popper (2002) argue that the new field of planning emerged in the 20th century purposely as a means of controlling growth and its impacts.

According to Rieniets (2005), our understanding of urban planning is closely connected to an assumption of ongoing demographic and economic growth; a result of urbanisation associated with industrialisation and its demand for urban solutions. Consequently, urban planning has had a quasi causal relationship with urban growth – methods, visions, and values are only envisioned based on the assumption of continuous growth (Rieniets, 2005). For instance, city and regional plans, local zoning ordinances, state land-use regulations, and environmental impact reviews all aim at managing rising population and new construction (Popper and Popper, 2002).

Not only theories but also practices of urban and regional development usually tend to emphasize the desirability, or the obligation, of growth. According to Bontje (2004), a review of theory and policy documents can soon lead to the impression that a city or region would be doomed when it does not possess a growing population, a growing economy and/or a growing national or international importance. Leo and Brown (2000) and Bontje (2004) call it *growth obsession*.

These authors also find that the possibility that continuous growth is an impossible, and sometimes undesirable, situation for any city or region had been accepted to a very limited extent until recently. The possibility of decline or even slow growth is admitted, provided it lasts for a short period of time. Bontje (2004) regards the stages of urban development model as the best-known example. This model is based on one phase of international economic development and considers that urbanisation is a cyclical process and that decline will, in the end, make way for new growth.

Leo and Anderson (2006) assert that for (North American) civic leaders there is no such thing as bad growth and no such thing as too much of it. Leo and Anderson find that the widespread impression is that growth is the elixir that cures all ills, and that any city that is not growing rapidly is being ''left behind'' and is ''off the map.'' The city is seen as a ''growth machine'' (Logan & Molotch, 1996) and is valued only if it conforms to that image.

According to growth machine theory, promoters of growth legitimate their actions with an ideology of value-free growth, with the claim that development is a universal good because growth increases cultural opportunities for residents, expands the tax base, and creates jobs (Troutman, 2004).

Notwithstanding, this is not exclusive to North American countries, or even to Western countries.

To be truthful, although economic growth and population growth do not always occur simultaneously or run in parallel, a negative correlation is atypical (Beauregard, 2009). However, a pattern of growth without employment effects (jobless growth) occurs in many cities (Franz, 2004).

For many years, the costs and consequences arising from suburbanisation were rarely considered. On the contrary, the benefits of suburban growth—increased tax revenue and investment in public services and infrastructure—received the bulk of attention and set the scene for continued suburban growth (Byun and Esparza, 2005).

Leo and Anderson (2006) state that previous research on the effects of urban form on the public costs of investment, operation and maintenance of network-related technical infrastructure has normally assumed a paradigm of growth. The authors also refer that most current studies are intended to show that substantial cost savings can be achieved by increasing urban densities and locating new development near existing built-up areas.

Despite the fact that growth has been replaced by urban stagnation and shrinkage processes at many places in the world during the last decades, shrinkage is not a topic of much discussion in most OECD countries where the planning paradigm of growth has dominated the scene for many years (Martinez-Fernandez and Wu, 2006).

Whether it is called declining growth, negative growth, urban decline, urban shrinkage or even slow growth, whether it happens in a region, city or areas of those regions and cities, population decline and what it entails is seldom considered acceptable.

Thus, the main dilemma of dealing with urban shrinkage from a planning perspective is that urban development is strongly interlinked with growth, leading to its perception as a threat (Banzhaf, 2006) or a taboo (Oswalt and Rieniets, 2006), a pathology at the least (Leo and Brown, 2000), or a stigma, not fitting into the ideal of decision makers (Beuaregard, 2003).

Within administrative systems, traditionally oriented towards growth objectives, shrinkage is generally considered to be intractable and policy makers and experts are unable to cope with the issue in a positive way (Wiechmann, 2008).

The most common reaction towards urban shrinkage, not very often leading to success, used to be maintaining a strategy of economic growth with the aim of regaining population growth in the shortest term possible (Banzhaf, 2006).

According to Borries and Böttger (2004), urban shrinkage is often described as a problem of building space, which can be solved, following the traditions of town planning, with building activity. Nevertheless, for the town planner, it should be primarily a shift away from the paradigm of growth.
The authors believe that the growth based discipline of town planning cannot address the phenomenon of urban shrinkage, because it is as much a cultural as a psychological problem. Neither the paradigm of growth-driven development nor the well-established planning instruments are helpful in a situation of shrinkage (Banzhaf et al, 2006).

From Beauregard's perspective (2003), a focus on urban shrinkage and their consequences would form a counterpoint to the literature on urban growth.

At this point, we may already conclude that both urban growth and urban shrinkage have obvious strengths and weaknesses posing greater or smaller opportunities and threats to the achievement of different planning goals and general aspirations.

The only ill-equipped bane is growth talk and the policy illusions it conveys (Leo and Anderson, 2006).

4 Criticism about urban growth

Urban growth is not immune to criticism in planning and in society in general and the argument that it can never do wrong is not utterly accurate. Suburbanisation and particularly urban sprawl have been the most targeted issues in this debate.

Bithas and Christofakis (2006) recognize the excesses observed in some of the sizes and densities of cities have been accompanied by the start of severely alarming malfunctions, such as atmospheric pollution; creation of fluid and solid waste; traffic congestion; criminality; and social alienation.

The authors believe that, in the light of these problems, the hypothesis that the marginal social benefits deriving from additional growth of cities are considerably smaller than the respective social costs has now a more convincing ring to it and, consequently, the additional growth of urban systems remains under systematic dispute.

Van den Berg et al (1982) point out there are negative consequences from growth and it must be feared that they will get worse as the scale of suburbanisation becomes larger, the worst problems being those relating to traffic. Besides traffic congestion and pollution, urban growth is frequently said to be the cause of negative effects such as the loss of outer open spaces for current and future generations (Garcia and Riera, 2003).

Khakee and Barbanente (2003) also reinforce the notion that global environmental problems are the result of a combination of population growth and shrinking stock of natural resources.

Chukwuma (1996) asserts that nature and wildlife may tolerate environmental insults only to a limited extent that is not commensurate with pressures exerted by population growth, global economic and technological development. In the author's point of view, a transition to sustainability requires, in the first place, voluntary social restraints on increasing industrial and population growth.
Consequently, one important environmental paradigm asserts that limits should be set to growth, because population growth has been mainly concentrated in urban areas, which have been the conventional nerve centres for trace element pollution.

Moreover, Tietjen (2007) supports that the task of territorial cohesion will become more and more a question of negotiating growth and decline rather than achieving equal growth in every place. Thus, the author understands development, not as growth, but as a matter of achieving maximum quality of life for a maximum number of people.

Hence, urban shrinkage is considered to challenge both the growth paradigm and the paradigm of spatial equality that have been the guiding principles of urbanism during the welfare state.

One particular relevant issue concerns social consequences of urban growth, namely of zoning. Zoning pushes and pulls people through land use, raising property values and thus exacerbating social segregation between rich and poor.

The most serious urban growth criticisms come about when sprawled suburbanisation takes place.

The consequences or more precisely the negative impacts of sprawl have been vastly debated. Although, in the past, suburbanisation and urban sprawl occurred primarily in conditions of

growth, partial or selective suburbanisation processes can occur in conditions of shrinkage (Hesse, 2006; Müller and Siedentop, 2004; Couch et al, 2005).

Despite the fact that there is still no absolute definition of urban sprawl, it is usually portrayed as an inefficient, because resource wasteful, land use pattern, which takes in almost every possible development with negative impacts, and is judgementally compared to the compact city *ideal.* There appears to be a broad consensus among planning and urban scholars that urban sprawl is a large and complex, not easily remedied, problem responsible for a number of negative consequences (Howell-Moroney, 2008).

Beside the issues of traffic congestion and environmental degradation identified previously for urban growth in general, urban sprawl is associated with high infrastructure development costs. On the other hand, the higher resource consumption, consequence of urban sprawl sets the stage to even greater damage of environmental conditions.

According to Dieleman and Wegener (2004), a range of unintentional consequences of this type of urban growth and expansion are brought forward in the literature; most prominent among these are: (i) disinvestment in urban core areas and central city decline; (ii) reliance on the use of private cars – auto-dependence – and therefore to growing number of vehicle miles travelled, road congestion and decline of air quality; and (iii) the loss of open space and scenic areas, agriculturally valuable or environmentally sensitive , in and close to metropolitan regions.

In the inner city, the urban fabric becomes perforated with increasing vacancy, run-down spaces and a generally deteriorated urban environment, characteristics not very different from others which can be identified in shrinking cities (Couch et al, 2005).

The poor transportation accessibility and longer trips can, in turn, constitute spatial obstacles in the pursuit of economic opportunities, first and foremost for people relying on public transport.
This sometimes called *ugly* pattern of development is, in addition, considered as the cause of decline of civic culture, and even obesity.

Couch et al (2005) highlight that urban sprawl exhibits combined low levels of eight dimensions: density, continuity, concentration, clustering, centrality, nuclearity, mixed uses and proximity. Almost all, if not all, of those dimensions are concepts which compose the base of the current generally acknowledged best practices in planning.

Nelson and Peterman (2000) note that in the past four decades growth management has been equated together with growth control. Growth controls seeks to limit growth, while growth management allows growth and seeks to alleviate its impacts, attempting to improve the ordering of development to improve outcomes. Even if only fairly successful, the authors feel that communities engaged in growth management should out-perform other communities in overall economic output .
Since the late 1990s the smart-growth movement emerged in planning theory and practice driven by the growing concern that the established development pattern – growth and especially urban sprawl – was not in the long-term interest of cities.

Nevertheless, urban shrinkage remains a sensitive matter when planning policies are concerned.

5 Consequences of population decline or characteristics of urban shrinkage

A sinking population density is one of the most obvious consequences of population decline, and a key characteristic of urban shrinkage, with important impacts.

For Ferrari and Roberts (2004), the dynamic of the built-up environment is a crucial aspect of the shrinkage concept and both the number of vacant dwellings and the amount of derelict land are vital when considering this phenomenon.

Ahrens (2005) anticipates there will be ever-increasing empty housing in a situation of shrinkage. In the new German states for example, studied by Ahrens, about one million flats are already vacant.

Nevin et al (2004) argue, referring to the M62 corridor running between Merseyside and central Manchester and beyond, that there is a shrinking housing market which exposes problems of obsolescence of property types; a declining target market; vacancy of properties and land; and a general hollowing-out of the inner-city, eroding the viability and sustainability of neighbourhoods and the services that support them, as we will discuss later in this section. Still, the problem is not exclusive to the cities' centre, and perforation can and does take place everywhere in a city region.

From Herz's (2006) point of view, demographic trends indicate a long-term decline in population and employment all over Europe, particularly in rural areas and smaller towns, but also in some quarters in larger cities; and eventually the declining population will lead to perforated urban areas.

Some of these consequences of urban shrinkage can turn out to be opportunities for planners. General falling property prices and a slack housing market can lead to less pressure on investments and space consumption and unexpectedly low property prices in inner city locations (Ahrens, 2005) or other sought-after locations.

Mäding (2004) explored the thesis of a demographically determined, generalised local government financial crisis taking in account not only revenues, but expenditures as well. According to Mäding, it is not enough to consider the impacts of demographic change – decline – on the revenues side. The author's arguments, on the revenues side, are the following: growth in productivity can be expected, *per capita* public and municipal revenues are likely to increase; and demographically determined income disparities between local authorities can be levelled by financial equalization.

On the other hand, Mäding finds that the danger on the expenditure side has four components: (1) persistence of expenditures in the event of a dwindling population; (2) rising *per capita* expenditures due to the effects of demographic structural change; (3) supplementary spending due to the effects of internal migration; (4) and, finally, additional spending in pursuit of an *excessive* attractiveness policy in *cut-throat* competition for residents. The later presents a danger indirectly connected with demographic decline: for a given total population, each individual can win only at the cost of others.

German municipalities are already engaged in fierce competition for residents for financial reasons, as the population as a whole decreases, the tone of this competition will certainly increase.

Ahrens (2005) also believes that a smaller tax base and declining tax revenues will not facilitate the financing of adjustments due to population losses, such as the adjustment of oversized facilities; and the renewal of urban structures.

Empty housing and vacant lots lead to oversized social, transportation and technical infrastructure.

With shrinkage, planners and operators of utility technical infrastructures are confronted with this completely new situation: over dimensioned and underutilised social and technical infrastructure.

With declining densities, unit and transaction costs of public services will increase progressively.

Koziol (2004) stresses that as population declines and consumption drops, many technical infrastructure systems will be used far below capacity and malfunctions will begin to increase. Hence, a situation of shrinkage is prone to hamper efficient operation and generate follow-up costs. First, the important basic investment in utility lines for drinking water supply, sewage disposal, electricity, district heating, and other services, are reflected in long-term effective fixed costs, the key component of charges and prices (50 to 80 per cent) for provision of those same services. Second, depending on the urban redevelopment/downsizing strategy adopted, high direct costs are incurred in scaling down, diverting, and relocating service lines, for adapting pumping stations and distribution stations etc., while indirect costs arise from apportioning existing fixed costs among a smaller number of consumers. Third, passing on the full direct and indirect costs of infrastructure adaptation to the consumer is not even feasible for political and legal reasons (Koziol, 2004).

In his paper, Herz (2006) also deals with the impact of shrinking cities on buried infrastructure. According to the author, the likelihood for densification around centres and along axes of infrastructure is small, and in addition new building activities will continue on a smaller scale. Nevertheless, although parts of buried infrastructures will become over-sized, a few of them even obsolete, most of them will still be necessary in the context of the distribution network. Herz believes that this process of shrinking demand for infrastructural services is accentuated by the decline of demand *per capita*, due to the need of more economical and efficient use of resources in harmony with the goals of sustainability. Therefore, the specific costs for the provision of infrastructural services increase, driven also by the need for infrastructure rehabilitation which, on the other hand, provides an opportunity for downsizing the system and adapting it in a sustainable way to the emerging pattern of demand.

Ahrens (2005) argues that financial burdens of fewer taxpayers will dramatically increase for infrastructure and social services, reducing the available budget of private households for mobility. Ahrens explains the difficulty in estimating precisely the consequences of demographic changes due to different influences on transportation demand. Some of the different effects can accelerate, but some can also compensate for each other. Nevertheless, significant traffic reductions in areas with large population losses can lead to:

- Lower volumes especially during peak hours, reduced lanes and width of streets;
- Less traffic in side streets to avoid congested major streets;
- Extension of zones with traffic-quietening;
- Better supply for parking;

- Reduced maintenance cost for transportation spaces;
- Renewed car driving among former public transportation users (because of available parking places and less congestion).

Besides, the author is also sure there will be a significantly lower demand for public transportation, but argues it is still not possible to make exact projections of mid-term and long-term developments.

On the basis of empirical studies, Strohmeier and Bader (2004) show that disadvantaged population groups – the poor, the old, and foreigners – will in future predominate in the urban landscape, and will concentrate in certain urban areas in which social problems cumulate. The causes lay both in selective migrations, especially out-migration by the German middle classes to the suburbs and in the ageing of population.

Strohmeier and Bader find polarising tendencies within cities. According to the authors, the urban sociologists call this segregation, meaning the degree of unequal distribution of the resident population over the territory in terms of social status characteristics (social status of residential areas), of family form life styles (family status).

As a result of the differential age structure of the German and non-German populations, most of the population in North Rhine-Westphalia cities will in the near future come from an immigrant background even if no further immigration takes place. This fact is considered quite upsetting, namely because *Districts with Special Development Needs* will proliferate causing urgent need for action to avoid further gaps in urban society. This is an enormous challenge for the shrinking cities.

Predominance of disadvantaged population groups entails declining purchasing power and cumulating social problems in those urban areas. The former and the later usually can bring about an increasing crime incidence, although some authors argue that thriving cities are more likely to attract crime perpetrators and have higher crime rates.

Adding to the aforementioned characteristics, decreasing population heterogeneity can lead to the death of social life, of public sphere, which constitutes the main source of creativity and innovation, creating a generalized knowledge and cultural void.

The generalized urban decay described above has an evident effect in the image of a territory. If, as Beauregard (2005) asserts, civic elites everywhere have become obsessed with the image that their cities project to the world, then the way the city is perceived has to be thoughtfully considered.

Beauregard finds images of renewal and images of decline are unequal in their narrative valence. While images of renewal/growth expand narrative options, decline shrinks narrative possibilities. Renewal and growth relate to affluence and accomplishment and practically unlimited opportunities for achieving and finding happiness. Decline is not able to appeal to positive narratives. Moreover, harsh daily routines do not leave space and time for anything else but exhaustion and negativism.

Borries and Böttger (2004) believe the real problems in shrinking cities are a lack of motivation, hopelessness and sadness – psychological conditions. Still, despite it all, Delken (2007) shows that, for the ones who choose to stay, living in a shrinking city does not lead to less life satisfaction.

Beauregard concludes reflecting briefly on the limits of images for helping us to understand the city:

«While we can see the consequences of disinvestment and abandonment and the results of large capital investments in businesses, leisure, and housing for the middle-class; the dynamics behind these images, the dynamics that produce them, are hidden from view».

All of these aspects, if not dealt with, can lead to even greater population loss, increasingly sharpening the cycle of urban decline, not shrinkage.

In our opinion, although they should not be taken carelessly, the characteristics of urban shrinkage are not fatal or failure determinant.

6 Urban shrinkage: an opportunity?

Whilst planning theorists and practitioners were busy trying to reverse urban shrinkage in order to get back in the pathway to growth, there has not been put much thought into shrinkage as an opportunity to rethink planning and maybe facilitate the solution of unsolved urban problems.

Kabisch et al (2006) believe that urban shrinkage is as a chance for reshaping urban spaces and that urban policy makers should feel challenged, not frustrated, by this very complex development, which entails the replacement of the paradigm of growth also in practice-related thinking and in developing new strategic goals for urban futures.

Bourne and Simmons assert that population decline, thus, is only a problem if it limits opportunities, increases unmet expectations, reduces public services and depreciates the quality of everyday life.

The *structural shrinking processes* need new innovative solutions to break the following causal chain suggested by Ahrens (2005): loss of job—move to a different town—empty apartment—reduction of social and technical infrastructure—further job losses—further losses of mobile employees—reduction of human capital—shrinking demand and markets—less social engagement and potential for innovations—loss of local identification—tax losses—less investments.

This causal chain is only one depiction of a multidimensional phenomenon, from several possible. Unemployment is an important reason but not the single reason why people migrate; and migration is not the only motive population decreases as a whole as we learned before in Section1.

Urban shrinkage implies (or it can imply) first and foremost a relief in pressures for growth.

For instance, as argued by Bourne and Simmons (2001), it may allow for regions and local municipalities to catch up with the demands for new infrastructure and social services, and to address the need for environmental sustainability. Banzhaf et al (2006) name it counter development, an opportunity to minimize the amount of further land consumption, to develop a different inner structure of a shrinking city, and to redevelop urban areas of residential vacancy and urban brownfields creating new open spaces or planning densification projects.

Reduced population densities can pose an opportunity to reshape from within, from the core out, in cases where central city decline is in place. In situations of random perforation, the loss of open space might be compensated through an appropriate strategy of deconstruction/naturalisation.

In this sense, sinking population density and the consequent vacant dwellings and derelict land present themselves as significant changes in circumstances and an opportunity to deconstruct created situations, otherwise unthinkable.

This deconstruction, counter urbanisation or, as we prefer, this urban shrinkage can also be an opportunity to restructure the relation between land use and transportation, once traffic reduction caused by population decline can lead to apparently several (inconvenient, but mostly convenient) changes in transportation demand and supply.

As for social and cultural consequences of urban shrinkage, they do not seem to differ appreciably from the consequences of urban sprawl; thus they do not constitute an argument to discriminate against the former pattern of development.

Leo and Anderson (2006) are quite realistic, and argue that most cities will not change their rate of growth appreciably, no matter what policies they institute, but that they can tailor their policies to capture the benefits of their slow or rapid rate of growth, while minimizing the constraints.

7 Conclusions

Throughout this paper, we support the argument that shrinking cities, or in a broader sense, urban shrinkage is a pattern of development, rather than a simple urban problem, and it is a serious matter for urban and regional planning.

Urban shrinkage, not only is it not an ordinary urban problem, it also cannot be tackled through conventional planning theory and practice.

Planning and urban growth have walked hand in hand, chiefly since the industrial revolution, giving an artificial perception that the former's existence is only justified by the occurrence of the later.

On the contrary, for a long time, there have been signs that urban growth is not limitless and perfectly correlated with urban development.

As we have described all through this paper, recent (and not so recent) events and findings corroborate these arguments.

While the number of shrinking cities augment all over the world, making the phenomenon more and more evident for planners and decision makers, it is also manifest the inability of current policies, instruments and tools to deal with it.

This is easily explained by the fact that the general assumption behind its design is urban growth. Additionally, most of the current planning policies, instruments and tools do not possess enough flexibility to adapt when the paradigm shifts.

Another point we tried to make was that urban growth itself is not a perfect pattern of development. There have been criticisms towards urban growth.

Undeniably, the most severe criticisms have been put forward in opposition to suburbanisation or, more specifically, against urban sprawl. Urban sprawl has been brought under strong planning control, even though levels of success vary.

Notwithstanding, some disadvantages are familiar to both urban growth and urban sprawl. Actually, some of them are similar to disadvantages of urban shrinkage, supporting the argument that shrinking cities are as acceptable as growing cities.

The paper has closed by exploring how these characteristics could be addressed within the broader context of urban and regional planning.

We have suggested that population decline or slow growth, leading to urban shrinkage, is clearly not inevitably a problem and we gave examples.

In sum, there are apparent motivations to engage in planning for shrinkage when challenged in this way and no solid reason to feel menaced by it.

Useful insights on this matter could be gained through a comparative analysis on how cities are coping with shrinkage and the results achieved by planning in those cities, making an inventory of policies, instruments and tools applied and simultaneously making a distinction between the cases where urban shrinkage was accepted and the cases it was rejected as an opportunity.

Future research could address the issues of innovation in planning for urban shrinkage and how to devise flexible enough strategies to manage urban growth and urban shrinkage scenarios.

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“Tagus Platform” project – innovating Lisbon's port territory

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At Lisbon waterfront, the project Tagus Platform presents a holistic perspective in which city and port are seen as part of the same system. The project makes use of land owned by the Municipality, the Railway Co. and the Port Authority, merging disciplines that are often presented separately – architecture and public space. Tagus Platform challenges the current convention that public open spaces are located between buildings. Here public space stands over functions working below inside the building structure and reshape the morphology of the landfill surface. The barrier of railway and/or heavy traffic is central to this project. It succeeds to remove the presence of the barrier and blur its effect with a low budget project. The fruitful dialogue between city and port is oriented to a specific project rather than general urban planning. The sustainable development of ports cities challenge the capacity of both port and city, to successfully negotiate and work towards mutual improvements. New public space at the waterfront adds value to the urban environment when mixed with port related activities. Tagus Platform links both, urban environment and port atmosphere increasing port city’s culture. The project brings value to urban life, to port, to city’s image, to tourism and mainly, to people who use, access and enjoy new facilities. The creation of new waterfront public spaces increase port city identity and consequently strengthen the public support for the port, the environment and the necessary use of green modes of transportation. The holistic transformation affects the heart of urban life and the idea that citizens have of their own port city for tomorrow.

Keywords: waterfront, urban design, new morphologies, public space.

1 Introduction

Any solution imagined for the waterfront must consider that Municipality and Port Authority land are covered by independent and autonomous jurisdiction and between them transportation infrastructures have created an urban barrier. It is through a fruitful dialogue between Municipality and Port Authority that different solutions for waterfront regeneration succeed to be implemented. The barrier of railway and/or heavy traffic interrupts the access from the city centre to the riverfront and creates a cut off effect. To remove the barrier, or blur its effect, the convergence of efforts between city and port is required.

The idea of complexity of the waterfront is shared by several authors who do not defend a new planning model but advocate a new way of addressing the city and port relations, seeing this approach becoming a new laboratory of urban quality and focusing the current discussions on the new opportunities for both citizens and port activities. Bruttomesso (2001, 44) dealing with the environmental and urban features of the waterfront highlights some general concepts about the need to open up the waterfront to the public, the development of accessibility with limitations for private vehicles and the upgrading of waterborne transport, and improving of the quality of water. It is the relationship established between the city, the port and the citizens that determines the success of the process.

Port Authorities depend on public opinion and neighbour municipalities’ support to expand and remain competitive. A public opinion support for Port Authorities come from a dialogue with the municipalities and environmental organizations projects to discuss the implementation of the

necessary transformations. There are geographic, cultural and historical dimensions that continuously affect the dialogue between City and Port.

We argue that the theoretical debate at the waterfront is mainly centred in two dimensions – space and time. The space of the urban waterfront is a constructed territory, built on landfill and through different periods of time, the history of port cities is written by the evolution of the waterfront. In addition to these dimensions, comparative cases studies with other waterfront regeneration processes should also be considered, since port cities face similar challenges. Once critically reviewed this material is useful to envision new solutions and to design a specific project. Design solutions have always been useful to discuss ideas of transformation with the main actors involved; municipality and port authority. At the end of this paper we present a waterfront project currently being discussed at the city of Lisbon – Tagus Platform.

The project aims at innovating Lisbon's port territory and supports the argument developed at Barcelona by architect Manuel Sola Morales, who claims for the waterfront the importance of the cartographic culture of the territory or the culture of working the territory. Morales ideas have influenced several scholars perceptions among which we should also be included. To trace the culture of the territory of Lisbon we analyze different projects for the site elaborated over several centuries revealing the ideas and influences that emerge when discussing the port area at one particular site – *Rocha Conde d'Óbidos*.

We argue that specific projects of architecture and urban design open the discussion to the public, which opinion is influenced and sensitive to the process in re-establishing access from central historic urban areas to the water. Site specific projects promote dialogue, discussion and knowledge. They engage the public to be supportive of needed transformation of port facilities.

In Lisbon, this project presents a new connection between city and port by reshaping the morphology of the landfill surface with a new building. It merges disciplines that are often presented separately – architecture and public space – and challenges the current convention that public open spaces are located between buildings, here public space stands over functions working below inside the building structure.

Will the project Tagus Platform succeed to re-establish the urban relationship, with the river that has been gradually eroded? It depends on a number of factors since we live in a period where it is not possible to have absolute control over the process of making the city, if that moment ever existed. However as Harvey (1990, 91-92) explains "major cities compete with each other, mainly as financial, consumption, and entertainment centres. Imaging a city through the organization of spectacular urban spaces (…)". The solution for economic success is increasingly dependant on the creativity of the investors and less on the number of square meters.

At present there are an increasing number of possibilities for cities to reinvent their waterfronts that shift towards recreational and tourism related activities, and the citizens' evident enjoyment of the new public spaces at the waterfront has proved this move to be successful. The spaces newly "available" have a strong cultural significance. It is the knowledge of the waterfront territory's continuous transformation that supports the design proposals for the future, one that is historically rooted when reshaping the morphology of the land, offering a new urban image for the port city.

2 Lisbon

2.1 Present situation

On the urban scale and in the context of the current discussion about the port area of Lisbon, one of the first questions to be formulated regards the failure in 1994 to implement the waterfront development plan – *Plano do Ordenamento do Porto de Lisboa* (Port of Lisbon waterfront plan), that became known as POZOR. Fifteen years later and armed with a more mature understanding of the subject both Municipality and Port Authority realize that the railway line and the road are the main physical barriers preventing the city from relating with the river; working as an obstacle that prevents urban life from entering the port area. The Port Authority/APL strategy that proclaims the need to integrate the port area into the city remains physically separated by the "cut off effect".

The plan presented strategies to attract partners for financial investment and it proposed a major urban development for the port area with the creation of new buildings organized within a new urban design frame The plan proposed the construction of new buildings in 450.000 m^2 of the area *Stº Amaro – Alcântara,* and in 160.000 m^2 of the area called *Rocha Conde D'Óbidos – Santos*; additionally, the Multi Development Corporation International (MCDI) was supposed to build in a 82.000 m^2 area at *Cais do Sodré.*

To re-establish the city back to the water requires mutual effort but POZOR was commissioned independently by the Port Authority – APL that was acting as a developer, effectively ruling the land in the public domain that cannot be privatized, but they did not know, at the time, how to handle the great complexity in the context of the city-port relation. On their own the presentation of the plan (POZOR) for public discussion was a breakthrough in Portuguese urban planning tradition, considering that most of the country's urban plans usually attract criticism only when the construction is already underway. The plan did not contain ideas for the long term urban improvement of the port-city relation – the needs of the neighbourhoods that are located along the port area were not considered. The multidisciplinary strategy did not achieve positive results and the Port Authority has acted independently to bring about the gradual changes it has decided on for the future.

After POZOR, future plan (or plans) should instead launch the base for a new frame of thinking, joining city and port representatives with the population represented by associations and individuals. As it is pointed out by Rabinovitch and Leitman (1996, 53) "Any plan should involve partnerships among private sector entrepreneurs, nongovernmental organizations, municipal agencies, utilities, neighbourhood associations, community groups and individuals." In the process of making the city in the Iberian cultural context, Monclús (2004, 22) argues that "the cultural dimension of the city returns to be prominent, now taking into account that the "culture of cities" refers as much the preservation of a "cultural inheritance" as to the use of culture as a strategic resource in which has come to be called "cultural economy". The cultural dimension of each city should be able to imprint specific qualities that reflect the uniqueness and the local traditions. In Lisbon, the triangle between municipality – port – citizens should be able to conceive an alternative to the standard ideas, embraced by narrow-minded investors and politicians who wish to play safe by copying solutions used globally.

Some authors have recently express their position, also based on public surveys, on how the city wishes to re-gain the river and preserve the port, integrating in its present day heritage some

remembrances of the port activity Craveiro (1997, 50). Soutinho (1999, 99) refers to the importance of the city's connection to the water, re-establishing the broken link. The port area should remain a public space; and the whole project should blend in with the natural landscape and the urban environment. The lack of dialogue and coordination between each entity causes the waste of energy, time and the constant misunderstanding which characterizes the painful relationship between the city and the port. The lack of coordination and exchange of information between institutions has prevented the efficient organization of the process.

When we look in detail at specific buildings placed next to the port area we find universities and museums that are willing to expand their facilities, several structures with potential for new urban activities and with great economic importance for the city. Cruise terminals are to be included they are simultaneously a port infrastructure and an urban facility. As the latest generation of these terminals incorporate commercial and cultural areas to serve both city and port. Cruise passengers are increasing at an unusual rate and they are becoming valuable to local economies. Some cities have been investing in good means of public transportation, as well as in direct pedestrian connections to the city.

The design and the popularity of the waterfront public spaces at the Expo'98 are relevant to the discussion as they are the most similar event both in time and space. At the Expo'98 public spaces and green areas are carefully designed, and the organization received evidence from the public that a traffic free environment was more attractive to them. According to Jan Gehl (2000, 12) "the city's new car-free space is used for a special form of social recreation, urban recreation, in which the opportunity to see, meet and interact with other people is a significant attraction." And that the spatially complex solution is successful in exploiting the three dimensional quality of public space, in which urban barriers at the ground level are integrated into urban life and new topographies blur the existing 'cut off effect' created by the flow of modern means of transportation.

Expo'98 model presents problems as a private corporation (S.A.) with public participation – being driven by motives of profit meant compromising with specific demands and pressures from investors. As a result instead of the expected continuity of the city, an urban insularity imposed the third world model of a private condominium (Cabral de Mello, 2002, 63) benefiting the richer strata of the population and cutting them off from the surrounding lower class areas." On the contrary, Brian Hoyle (1997, 50) argues that "waterfront redevelopment has the effect of removing barriers between city and the sea". To conclude that attracting the private sector should not mean opposition to invest widely in the removal of the existing barriers.

Among several port cities the participation of the population in the process of city and port urban regeneration has resulted in improvements for all three. Although using different methods there is a common tendency for the port area to provide creative public spaces, related to memory, art, culture and historical context, "downtown is related directly to the waterfront, and that represents the most ancient part of the town. […] The square facing the water was one of the favourite places for citizens to meet, to discuss and walk together" (Brutomesso, 1997, 121). The intervention of artists in the public space emerged as a key factor for the creative use of the urban habitat by the public, leading to possible functions and fictions to reproduce social life.

In 1988, the competition organized by the Architects for the waterfront of Lisbon, was set up to confront current ideas and discuss the future of the city as a whole and not fragmented and separated by different landlords. The proposal awarded with the FLAD prize, has presented the city as one entity, one body that searches to re-establish its relationship with the water by making use of the land at the port area, and in our view this illustrates a possible direction for future projects.

Looking at the evolution of previous projects helps to evaluate the problems and the possibilities of the site. In doing so, designers may engage in this architecture and city planning spectrum, to attain a new freedom and develop new creative possibilities, such as those that have begun to be felt in the last decades in the fields of painting, sculpture, music, and poetry. At present some architects like Elia Zenghelis (2001, 136) argue that architects are expected to declare a very strong view and develop concepts that they could defend in projecting a future for the city. On the waterfront there is an "opportunity to discuss architecture and the iconography of architecture as a kind of theoretical, symbolic aspect (…) of architecture not being contextual, but always generating context." Design proposals form the base for establishing a dialogue between the Port Authority and city. Drawings usually presented as preliminary sketches have forced both entities to work together to reach converging visions and continue the *culture of working the territory*.

2.2 The process in time

Historic research provides a deeper understanding of the site cultural significance and the importance of public spaces, the conflict opposing *AGPL* (Port Authority) and *Marinha* (Navy) ended up aborting the project of the industrial port built between the end of 1880s and the first decade of the 1900s. Between *Cais do Sodré* and *Terreiro do Paço* a small waterfront area remained untouched, the only gap in the barrier created by the industrial port. It did finish with a careful construction of spaces conforming to the human scale, and also erased centuries of a rich series of buildings and open spaces along the river. The last record of the urban features becomes relevant for the present debate as urban life returns to the site. The Tramway line project by Louis de Lennen in 1862 was designed just before the construction of the industrial landfill, and it remains the most accurate record of the city's relationship with the river, revealing rich details of urban spaces and a diversity of urban features constructed throughout generations. It could be seen as a lost heritage banned from the site. The scene presented in the drawings does not only evoke nostalgia but also provides a visual record of a lost reality, one that combined a quality and diversity of urban spaces that should be taken in consideration when redesigning future public spaces for the site.

For centuries the morphology of the waterfront territory changes in order to link city and water through the artificial land. To discuss that possibility for the port area of Lisbon we have researched the construction and the evolution of the industrial port. According to Baldaque da Silva (1893), a military engineer working for the Port Authority during the 1990s, the new landfill of the industrial port would sever the relationship established throughout the centuries between city and river, backing his argument with scientific data based on regular measurements of the river bottom revealing a disruptive ecologic and natural balance of the riverfront. At the time Baldaque's holistic approach was not well received by dominant decision makers, therefore the landfill was constructed with underground pipes to collect the rain waters to the river. The necessity to link the hill and the river

has been present since the Mardel project which envisions transversal canals from the natural topography of the hills through the artificial landfill to the river.

Nowadays landscape architects believe that sustainable solutions should make use of the natural forces of nature rather than permanently try to control them, and therefore future intervention at the landfill of the port area should include transversal open-air canals. The previous studies have been commissioned either by the port or by the city and reflect their own visions or future interests. This research from an independent assessment will hopefully contribute to a wider discussion including different standpoints. The physical aspect of the territory, artificially constructed on landfill sets the basis for further discussions.

3 Other Port Cities

3.1 Comparative cases

San Francisco and Barcelona waterfronts projects both "emphasize specific projects rather than general urban planning. This active city policy can aim to bring back the quality of urban life, by providing dozens of projects for new public spaces, parks and squares, elevating public space to the level of an independent architectural field." (Garcia, 2008, 78). On the waterfront open spaces are more stable and more important than buildings. There, the people have learned to enjoy the privileges of the waterfront as a public space and the cultural facilities are proving to be both economically feasible and popular. Michael Hebbert states that Oriol Bohigas's general proposition for Barcelona was "that urbanism should be based on projects rather than plans" a theoretical proposition he started to develop when working for the Municipality of Barcelona in the early 1980s.

"First: urban planning should not only be a law to limit, a survey of the private investment, but an effective, immediate, achievable, proposition. That is to say, it was necessary to go from systematic future visions, but abstract, to precise propositions and sharp realizations. This implied a second criteria: these sharp realizations should be projects of the collective space. Not just urban space – squares, streets, gardens, etc. – but also of large infrastructures and social equipments. As a consequence, more then «urban spaces» we should talk about «public spaces». Public spaces that are, equipments as well as road structures, squares, gardens or monuments, they are places to meet, the scenery and the signs of the collective identity." (Bohigas, 1996, 210).

At this time when the projects were commissioned, the one by Sola Morales was the first to transform the relations between city and port. This shift was not produced through the signature of protocols between institutions or the production of a new master plan, but instead through a new type of thinking, where design projects are analysed and discussed individually. In his analysis Hebbert (2004, 95) argues that "Barcelona's most precious contribution to urbanism is less the primacy of projects over plans than the dialogue between urbanism and contemporary architecture". The administrative structures Bohigas found operating in the city were disorganized and inefficient; each was concerned with its own problems. In reordering the procedures of the existing administration, models were turned upside down – "the general policy framework was left on the shelf." (Hebbert, 2004, 94) In the new framework each department of the municipality was participating in the future projects together, making an effort to develop strong relationships between interest groups, because relationships are better than rules. In the new procedure architects and

urban designers were asked to bring forward proposals to be discussed. From these preliminary sketches various entities involved collaborated in a common project, so that together they could start the transformation. The relationship between city and port improved through the implementation of the chosen project, containing buildings and space for public use.

Cities rely on public spaces more than they do on buildings to claim their urban identity. Cities are the main physical source of identity for their residents who use common spaces to gather, to wonder, to share and exchange, and simply to stare at the landscape. A series of small scale projects accepting the premise that waterfront renovation is neither necessarily spectacular nor dependant on projects presenting a surprising new urban image.

The land, piers and wharves were not accepted as immutable features but as part of an evolving territory supporting new needs for the city. Artificial land was built up for specific purposes in the same way that it is now being transformed for new uses. Public surveys to determine the necessities of the population are an efficient tool to test new programs and formulate ideas.

At Barcelona the relationship between city and port boosted the urban social and cultural environment and reinvented the past dignity of a degraded cityscape, during a unique political situation that empowered the architects, working in a true democratic tradition, to grasp the opportunity to build spaces for people to gather and showed the port as a central space with emphasis on visual openness. Local residents were not driven out from their neighborhoods while new groups came to live and work in the area, reducing gentrification. Public art programs and an active cooperation between architects and artists were created to improve a previously decadent area that now became more alive, more dynamic, with improved street life, attracting new residents and more commerce. Making pedestrian mobility and social interaction the priority, transformed streets and squares into traffic free zones for both residents and visitors, and provided transversal accessibility from the residential neighborhoods to the waterfront

At the present the cultural significance of public spaces at the waterfront faces the threat of privatization. In Barcelona, instead of attracting large investors whose commercial demands usually lead to decide against the use of the urban space for the benefit of the public, preferring instead the privatization of the public space, the municipality and port authority have considered the priorities of each body and only then invited developers to invest. They realize that the city and port transformation is not the concern of the investor but a collective responsibility. Through the creation of flexible regulations small investors found interest in renovating their own properties in the central areas, proving that several small investors generate more development that can be achieved by few investors with large sums of money.

3.2 Waterfront projects

Several authors through their communications at International Conferences such as AIVP (Association International des Villes et Ports) and Waterfronts of Art, and through publications are examining the present day transformations occurring between the city and the port, claim that the key concept is imagination, therefore the analyses of imaginative projects becomes fundamental for future debate. Smaller case studies raise different ideas about the possible topics for debate. Architecture is one of the narrators of the city, bringing art to urban design, and constituting a gallery

of examples that illustrate what we found to demonstrate the philosophical approach regarding waterfront projects which best supports our argument. We briefly make reference to these examples to formulate an hypothesis to test whether projects can favor not just a claim for the water but also the symbolic centrality of this site in the city.

The Tenerife Cruise Terminal International competition brought forward the idea of organizing and taking advantage of conflicting urban flows. In their design proposal Foreign Office Architects, find that cities with dynamic topographic features tend to have three-dimensional flows and they have addressed the usual 'cut off effect' located between port and city. In their proposal the barrier would lose impact by creating new topographic features and by the manipulation of infrastructural systems, FOA thus emphasizing the importance of connecting the port area to the city behind it. The conflict between pedestrian traffic and the roadway was solved in a sustainable manner because their flows were integrated in the forms of the buildings. Consequently the building become a truly urban conquest of the port area and new forms of architecture emerge from the contemporary challenges of city and port relations. The concept of the a new landscape that covers modern means of transportation and its necessary infrastructures was also present at the Olympic Sculpture Park in Seattle (Weiss and Manfredi, 2001) but FOA here, extended the concept to the form of the building.

The most relevant and prominent aspect of the Yokohama waterfront renovation is the preservation of dry docks and that should be considered in Lisbon. It connects the user to the *genius loci,* that is to say, to the soul of the site, opposing the mainstream process of waterfront renovation stigmatized by an 'efficient *disneyfication*'. As Berman (2001,65) puts it "Preservation also corresponds to site art in how it can emotionally and intellectually stimulate people. At one level, a historically preserved site can add beauty to the environment. At another it can make people think about an area's past and their own connections with that history." This happens successfully at the Kishamich Promenade where the user may indulge in the art of contemplation and experience serenity even amid the hasty urban life around them. It became a 'path' for the contemplation of nature, and discretely connects past and present. The dry docks are an industrial element that can be reused today for a variety of cultural and educational activities that add value to the citizen's quality of life. Industrial architecture of the port is able to push one step forward, because it adds to our previous knowledge of the world. Japanese architectural heritage is acted upon by following an 'evolving heritage' philosophy, not seen as a frozen element in an open-air museum, but an icon that stimulates people's perception of the culture of the site.

It has been argued that projects for the new infrastructures are including the participation of artists and scientists, and artist's interventions play a significant role in the design of symbolic common spaces for each community. The art program *promenart* at Sydney is a good example of it. The initiative to invite artist to produce art work related to the balance of eco-systems at the waterfront, was useful in establishing whether scientific-artistic relationships are needed between nature and the city. The art work responds to the natural forces and symbolically subverts the common idea that man must always control nature through *machinery*. The movement of machines is controlled by man; in this case it is controlled by nature.

At present, we have lost the understanding of the mechanisms operating the machines and they are constantly evolving, replacing previous versions. «The machinery when outdated is

dismantled, and we face an important question about what to do with it. Should we erase the narrative of times in which the port and maritime activity played a relevant role in the identity of port cities?

4 Solutions

4.1 Complexity and flexibility

At present the laws relating to the land under APL jurisdiction do not encourage a diversity of small private investors or ventures by real estate developers. Several European cities have been changing regulations to overcome specific problems. In the Portuguese legal system and its various institutions there is an endemic inertia that offers a great deal of resistance to the necessary changes in the legal framework which may narrow new possibilities. The Expo'98 should be considered an exception, for it was mainly controlled and directed by the central government. Some projects for the transformation of the Lisbon waterfront areas have been criticized for their fragmented urban policy, in the sense that connections between new areas and existing neighborhoods are not considered nor proposed, and because the urban 'show-case' nature of such projects dominates the waterfront development. (Crosby, 1970, 91) "In the future city we will need monuments, places to visit, to look and wonder at, for this is the purpose of our hard won mobility. In the coming years of mass international transportation, when whole populations will move every year each summer, the pressure on the older, established monuments will be unbelievable."

APL took this idea into consideration when it decided to built the new (Vessel Control Traffic) VTC tower and chose architect Gonçalo Byrne to produce an "exceptional building with a monumental presence" that has given a new prominent feature to the image of the city. Considering the importance of public spaces, from which the tower is excluded apparently for security reasons, APL has invested extensively in the reconfiguration of a strip of former port facilities into public spaces along the area of Junqueira. This process is commented by Busquets (1999, 97-98) who argues that on the waterfront, "the public space should be seen in terms of the new cultural role being stimulated by contemporary use. Originally, the park was an aesthetic or moral facility introduced by hygienists as a counterbalance to the heavily industrialized city. Later, in the modern city, new dimensions were added to the open space: sports and other facilities. Now, once again, new demands are being made on open space: in addition to their traditional possibilities for use, the public is now asking for a new circuit and the introduction of art and culture. They want something that is very special to their city, but they also want space for leisure activities."

Most of the artists invited to participate in waterfront projects deal with the future role of the water and the fragile equilibrium of nature, helping to bring these issues into public discussions that, in turn, contribute for new options and better solutions. A considerable amount of public art of the city and a number of significant buildings are located along the waterfront. Therefore it makes sense to reflect upon Sophie Trelcat's (2000, 52) words "Growth is based on tension that opens directions and integrates a considerable degree of liberty for spatial and functional alternatives, yet keeps as close as possible to the real needs of the city." One the arguments structuring this study is that the participation of the present generation should be in the construction of the city as part of a pattern of various generations, in a way that does not hold the solution to all problems but instead provides a

number of suggestions to improve the present situation at the port area. That necessarily requires time, effort and research to bring flexible uses of maritime and urban activities without compromising the future of the port area after facing a process of transformation for the last couple of decades that will continue to change and evolve in unpredictable ways. As Boeri (2001, 407) puts it, “Designing a port area means learning to deal with the issue of uncertainty and the unforeseeable nature of the future of an urban coastal area.”

4.2 How to imagine transformation

Some of the international competitions are developing partnerships between the public and the private sector to redesign their waterfronts, with more or less public participation. In many cases the process of transformation, is requiring major investments to reshape large surfaces. This becomes particularly relevant because contemporary society has developed powerful means to transform and shape the territory, based on technological expertise. The public protests against the urban development on former port areas in places like Bilbau, Barcelona, Lisbon, Rio de Janeiro and San Francisco, reveal that when the surroundings of industrial ports become an area for developers to discuss in terms of prices per square meter, citizens manifest against these developments as they realize they will not increase the quality of their urban life.

In the case of Lisbon – the Municipality, the Railway Company, and the Port Authority are the most dominant actors. New programs to be implemented at the industrial landfill should value both the urban life and the port activity. Cities envision improving the lives of their citizens and the ports search for efficiency and economic benefits. New activities emerging in this context will bring urban features towards the water and maritime activities; recreational, cultural, tourism, cruise terminals, etc towards the historic city. If the city’s ‘raison d’être’ is the port, they have grown together and depend on each other. One of the challenges is to find the necessary new activities and programs that have been waiting to find a place and give a positive contribution to the relation between urban life and port activity. To do this the Municipality and the Port Authority should find other partners to update port facilities like the cruise terminal or the European Maritime Agency, but should not shut down existing facilities prior to having a common agreement between them, as happened with *‘doca pesca’* which was active and brought an added value for both city and port. The closure in 2003 was contrary to the strategies followed by Barcelona and San Francisco that have kept their facilities and expanded adapting to new necessities.

Significant results can be obtained by studying examples of port cities that have commissioned research projects from other cities. In Rotterdam, at the heart of the historic city - De Boompjes, while organizing the event European Capital of Culture, in 2001 the city asked experts from a number of foreign cities to draw up new design for De Boompjes. The organizers felt that inspiration could be drawn and lessons learnt from strategies adopted elsewhere. Designers from other cities contributed with a specific project for the historical central area of the city and proposed solutions to re-establish a relationship with the river. The city of Rotterdam provided them with rigorous historic and geographic information and asked the participants to develop their own visions. In the case of «Marseille – Making the City by the Sea» in 2001, the method used was also similar. Scholars gave an extensive historic and geographic background to foreign designers who were

asked to present creative projects on the improvement of city and port relations. There the Port Authority, the Municipality and the population are working together as they need to expand their understanding of the subject. It is a process of public debate where 'borrowing' creative visions, produced by architectural drawings contribute to the discussion about the sites future urban design. Showing evidence that new design work can shift the common perception to one that conceives transformation not as a final product but more as a process of thinking.

5 Innovating Lisbon's port territory

To blur the existing urban barriers we design a complex scheme of a building covered with public space in a way that it brings the city ground level to another level, integrating and extending the surrounding neighbourhoods urban fabric. The new ground level allows urban network continuity and pedestrian access to the riverfront. The project creates a new place for the city facing south, the extension of the garden "*Jardim 9 de Abril"* offers more panoramic views, a good place to look at the estuary but also for big cultural events. This new public space faces the larger container terminal in the country where citizens will have the opportunity to enjoy and contemplate the port activity.

The building stands on surface owned by several landlords. The success of this project depends on the integration and articulation of governmental Traffic Office, Municipality, Port Authority and Railway Co. Several Port Cities are involved in the development and implementation of new models to overcome difficulties and achieve agreement between institutions.

Port Authorities seek profitability and efficiency of transportation while Municipalities promote the improvement of their citizen's quality of life. Trough the implementation of these projects they both win, since the port pleases the public with the creation of waterfront public spaces at the p0ort area and the city in return supports the necessary transformation required by the port activity growth. It is a "win win" situation where main city and port work together for their own purposes.

The project stands for mainly three reasons: Barrier/ Access / Meeting Point.

The barrier effect is deluded by the difference of level of these different flows of urban mobility. Access between the consolidated urban fabric and the surface of the port allow the city to re-establish the relation with the water. The extension of public space, at the river, brings people to gather at the site creating a meeting point.

5.1 Barrier

Back in 1994 when the first marina was regenerated for bars and restaurants, the citizens of Lisbon experienced its closeness with the river; this was reinforced later by Expo'98 urban project. The two first urban approaches towards the river, despite its great success amongst Lisbon inhabitants and visitors, did not achieve any further consequence within the city. Waterfront redevelopment did not promote urban integration but contributed instead for a further segregation within the city.

Dock's regeneration and Expo'98 interventions did not succeed to eliminate this barrier set up between port and city, it still is the fundamental issue for this central area of the city. Thinking riverfront have been evoked by several authors, media, common citizens and politicians who discuss the train traffic line and the intensive traffic road and consequently the barrier effect existing between city and river.

5.2 Access

Tejo River and city have not always been detached. At present accessibility is a central problem of the area, passenger's cruises are growing every year, the largest Portuguese Museum continuously registered a reduce number of visitors when compared with the number of tourists, visiting other museums. Future Museum of *Oriente* is also crammed between train railways and port building. The surface of the port, built of platforms over the river, has recently revealed its natural vocation when receiving festivals and cultural events, such as life music, cinema or broadcasted shows on big screen TVs.

The association of the institutions, the creation of partnership and articulation of interest turns possible outstanding results, no matter imposed difficulties by on going local legislation. The leadings solution points out the goal of re-establishing the river connection to the city throughout port area. The project establishes the articulation of these facilities and institutions in a wag that site revitalization can be achieved as a whole.

5.3 Meeting point

The port area physically meets the heart of the city and it has been occupied for some decades with warehouses and port facilities. Today it constitutes a central space where programs and ideas are expected to mix urban and port activities and turn them into contemporary icons. It's one in a life time opportunity to offer the ancient city better conditions, suppress its needs as well its own facilities, bringing new value to public spaces and updating solutions continuously delayed.

We believe that the design of empty space is requested to city creation and that urban drawing must be perceived in a three-dimensional base, rather than just bi-dimensional (as usually is thought).

Public space is in the first place the space of the other. A place where differences meet and interaction between social groups exist. This place is destined to embrace several age groups: for kids playing ball, for teenagers riding bicycles, for adults relaxing, for older people chatting, solitary, lovers, families, for groups; it's a place were kisses are exchanged on garden benches, where babies are walked in their baby's strollers. A place for everybody coming from distant cultures, that physically works as a common "bridge" between them, to value the presence of the port and its cultural significance in the city.

5.5 Conclusion

From precious success experiences one can conclude that the challenge is in the identity and modernity driven by imagination. Good solutions are creative, not just about organization models of implied institutions - City-hall, Port Administration, Urban Transport's enterprise, amongst others – but also about urban drawing and architecture.

We use this knowledge to develop Tagus Platform project that engages the evolutionary process of the area and continuously reshapes the waterfront morphology. The design proposal creates at a low cost, a contemporary public space oriented towards the river. It changes an industrial zone of the city, into an immense suspended garden (green space). It makes possible the

access to the largest Portuguese museum - MNAA, to the Portuguese Red Cross headquarters, the Cruise Terminal and to the *Oriente* Museum, enhancing the whole site as a cultural hub.

It contributes to blur the barrier effect existing between Lisbon and river without affecting the road and railroad circulation of the area. The project is financially sustainable since it generates 7500*sq/m* of commerce and services, 4.150m² of parking and 11.500m² of park, in a highly congested urban area. To solve the problems of the area the proposal does not demand any governmental effort to redesign the existing infrastructures; instead, accept the situation as it is and present one solution.

Conceptually, guidelines and main goal are drawn with the transformation of the riverside and the construction of the landfill. The creation of the morphology is the central theme for the evolution of port cities. Nevertheless, one can observe from different Port Cities that the most success examples comes from the Architectural project which then implies urban design and the continuous transformation of the morphology. These dynamics work when are combined by several landlords who turned possible the project, increase value to urban life, to port, to city's image, to tourism and mainly, to people who uses, accesses and enjoys new facilities. The holistic transformation affects the heart of urban life and the idea citizens have of their own port city for tomorrow.

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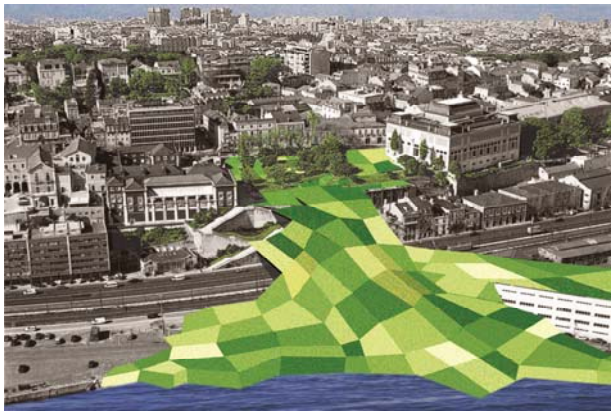

Figure 1. Perspective of the extension of the garden, seen from upper area.

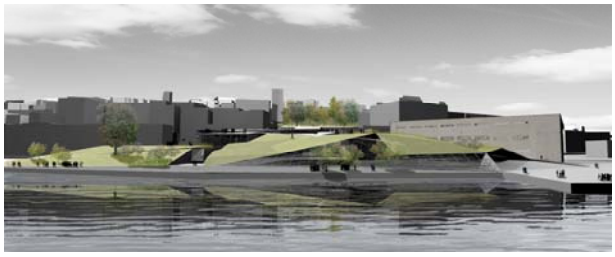

Figure 2. View of the entrance at *Rocha de Conde d'Óbidos* dockyard

Figure 3. View of Tagus Platform - an extension of the 9th of April garden

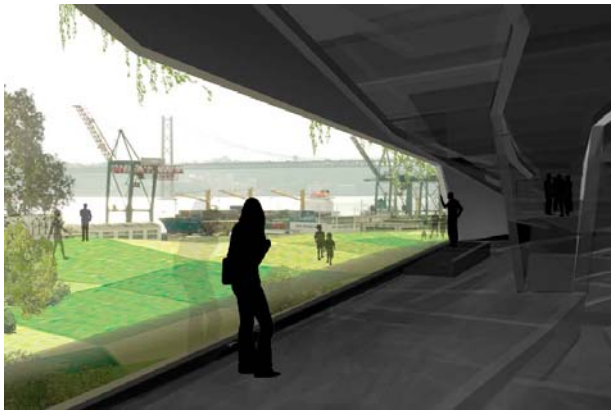

Figure 4. View from the inside looking at Lisbon port

Figure 5. View from the waterfront promenade

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The environmental agenda of local plans: a comparative analysis in the European context

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This paper presents the results of a comparative study designed to identify and characterise the environmental contents of local plans in four different national planning systems in Europe: Portugal, Spain, France and England. Our research made evident an important tension between the common framework of the European environmental policies, developed throughout the last three decades, and the profound differences between national planning systems in Europe, deeply rooted into the political and administrative country contexts, distinct past and present practices and national planning cultures. The comparative analysis seems to point out that, so far, significant differences can still be found in the way local (urban) plans integrate environmental policies. In other words, planning systems seem reluctant to adopt a common European approach, as it is the case with the environmental policy standards and instruments driven by the European Union. For how long this planning diversity holds, at least as far as environmental policies are concerned, remains to be seen.

1 Introduction

The possibility to achieve environmental goals and sustainable development processes through spatial planning systems and, in this way, proceed to a more successful environmental preservation and qualification, are motive enough for this work. In this sense, the local effectiveness of the planning system is fundamental to produce results *on the ground* in terms of environmental management and protection. The intention is not to evaluate these concrete results or to make a value judgement of system's practices, but to evaluate in what way four different planning systems in Europe have become more sensible to environmental criteria and more efficient in implementing a more ambitious environmental policy. In addition, the research allowed us to understand the nature and the extent of the differences and similarities among these particular spatial planning and environmental management systems.

The selected systems include Portugal, the main object of the study, and Spain, France and England, due to their contrasting institutional models, different administration backgrounds and different regulatory approaches.

2 Spatial planning, environmental management systems and sustainable development

2.1 The political nature of spatial planning systems

Spatial planning is based on a set of methods and actions carried out by the public sector to guide future (re)distribution of activities in space (EC, 1997; Rydin, 1998). These methods are designed to achieve higher objectives such as the rational spatial organization of land uses, or the right balance between development pressures and environmental protection addressing, at the same time, social and economic goals (Faludi 2001). Planning involves the definition of a proper set of criteria and actions to support the decision making process. This really is a political process, comprehending the real nature of both economic and social processes involved. In spite of the international and

globalising forces, national cultural and political contexts are still able, so far, to produce different planning approaches and instruments. Indeed, it is possible to identify corresponding different planning styles as refered to by Newman e Thornley (1996). The truth is that the political nature of spatial planning is reinforced by the fact that national institutional layouts frame spatial planning systems' layouts.

Spatial planning is currently focused on relations and processes rather than objects and shapes, emphasising multiple time-space concepts and comprehending diverse negotiation methods and relations within the power levels' geometry (Graham et Healey, 1999). It distinguishes itself from traditional planning by comprehending implementation, control and evaluation procedures based on permanent adjustments through experimental processes. This experimental dimension allowed for the inclusion of a strategic dimension on development plans using different political and procedural approaches to frame their formulation and implementation. Every spatial planning system tries to achieve a balance between the investors' assurance, market opportunities and public needs (EC, 1997), providing a guiding framework to decisions in uncertain and conflicting situations.

The plan evolved into a process-plan perspective adjusting methods and actions, bringing space and land to the arena of economic and social development. In complex areas such as spatial and environmental planning, policies must be understood as a 'socially built phenomena' where environmental issues take part in a broader set of social practices (Vigar and Healey, 2002). Current spatial planning systems are a result of evolution processes, progressively and systematically (re)built according to the evolving institutional and political contexts (Haases et Nuissl, 2008). The promotion and regulation of land uses is now based on other than physical considerations, and on a new attitude, looking for win-win situations and solving interest conflicts through collaborative participation.

As we know, economic considerations were the first argument for European integration but ever since things changed, like the emerging interest on spatial planning, particularly since 1988 (Shafer, 2005). Efforts in this field have been developed by the promotion of a European spatial policy through Trans-European integrated and sustainable networks, environmental policies and structural funds regulation (ECC, 2008). In addition, the recognition of economic and social cohesion as part of sustainable development within the European Single Act has been used by the Commission as a reference to promote a common European perspective to spatial planning. Gradually, community regional policy instruments tend to include spatial planning issues as a result of cohesion policies and the (re)discovery of the spatial regional policy dimension (Leonardi, 2006). Yet, as Faludi (2004) mentions, the absence of planning powers in the European Treaties can be seen as an obstacle to European planning.

Nevertheless, States seem to remain reluctant to promote a centrally guided European spatial planning policy, which might threat their sovereignty and freedom concerning land use regulations, which leaves us with a volunteer approach based on intergovernmental cooperation (Faludi 2002). Perhaps, the most important example of this attitude was the creation of ESDP, European Spatial Development Perspective, focused on horizontal coordination of sectoral policies and vertical coordination of local, regional and national policies in and between States (Allmendinger, 2003), recognising the growing importance of space in the management of Structural Funds. In this sense,

the introduction of territorial cohesion objectives opens new possibilities to ESDP, emphasising spatial planning cooperation (Faludi, 2006; Shafer, 2005). That is the case with the new European Territorial Agenda (2007) that reinforces territorial cohesion to guide development (Duhr et al, 2007) and to improve the efficiency of risk management activities mainly in flood protection, draught and desertification prevention, and integrated coastal zones and mountainous areas management (DGOTDU, 2007; ECC, 2008).

2.2 The steady convergence of environmental policies

Environmental resources possess an intrinsic and instrumental value that varies according to the social groups involved in their definition (Haughton et Counsell, 2004). In this line, environmental limits are not simple nature properties since they are subject to social order judgements and political options (Kelly et al, 2004). In any case, to avoid the risk of irreversible environmental consequences derived from consensual negotiation processes (Naess, 2001), choices must be based on sound scientific and technical knowledge. In the field of environmental management, policies have been developed throughout the years reaching a highlight point at the Rio Earth Summit in 1992. Ten years passed, the United Nations Summit in 2002 in Johannesburg reaffirmed its commitment to global sustainable development and recognised the need to joint efforts in a global era where, paradoxly, unilateral action is still a temptation (Wallstrom, 2002).

In Europe, environmental policies were absent from the Rome Treaty in 1957. Fifteen years later the first European declaration on the environment was adopted as well as the First European Environment Action Programme. Until the Single European Act there was no real legal basis for environmental policy which, in any case, did not stop the emergence of environmental laws under Articles 100 and 235, before the introduction of Article 130 (Welford and Gouldson, 1993). The new Treaty in 1992 introduced sustainable development goals in European policy assuming that "*the Community shall have as its task to promote sustainable and non inflationary growth*". As a result, the Fifth Environmental Programme addressed the roots of environmental problems promoting a broader set of environmental instruments beyond the existing ones, such as market mechanisms, sectoral-based policies, spatial planning, information, education and financial instruments (EC, 1993). Later, the Sixth Environmental Programme recognised the key role of spatial planning in environmental protection (Voghera, 2003). It also specified the goals of higher environmental protection levels and the integration of environmental objectives into other sectoral policies within the Union (EC, 2001).

In spite of these programmes and initiatives, experience has revealed a number of difficulties, such as a widespread implementation deficit of environmental management policies, a considerable distance between intentions, strategies and objectives and the practical results "on the ground" (Pinho, 1998). As Jordan (1999) emphasises, the political compromise of the EU Directives provides States with a large range of options concerning their internal practices, which explains why these Directives are preferred to other detailed regulation instruments. The attempts to reduce the gap between intentions and realities are rediscovering the potentials of the intrinsic political dimension of most spatial planning and management tools to deliver environmental protection policies (Haases and Nuissl, 2008).

2.3 Sustainability: merging spatial planning and environmental management

The sustainable development concept dominates the current political discourse and, consequently, the planning systems. It evolved since 1980 with the IUCN *International Union for the Conservation of Nature and Natural Resources*, followed by the well-known WCED *World Commission on Environment and Development – Brundtland Report*, in 1987. This concept placed growth as part of the solution instead of part of the problem, a new insight into development much more appreciated by economic agents and politicians, involving multiple definitions as well as numerous rhetoric interpretations (Haughton and Counsell, 2004). It is important though to distinguish sustainable development and sustainability. The difference lays in the fact that sustainability describes a desirable set of qualities over time, while development refers to the process to reach it. Achieving sustainability through sustainable development is more than a mere objective choice, involving innovation and new forms of doing things. In spite of the changes in priorities and criteria, the fact is that sustainable development as a concept does not necessarily lead to sustainability and it is often used in an unclear and vague way to justify both the refusal or approval of development proposals (Kelly et al, 2004; Bell and Morse, 2005).

Nevertheless, most of the new approaches to spatial planning are based on the sustainability concept and, at the same time, on the environmental quality promotion (Gunder, 2006) which are not necessarily compatible, in practice. Sustainable development fosters a new approach to spatial planning, producing different responses to the Environmental Agenda supported on three types of instruments: pollution regulation, spatial planning and environmental assessment. The key question is whether it is viable or not to combine economic growth and social equity within a framework of environmental restrictions (Rydin, 1998; Kelly et al, 2004) which brings us back to the political nature of planning and environmental conflicts. Spatial planning is particularly sensible to the nature of environmental conflicts. Land use plans may adopt specific environmental criteria to select development proposals accordingly. In fact spatial planning has been in many occasions, and throughout the years, the only and oldest environment defence mechanism, through zoning, classification and regulation to protect natural and cultural heritage, to promote protection areas and green parks. As an interactive process, development control is based on land use regulations and environmental zoning to promote development and protect the environment (White and Richards, 2007). As an environmental management tool it goes also beyond current pollution control practices or simple and cosmetic natural environment improvements.

2.4 The urban scale of sustainable development

The Environmental Agenda is also a priority in urban planning. The concentration of population and economic activities in urban areas brings along complex environmental problems both physical and ecological or social and economic. The former problems include air and water pollution, land consumption and ecologic dysfunctions. The latter include decaying built environments and social relations. Traffic congestion, racial discrimination or financial crises have a significant effect over urban centres (Hall and Pfeiffer, 2000). On the other hand, generalised income increases creates new demands and pressures over land and over energy consumption, favouring urban sprawl,

commuting traffic and increasing soil permeability problems. But urban sustainability is contradictory in itself since environmental resources do not confine to an urban area, spreading well beyond its limits (Healey, 2003).

Redclift suggested already in 1993 that global level environment management is impossible without significant progress in local sustainability: the truth is, current urban problems cannot be solved by conventional solutions. They need actions responsive to the urban scale and adapted to local circumstances. In this sense, sustainable cities became central to sustainable global development (Pinho, 1995), promoting both efficiency in energy and soil consumption, and cohesion and continuity in the urban service and infrastructure network (Priemus and Zonneveld, 2004). To achieve urban sustainability, urban policy can play an important role, dealing with issues such as low-density urban sprawl and its heavy environmental costs (Hall and Pfeiffer, 2000). This urban growth and sprawl produced new “city countryside” relationships and new partnerships that led to integrated approaches to common territories, since frontiers are no longer clear, minimizing sustainability transference phenomena (Zuindeau, 2006). As a result, strategies based on sustainable cities are now more consistent (Priemus and Zonneveld, 2004), overcoming orthodox strategies conceived at global scale that turned out to be more difficult to connect with lower levels.

It is also important to refer that local planning instruments which support urban policies, combined with environmental ones, are now the object of European concern too. The European Commission action framework strongly supports urban sustainable development and recognises that most sectoral policies in the EU are relevant to urban development and do affect urban environmental quality (EC, 1998). One of the most interesting new instruments is Agenda 21 that, amongst others, tries to promote sustainable human settlements and to reposition planning activity through local sustainable planning instruments. Another set of instruments are development indicators and quality standards (Partidário, 2002; Dobbelsteen and Wilde, 2004), used to detect environmental pressure situations, involving the evaluation of emission patterns, cumulative effects and environmental capacity in each place.

In this sense and when it comes to identify in which way plans integrate environmental policies, different sectors must be analised. In the case of water resource management, instruments such as Water Directive 2000/60/EC assumed an integrative attitude and a special approach to water resource management in Europe, as well as a more efficient economic valuation of water resources (Kallis and Groot, 2002; Carter and Howe, 2006). It established amongst others, natural territorial boundaries, like river basins, for plan preparation purposes. Water resource management also refers to water distribution and sewage drainage networks design, including urban growth and urban hydrology. Major concerns comprise water supply quality, floods and droughts (Narcy, 2003; Kallis and Groot, 2002) which leads us to a better risk evaluation of settlement in flood areas (White and Richards, 2007), new water treatment infrastructures and soil permeability recovery strategies (Narcy, 2003), as well as coastal area management and protection (Midlen, 2006). An also important sector in environmental policies is solid waste treatment and disposal, both urban and industrial solid waste collection and treatment, and its territorial location, since these facilities produce strong environmental and social impacts in local terms.

Air quality and noise pollution are also sectors to integrate in the spatial planning system. In the case of air pollution, local plans find it difficult to deal with this problem since most air quality programmes are developed at national level and local populations do not have a real perception of the associated risks (Petts, 2005). In what concerns noise pollution, actions taken are mostly directed to environmental zoning in order to separate noise-polluting uses from sensible uses, but they also include conditioning buildings, public space and road network features (Stone, 2005). These sectors also involve transport and industrial regulation and environmental licensing. Environmental zoning is also used to ensure nature protection and conservation through land classification, in order to preserve green areas, biodiversity, landscape, forests and agriculture. Europe is now emphasising ecological networks to protect places and species (Jongman et al, 2004) using legal instruments like Natura 2000 or Directive Habitat EC/92/43. Also concepts, such as green corridors, are being reused to protect environmentally valuable areas (Haughton and Counsell, 2004).

Besides the sectoral analysis, two intruments, different in nature, were included in this study. The first one was Environmental Impact Assessment as an important instrument to bring environmental criteria to the spatial planning process. The Directive EEC/85/337 reviewed by Directive 97/11/CEE established mandatory EIA. Its contribution to spatial planning is attached to the possibility to introduce corrections and alterations to development proposals in the early phases of their conception. The second one was Strategic Environmental Assessment (SEA) of plans and policies, regulated by the Directive 2001/42/EC. Among other plans and programmes it deals specifically with the environmental implications of spatial planning instruments and their infrastructural projects, supporting a more sustainable decision making process (Fisher and Seaton, 2002; Fisher 2003). SEA is a pro-active mechanism that uses environmental reports to propose mitigation measures, alternatives and supervising methods to plan implementation (Carter and Howe, 2006).

3 Comparative analysis of environmental policy integration in four planning systems[34]

3.1 Planning Systems

In order to reach our objective and identify environmental policies integration in local plans, a characterization matrix (table1) was defined to present the main guidelines for the analysis of the selected cases. This analysis involved the general structure of spatial planning systems, including their genesis, evolution and their current framework, especially in what concerns local instruments, as well as the contents of environment management systems and their supporting institutional frame. Five environmental sectors were selected and their policy instruments and integration mechanisms in the respective spatial planning system under analysis. Those were water resource planning and management, solid waste treatment and disposal, air pollution, noise and sound pollution, and nature and natural resources conservation. The analysis also included environmental impact assessment and strategic environmental assessment.

[34] This analysis is based on direct reading of Portuguese, Spanish, French and English legislation which is not presented in the bibliography due to its extension. It is also based on four important references: EC/P, EC/S, EC/F and EC/UK (2000).

Table 1. Planning systems' characterization matrix

Country Contexts	Dimensions	Typologies	Integration	Urban Scale	Local Instruments
Portugal	Economic	Institutional system	Environmental criteria	Implementation	Local A21
Spain	Environment			Integration	Indicators
	Social	Levels	Classification	Flexibility	Standards
France		Contents	Protection areas	Continuity	Sectoral instruments
	Sustainability	Integration	Environmental zoning		Market instruments
England	Politics	Legal frame		Spatial models	Information
	Policies	Spatial planning		Sustainable city	
		Licencing		Compacity	
	Criteria	Pollution regulation	Sectoral policy	Urban sprawl	Water
	References	Environmental legislation	Coordination		Solid Waste
				Energetic efficiency	Air pollution
		Promotion	Development model		Noise
		Regulation	Spatial model	Land consumption	Nature conservation
		Control			EIA
				Regeneration	SEA

From the comparative analysis some relevant facts emerged. The first one is that spatial planning systems are based on administrative structures and deeply influenced by the political framework of each country, which produces different planning instruments and approaches at different levels. The weight of cultural and socio political backgrounds and the difficulties to acknowledge procedure changes contribute to spatial planning systems inertia, creating significant obstacles to a quicker convergence process. These facts are motive enough for change to happen slowly and carefully when it comes to new contents, objectives and regulations, and explains the systems' instrumental and operational diversity: different instruments and operational approaches, absorbing EU directions differently, with significant differences in the way local (urban) plans integrate environmental policies.

The studied cases (table 2) present legal framework differences whether in the laws' nature, policies and plans mandatory capacity, or in land and property legal rights. In regulatory systems, with mandatory local plans, development rights become a natural consequence and do create edification expectations. This explains the political nature of spatial planning since, in practice, politicians determine plans' aims and guidelines, driven by economic and social development goals, which end up justifying the territorial distribution of benefits, equipment and infrastructure. The political nature of the process is real, and indeed spatial planning systems are associated to the exercise of power.

Table 2. Comparative synthesis of spatial planning systems

SPS	Typologies	Property	Local Plans	Other Instruments	Integration
Portugal	Centralized state No regional government: Levels: national, regional and local. Regional administration: deconcentrated state services. Plan hierarchy: contents compatibility, government ratification. Previously determined execution systems.	Local plan: mandatory. Local plan produces development rights. Public participation: during plan elaboration. PDM determines legal conditions to property use through qualification and classification.	Land use classification: urban and urbanization area, rural areas (agriculture, minerals and forest). Qualification: based in dominant use and use compatibility. Local plans: urban perimeter Intermunicipal plans and territorial plans Plano Director Municipal -PDM Plano Urbanização - PU Plano Pormenor - PP Planning permission: conformity to plan.	Programa Nacional da Política de Ordenamento do Território - PNPOT Plano regional de Ordenamento do Território - PROT Reserva agrícola Nacional - RAN and Reserva Ecológica Nacional – REN Sectoral plans Planos especiais	Regular Plan review PDM, PU E PP: conditioning plant identifies servitudes and public utility conditions according to sectoral plans. Technical grounding determines plan and programme integration. Multi sectoral supervising commissions.
Spain	Regionalized State: regional autonomy (different degrees). Levels: national, regional and local. Decentralized legislative competences. Plan hierarchy: contents compatibility. Previously determined execution systems. Different local plans according to settlement model.	Local plan: mandatory. Local plan produces development rights and obligations. Private execution of public urbanism. Public participation: all phases of the planning process. PGOU determines legal conditions to property use through qualification and classification.	Land use classification: urban and urbanization areas(programmed and unprogrammed), non urban areas. Planes Especiales - local Plan General de Ordenación Urbana Normas Complementares de Planeamiento Municipal - NCPM Normas Subsidiarias de Plan.Municipal Proyecto de Delimitacion de Suelo Urbano - PDSU Programa de Actuación Urbanistica Planes Parciales (PP) Estudios de Detalle - ED Proyecto de Urbanización - PU Planning permission: conformity to plan.	Plan Nacional Plan Director Territorial de Coordenación - PDTC Plan Director de Infrestructuras - PDI: not a SPS instrument Plan Especial regional - PEr Regional incentive policy SEPES: acquire and prepare land; land reserves.	Regular Plan review. Plan amendment. “Convénios Urbanísticos” Public-private agreements “Conferencias Sectoriales”
France	Decentralized unitary. Levels: national, regional, departments and local. Departments have no planning power. Independent local government. Complex structure; parallel organs. Regulamentar system; little discretion,; development control through conformity. No previously determined execution systems .	Local plan: mandatory. Local plan produces development rights. Expecting land and retention penalized. Edification rights transference between soil parcels. Certificat d’Urbanisme: defines legal conditions on land, besides “urbanisme” rules. Little public participation; public enquiry during elaboration.	Land use classification: urban and urbanization rural, natural and forest. Plan Local d’Urbanisme - PLU: Projet d’Aménagement et de Développement Durable -PADD Cartes Communales – CC Plan de Sauvegard et de Mise en Valeur - PSMV Zones d’Aménagement Concerté ZAC: urban zones in PLU Zones d’Aménagement Diféré – ZAD Planning permission: conformity to plan.	Schéma National Schéma de Secteur Shémas Regionaux Schémas Directeurs d’Infrastructures Directive Territoriale - DI Sectoral plans Contrat de Plan État-région Schéma de Cohérence Territoriale - SCOT Schéma Directeur d’Amenagement et d’Urbanisme – SDAU	Regular Plan review Planning missions: inter-ministerial character. ZAC: flexibility according to PLU. Rigid system; allows negotiation based in regulation interpretation.
England	Unitary and centralized. Levels: national, regional and local. Central departments and ministries, RDA and Regional Assemblies, local authorities and quangos. Discretionary nature: other material considerations; substitution and mitigation measures. No previously determined execution systems.	Local plan: indicative. Local plan doesn’t produce development rights. Publicizing and public participation in development plans. EZ and SPZ – exceptional instruments, produce development rights.	Land use classification: large number of use classes based in dominant use urban (qualification). Development Plans – DP; Unitary Development Plans - UDP Supplementary planning documents Structure Plans - SP e Unitary Development Plan I - UDP I Local Plans - LP e Unitary Development Plans II - UDP II Enterprise Zones - EZ ; Simplified Planning Zones - SPZ Planning permission: according to plan and other material considerations.	No national plan Green belts Planning Policy Guiding Notes - PPG and Planning Policy Statements - PPS Regional Planning Guidance - RPG and Regional Spatial Strategies - RSS Strategic Planning Guidance - SPG Sectoral plans	Regular Plan review. Technical grounding of DP proposals. Inter-ministerial Office for state level integration.

It is clear that each institutional framework produced instruments at national, regional and local level, though with different centralization and autonomy. Two distinct models are centralized and regionalized systems. Portugal and England spatial systems portray relevant roles to local authorities and are currently developing decentralization efforts beyond State central services deconcentration.

France sets the example for decentralized unitary State with reasonable regional and local autonomy, though in a lesser degree than Spain, where regions are really autonomous.

Differences are also explained by the fact that, though spatial planning systems are strongly influenced by administration structures, in some cases does not exist a direct connection between planning and administration levels. In the four studied cases all three planning levels (co)exist but the French system is connected to a four level administration structure while in Portugal and in England regional plans exist but regional administration does not. Other important differences are related to the existence of a single type of local development plan, as in the Portuguese case, or the existence of different types of plan according to settlement dimensions, as in France or Spain. In the English case, large settlements are also the object of different types of planning instruments. The same happens in plan implementation. Portuguese and Spanish planning systems define implementation procedures to ensure greater guarantees to the plan efficient implementation and equity criteria integration through cost benefit distribution. Though, these pre-defined systems can contribute to a higher rigidity in practice, which does not happen in England due to its' indicative nature. In France the absence of these procedures justifies systematic introduction of new regulation, producing a complex result.

These differences are quite understandable in different planning contexts but one must recognise that this diversity in planning instruments produces major difficulties to the development of common approaches to local planning. In spite of these differences we can also identify common aspects. One of them is related to land use regulation as the basis of development proposals approval (or not). Permit granting is common to all systems and provides an important control instrument, though rather discretionary in the English system, where "other material considerations" allows for the introduction of a wide range of other criteria. In the other three cases, strong mandatory regulation ensures a licensing process based on proposal appraisal according to criteria defined in the local plan. This provides transparency to the process but in some cases turns into a barrier to seize development opportunities.

Another common aspect has to do with gaps in vertical and horizontal communication between institutions. The absence of the regional administration in Portugal and England represents a major difficulty to vertical integration. In Spain, a regional strong autonomy is responsible for integration deficiencies and competition between administration levels. In the French case, institutional complexity and function duplication produced a fragmented planning system. In Portugal and Spain the plan hierarchy ensures that compatibility conditions are respected and transposed between planning levels. In England the interministerial cabinet ensures part of the horizontal integration and is gradually granting regional power to ensure vertical integration. Flexibility mechanisms are becoming more important and represent an effort to reduce the planning system inertia and improve its capacity to keep up with societal evolution. In Portugal, the submission of technical arguments in development proposals included in urbanization plans or detail plans can be used to introduce changes in the local development plan review process. In Spain flexibility is achieved through public private agreements signed in urbanistic "convenios" and France chose negotiation strategies in "urbanisme concerté".

3.2 Environmental policies

When it comes to environmental management the situation is quite different. While planning systems seem reluctant to adopt a common European approach, there is a tendency in member States to develop common environmental policy approaches and instruments, resulting from EU Directives transposition. Natural resources protection and management mechanisms are developing rapidly, favoured by better information and perception of environmental problems and sustained in scientific and technical criteria, which evolutionary nature is easily understood and accepted. These differences between systems explain the variety in the ways local plans absorbed environmental protection contents and in the way they bring that protection into practice. To prove it, several tables were developed comparing spatial environmental contents in the planning systems, each referring to a specific environmental dimension.

Water resources

With respect to water resource management and protection (table 3), local plans are mainly concerned with water distribution and sewage drainage networks and treatment facilities, closely attached to the urban structure and street network, leaving aside urban hydrology. In this sector, the local planning system is mainly concerned with infrastructure design and capacity definition, using project reference values that depend on the territorial type of settlement. Curiously, the Portuguese system refers to the rain water drainage network integration in the urban structure using green and public spaces. Other matters are also the object of attention through sectoral regulation. The public water *dominium* concept is present in every case, except in the English one. Its protection is mainly assured through administration servitudes and rights of way that prescribe conditions to development proposals, which are then reproduced in local plans. The extension of the areas subject to these servitudes varies from 50 to 500 metres, being the Portuguese case the most ambitious one. Though the protection of such areas is most relevant, pre-established reference values for protection buffers may not respond to local particular circumstances and are often a source of conflicts.

In the water resource management and protection sector, further important matters are water quality, floodable areas and coastal areas. About water quality, scarcity, aggravated in the Spanish case by strong spatial distribution heterogeneity, explains the effort in water resource management in all cases, especially since problems with underground and superficial waters contamination are becoming more and more serious. Criteria for water classification according to its uses, or sewage drainage and treatment, are mostly based on EU Directives, setting restrictions to development proposals that are transposed to the local plan. The reference standards are the same, based on public health guarantees, but recognising that different development models produce different impacts over water quality. A singular aspect has to do with the establishment of special quality conditions in draught situations, currently more and more critical due to climate change conditions.

On the other hand, floods are also part of this climate change. Floodable areas are evaluated in all cases but present different physical boundaries. Portugal uses 100 metres, or a 100 years period for flood flow evaluation, to define these areas, whereas in France the limit reaches 300 metres. England and Spain also refer to variations in water volumes related to flood flows. These areas are identified as risk areas in local plans, which will ensure use and activity compatibility

evaluation for every development proposal under these conditions. In the Portuguese case, floodable areas must be identified for each municipality affected by this problem, and must be integrated in the local plan during its preparation or review. In the French case the “code d’urbanisme” defines special measures and conditions to development in areas surrounding water courses. All the cases assume that physical characterization and hydrological regimes are set based on the definition of protection areas.

Table 3. Water resource management

	Public Water Dominium	Floodable areas	Water quality	Local plan	Coastal zones
Portugal	River basin as territorial unit. Land regulation around water; water servitudes; public interest restrictions POAAP: protection zones up to 500 m; 50 m reserved areas (no building allowed). Plans for classifiealbufeiras: use and activity regulation. Plans for river basins. National water Plan (coordination). Portuguese and Spanish common river basins.	Classified risk areas: areas correspondent to 100 years flood peak flow; edification restrictions. Hydraulic protection infrastructures. Mandatory floodable areas maps in municipalities (100 metres or 100 years flood water volume) included in local development plan. Rain water drainage systems included in local plan. Soil natural permeability restoration.	EU Directives: water quality and treatment (consumption and disposal). Criteria according to land use (classes A1, A2 e A3) and water use (public health standards). Water sources protection Identified in local plans. Special conditions for draught periods: priority to human consumption. Multimunicipal systems (scale economies): public private partnerships	PDM identifies water treatment and distribution networks. Local authority approval of network design according to local plan. Rain water network integration: water retention basins (green and public spaces.	Coastal plan: use classification; regulation and restrictions included in the local plan. Protection areas up to 500 m also include in REN. Interdiction to vehicle and boat circulation outside allowed areas, waste deposits prohibition. Settlement rules: edification parted from coast line, already existent settlement consolidation: building prohibition in natural areas between, in natural drainage areas or erosion risk areas. Perpendicular access to coast line; parking lots. Permeability restoration; natural vegetation. Beach plans.
Spain	River basin as territorial unit. Restriction along rivers lakes and lagoons. Servitude areas (variable): 5 metres construction prohibition; 100 m “police” areas, construction conditions. Hydrologic National Plan. Water management plans. Transvase (EIA) and alternative projects (scarcity). River basin Plans: use compatibility. Special protection zones.	Defined by basin institutions. Restrictions to occupation according to risk measurement identified in the local plan.	EU Directives: water quality and treatment (consumption and disposal). Criteria according to land use and water use (public health standards). Water sources protection Identified in local plans. Special conditions for draught periods: priority to human consumption. National Plan for water treatment and disposal Water re-use.	Water infrastructure in special plans appears in local plans. Local authority approval of network design according to local plan.	Erosion prevention - servitude areas (100-200 m): construction prohibition (housing, roads, activities), sewage disposal restrictions. Traffic servitudes for surveillance activities (6-20 m). Protection areas 500 m minimum: edification restrictions adapted to local plan. Permanent and non-permanent reserve areas. Beach equipment definition.
France	River basin as territorial unit. Guiding schemes for water and basin management also developed by local authorities. Environmental interesting wet zones protection. Public servitudes around rivers; activity and use restrictions.	Code d’urbanisme: 300 m protection areas: edification prohibition (housing and road9) combined with SCOT, PLU ou CC restrictions. Passing servitude of 3 m. Natural risks prevention schemes. Hydraulic mobility protection areas: natural circuits.	EU Directives: water quality and treatment (consumption and disposal). Water sources protection Identified in local plans. Special conditions for draught periods: priority to human consumption. Ecosystems preservation.	Water quality preservation and salubrity measures in local plans. Urbanization continuity in riverside settlements. Technical justification for construction in restricted areas.	DTA, articulated with PLU and CC regulate land, water and wet areas use. Urbanization continuity in existing settlements. Outside urban areas 100 metres building prohibition zone (may be aggravated by PLU restrictions) Road restrictions in 200 m areas. Beach and natural coastal spaces schemes.
England	River basin as territorial unit. Local authority participation.	Floodable areas maps according to tides and water volume peak flows. Risk areas identified in the development plan. Technical justification of building and infrastructures: risk assessment in licensing. Avoid coastal protection infrastructure.	EU Directives: water quality and treatment (consumption and disposal). EA: Water sources protection; sewage discharges control; sewage treatment control. Sectoral consultation on licensing in 500 m around industrial sites.	LP and UDOII: restrictions on development to ensure water protection (proposals map), restrictions as material considerations in planning applications appraisal.	Classified coastal areas according to local authority and identified in the local plan (natural hydraulic processes, flood areas, erosion areas, tides). Physical limits depend on local conditions. Urbanization continuity in existing settlements. New construction restriction to absolute need of water use. Port areas rehabilitation.

Coastal areas represent another concerning issue, due to global coastal line erosion and retreat, aggravated by strong economic and urban development pressure, which led to the reinforcement of protection measures in these areas. The extension of coastal areas under protection varies in each country, depending on natural conditions and settlement models, but in all cases new territorial occupation models are proposed, models favouring the consolidation of existing settlements, the preservation of natural areas between them, avoiding the construction of infrastructures parallel and close to the coastline.

Waste management

In the case of waste treatment and disposal (table 4), EU Directives also performed an important role determining similar national waste management policies, respecting common principles to define treatment methods and the location of treatment and disposal facilities. Also important is the fact that distinct procedures exist to treat dangerous or industrial waste. Regional level intervention is relevant in Spain and France, while in Portugal and England is the local level that deals with these matters. In the Portuguese case, scale economies justify the development of multi-municipal systems.

In all cases, impacts in areas surrounding waste facilities must be evaluated and mitigated according to local plan guidelines and regulations. This is the least explored sector in spatial planning: the plan simply absorbs public rights of way and servitudes determined by environmental regulation, or defines proper integration for waste collection points and routes. The English case presents a singularity since it includes local waste management plans integrated in the development plan. Gradually this situation is changing due to the growing population awareness of waste facilities local impacts. These are pressing local authorities to participate in the process presenting, in the local plan, alternatives to site location based on use compatibility criteria. General standards and strategies make sense at national level but location clearly is a local problem.

Table 4. Waste management

	National level	Regional level	Local level	Dangerous waste
Portugal	EU Directives. Waste management: collection, transport, valuing and disposal. Recycling: selective recollection and re-use strategies. Co-incineration under study. Closing traditional waste facilities.		Local plans present restrictions to waste facilities location and methods, subjected to local approval according to local plan. Servitudes around waste facilities dictate restrictions: facilities 2 km apart from population settlements. Cumulative effects evaluation: 25 km distance between waste facilities. Multimunicipal systems for waste management (scale economy). Public-private partnerships.	Industrial and dangerous waste has specific management systems including separate recollection, treatment and disposal.
Spain	EU Directives. The polluter payer principle. Prevention at the origin. Re-use and recycling. Waste national plan. Co-incinerations: restrictions to air pollution emissions.	Special plans include waste infrastructure management. Autonomous communities define edification, location and management rules for waste facilities. Impact minimization. Integrated systems for waste valuing and management.	Facilities location and treatment methods approved by local authorities according to waste management plan oan the local plan. Ordenanzas to regulate local recollection (selective) and site location (non urban areas). Selective recollection in settlements with more than 5.000 inhabitants.	National plan for industrial waste and National plan for dangerous waste. .
France	EU Directives. Coordinated disposal facilities network . Waste management: collection, transport, valuing and disposal. Recycling: selective recollection and re-use strategies. Energetic valuation. National waste plan. Waste classification and treatment Closing traditional waste facilities.	Listing of facilities. Technological risk .prevention plans: exposure risk perimeters determine prohibition and use restrictions. Population protection measures.	Land development schemes must include waste disposal regulation.	Industrial and dangerous waste have specific management systems. Public servitudes around dangerous waste deposits: 200 m area around with building prohibition or restrictions. Servitudes included in the local plan.
England	Prevention at the origin: volume reduction, recycling, proximity and self-sufficiency criteria.		Facilities necessities evaluation in DP: quantity, dimension and location. Areas defined in LP proposal map Planning Conditions: facilities control. Waste Local Plans prepared at county level; management by local authorities. Each site has a Site Waste Management Plan. Licensing by waste authorities based on EIA.	Mineral Local Plans: conditions about waste produced in the facilities

Air pollution

In what concerns air pollution (table 5), all countries present regulations on air quality and zoning, framed by EU Directives and linked with transport and industry regulations. Similarities in national policies, resulting from European laws, are also visible in this sector. International and national strategies are necessary since air pollution has no defined frontiers and local pollution can produce serious effects in distant places. The local plans have no relevant role in terms of global strategies, since these sectoral instruments are not clearly transposed to spatial plans, but can, nonetheless, perform an important role, monitoring and controlling land uses responsible for air pollution.

Reference standards and limit values, based on population and ecosystem exposure to pollutants and public health recommendations, are used to establish local control programmes, though this only happens at local authority level in the English case. These reference values can be used to classify sensible and mixed zones, as part of the environmental zoning included in local plans. From a planning perspective, this is somehow a passive attitude, merely absorbing restrictions associated to sectoral policies. But the plan can also be responsible for strategic change in economic dynamics and change local consumption patterns, reducing industrial and transport emissions for example. The local plan can also contemplate prevention plans, and mitigation and correction measures.

Table 5. Air pollution

	Air Quality and monitoring	Classification and SPS	Industry	Transports
Portugal	EU Directives. Alert thresholds, limit values, tolerance margin. Fixed and mobile sources evaluation. Exposure risk (population and ecosystem). Conditions on activity licensing. National plan on permit attribution for pollutant gases emissions. DRA: air quality monitoring. No systematic mechanisms to inform local authorities.	Sensible areas protection: restrictions on pollutant emissions. Pollutants regulated in settlements and critical areas. National road plan: Non aedificandi protection zones around main roads. Action plans (DRA) to deal with critical situations. Control and suspension of vehicle circulation. Industrial zones and channel spaces definition on local plan. Mitigation measures and protection barriers. Restrictions on network design according to local plan.	Previous licensing of industrial facilities with pollutant emissions. Environmental licence. Integrated pollution control and prevention. Local authority appraisal on industrial location and licensing. Class A or B facilities must locate in industrial areas defined in the local plan.	Mobile sources: restrictions on vehicle emissions. Road circulation regulation and restriction on settlements. Dangerous products circulation restrictions. Protection zones: use conditions around main roads.
Spain	EU Directives. Regional maximum tolerable values. Alert thresholds, limit values. Exposure risk (population and ecosystem). Gas emission rights commercial regime. National monitoring net.	Contamined zones. Emergency declaration: recovery action plans; use conditions and restrictions. Classification in the local plan: Public road dominium: 8m HW and 3m others. Road servitude zones: 25m HW and 8m others. Affected areas: 100m HW and 50m others. These values can be reduced in urban areas. Local plan conditions road structure and connections to local net. Road special protection plans.	Environmental licence. Integrated pollution control and prevention. Local authority appraisal on industrial location and licensing.	Mobile sources: restrictions on vehicle emissions. Road circulation regulation and restriction on settlements. Dangerous products circulation restrictions.
France	EU Directives. Alert thresholds, limit values. Exposure risk (population and ecosystem). Air quality regional plans: prevention and reduction. Restrictive conditions on special zones: determinations on SCOT, urban displacement plans and transport plans. Air quality monitoring.	Critical zones: protection plans (settlements above 250.000 inhabit; procedures in critical situations; conditions on activities and vehicle circulation. Public road dominium: road network design and areas around restrictions. Visibility servitudes. Non aedificandi protection zones around main roads: 100 HW and 65m high circulation roads. SCOT and PLU ensure air quality: road circulation regulation and restriction on settlements. SCOT: settlement and collective transport. PLU: network design. ZAC- industrial zones.	Atmosphere protection plans: production sites regulation. Special licensing process. Industrial zones conditions.	Urban displacement and transport plans: emergency measures, circulation suspension.
England	EU Directives Air Quality Limit Values Regulations, Local authority air monitoring	Local air quality action plans according to local conditions. Air Quality Limit Values Regulations: material consideration in planning applications appraisal. SP and LP: road structure design and industrial location. SPZ: industrial areas; emission control. Local Transport Plans complementary to DP.	Local air quality action plans: control and rehabilitation measures in industrial sites. IPC: critical situations; inspection mechanisms. Special authority approval to development proposals 500m around industrial facilities.	Local air quality action plans: control and rehabilitation measures in transport activities. Local transport plans: Applications appraisal in parking, accessibility. Transport assessment.

Noise pollution

Noise pollution is also an important environmental sector to analyse since noise levels are increasing, producing immediate discomfort effects on people, activities and the overall environment (table 6). This is also a sector where EU Directives produced similar approaches in the different countries,

especially in what concerns the definition of acceptable noise values compatible with different uses of the territory. These values feed the preparation of noise maps, defining different zones with different development restrictions. In Portugal and in England reference values for sensitive areas (class A) and mixed uses zones (class B) are quite similar but in England two more classes are considered (classes C and D) witch are less restrictive. In Portugal these noise maps are part of the local development plan. In the other case studies reference values are not mentioned but action plans do exist, in order to control and mitigate the noise pollution problem.

Table 6. Noise pollution

	Regulation and instruments	SPS	Activities
Portugal	EU Directives. Sound emissions regulations. Preventive actions. Sanctions. Noise measurement methods. Noise maps support local plan elaboration. Noise regulation in local plans. Classification: Sensible areas: 55 dB(A)(7-22h); 45 dB(A)(22-7h); Mixed areas: 65 dB (A) (7-22h); 55 dB (A) (22-7h).	Noise maps includes in the local plan: conditions on activities. Prevention strategies in local plans. Municipal plans for noise reduction: sensitive areas or mixed areas, admissible values – criteria for uses or activities licensing and prevention measures. Temporary noisy activities: special licensing by local authority. Acoustic treatment on buildings: acoustic comfort for different uses.	Vehicle noise emission control. Non aedificandi areas around roads (national road plan). Sensitive areas: noisy activities, prohibition, traffic restrictions. Mixed areas: condition according to admissible values.
Spain	EU Directives. Local competence on noise ordenazas approval: critical areas classification; infrastructure and acoustic servitude zones. Acoustic areas: population and ecosystem exposure. Noise maps; competent authority approval. Special acoustic protection zones (corrective measures). Special acoustic zones: critical situations.	Action plans for acoustic correction and priority measures to sensitive areas in local plans. Construction and activity licensing according to land use and sensitivity classification defined in noise maps and local plans. Edification acoustic regulation: acoustic comfort. Special protection measures around hospitals, schools, housing and culture sensible activities.	Acoustic servitude zones: aggressive emissions (transport infrastructures and equipment). Environmental integrated licence. Special road protection plans: use restrictions in surrounding areas. Security criteria.
France	EU Directives. Noise admissible levels. Noise prevention plan: population and ecosystem exposure. Noise measurement methods. Noise map to transport channels in settlements.	Local plan regulates according to noise prevention plan. Local plan promotes prevention and suppression of noisy activities (restrictions). Edification acoustic regulation: acoustic comfort.	PLU defines street and road network features to improve public transport; and edification conditions around. Noise maps: conditions on industrial licensing.
England	EU Directives SP and LP: sensible uses apart from noise sources; noisy activities in non sensible areas; proposal map. Classification A – noise is not determinant: 55dB (7-23h) and 45db (23-7h) B and C – mitigation measures: 55-63-72 dB (7-23h) and 45-57-66 db 823-7h) D – Reproves: 72dB 87-23h) and 66dB (23-7h).	USE OF planning conditions and planning obligations to solve compatibility issues. Noise levels are a material consideration in planning applications. SP and LP: sensitive use classification in proposal map for activity licensing. Acoustic conditions more restrictive in classified natural areas. Edification acoustic regulation: acoustic comfort.	Noise Work Regulations and Civil Aviation Act: limits activities. Local authority controls noise pollution in industry. Special authority approval to development proposals 500m around industrial facilities

Local planning instruments can guide development to specific areas separating noisy activities from sensitive uses. The Spanish system recognizes special acoustic zones and uses “ordenanzas” to classify areas according to use and noise sensitivity. English Local Authorities consider noise as another “material consideration” in development control and use planning conditions and planning obligations to mitigate critical situations.

Noise sensitivity classification informs the spatial planning system at two levels: on one hand it is used in the licensing process and, on the other, supports environmental zoning during plan preparation through noise maps, integrating information from industrial and transport regulation as well. These last two are absorbed using pollution integrated control mechanisms since they are identified as particularly noisy activities with strong impacts over local population and ecosystems. Permit granting also uses information on acoustic quality and treatment of buildings, defined at national level according to its functions, but implemented locally through project approval procedures.

Local authorities are more aware of noise pollution since population feels its direct and immediate impacts and responds with strong social and political pressure.

Nature conservation

Finally, in the field of nature conservation it is possible to identify several protection and preservation instruments in the spatial planning systems (table 7). Local plans are engaged with natural resource protection in many ways but their main asset is land classification, distinguishing urban and non-urban soil. In this way, the local plan can ensure the control of urban sprawl, favouring reasonable compacity and consolidation in urban areas, and preserving non-urban ones, establishing a sustainable development pattern of land consumption. It also uses classification instruments, similar in all cases, allowing the preservation of green areas, habitats and biodiversity.

Table 7. Nature conservation

	SPS and classification	Agriculture and forest
Portugal	EU Directives. Protected areas national network. Classification: management plans - restrictions (or prohibition) on land use and activity proposals. Natural parks, natural reserves, natural monuments, protected landscape areas, biological interesting sites. Special protection zones. Biodiversity and habitat protection. REN: action forbidden except for national public interest proposals. Includes: 30 m area along the shoreline, 200 m around estuaries, and wet zones, 100 m area around lagoons, lakes water courses and erosion sites, floodable areas. Natural 2000: special conservation zones. POAAP protection zones articulated with Natura 2000 and REN. Mineral facilities regulation (defence zones and landscape rehabilitation). Sand extraction on rivers regulation. Coastal ecological interesting areas: dunes, rivers and wetlands. Urban and non urban soil classification protects the countryside from urban sprawl. POAP: landscape protection and valuation PDM and PU: natural resources protection (agriculture and forest, local ecologic structure). PP: rural space interventions.	Non urban land classification. RAN: agricultural quality and capacity determines soil classification - classes A and B (high capacity) conditions even on development proposals for agricultural purposes. Transcription in local plans: non urban soil. Forest spatial regional plan and forest management plans articulated with local plans: sustainable local forest and agriculture management. Municipal forest plans. Local plan identifies forest development areas.
Spain	EU Directives. National and regional laws. Natural resource planning guidelines. Natural resource plans for classified areas (restrictions on activities and land uses). National parks, natural reserves (conditions even on scientific actions), protected landscape, natural monuments. Peripheral protection zones. PGOU, NSPM and PDSU: define agricultural land, forests and green spaces (preservation measures and land use restrictions) and special protection zones. PP: land reserves for gardens and green spaces. Catalogues: classify gardens, natural parks and landscape. Habitat and threatened species recovery and protection plans: Natura 2000 integration. Ecological value special protection zones in river basins. Special protection plans for landscape, natural spaces (mountains) protection: restrictions on edification.	Non urban land classification. Special plans on urban or rural environmental improvement. Special plans for forests: conditions on uses and edification. Spanish forest plan: fire prevention and fight plans; high risk forest areas classification; reforestation and recovery plans; reclassification for other uses forbidden. Local forest plans: compatible activities; rural development and nature conservation compatible activities. Special authority approval on forest land development proposals (mandatory for classified mountains.
France	EU Directives. National parks: classified areas; land use regulation; protection zones. Reserve integral areas: stronger restrictions. Natural reserves and protection perimeters. Interesting landscapes. Habitat and threatened species recovery and protection plans: public and private action. Natura 2000 integration. Regional parks: protection plan (circulation and tourism activities regulation). Natural monuments and sites: restrictions on development proposals (PLU or CC). SCOT and PLU: agricultural, forest land and green spaces protection and preservation PLU: edification regulation on agricultural land; green spaces in urban soil. Mineral facilities regulation (defence zones and landscape rehabilitation). Sand extraction on rivers and dunes regulation. Coastal ecological interesting areas: dunes, rivers and wetlands. Forest law: mountain and dunes vegetation protection.	Rural and forest management documents guide spatial plans elaboration. Agricultural quality and capacity determines soil classification: PLU and CC reclassification rural areas subjected to special authority approval. Regional management schemes; intercomunal syndicates; sustainable management plans. Fire prevention and fight measures; high risk forest areas classification; 6 m passage servitudes. Protection forests (public interest): erosion and soil degradation prevention.
England	EU Directives. Habitat and threatened species recovery and protection plans: instruments diversity. National parks, special protection zones, special conservation areas, special scientific interest areas, national natural reserves, astounding beauty areas, environmentally sensitive areas, special landscape areas. LP and UDO I: classified areas identified in proposals map. Mineral Local Plans: impact minimization; old facilities rehabilitation: waste regulation.	LP and UDO I - Area Action Plans: agricultural soil protection. SP: avoid rural land transference for urban uses Rural settlement consolidation: life quality: rural development protection. DP: reforestation guidelines Agricultural quality and capacity determines soil classification and use restrictions - classes 1,2,3a (strong restrictions); 3b, 4, 5(if necessary). Green belts: avoid rural and forest land for urban uses and fight urban sprawl.

These designated protection areas assume a special role, developing special management plans, oriented towards the sustainable use of natural resources and are, in many ways, related to international protection legislation. Many of these classified areas are integrated in national and international nature networks such as Natura 2000. The articulation of protected spaces is a fundamental step to ensure species and habitat preservation and ecosystem balance. This is true

particularly in the continental cases, due to their natural physical continuity and the influence of European laws in this matter. Nevertheless, England also presents strong guidelines in this matter, due to their traditional attitude towards countryside and landscape protection.

Nature conservation strategies also include agricultural land and forest preservation. All case studies possess protection instruments oriented to rural areas in order to ensure that good agricultural land does not end up being occupied with other activities than agriculture itself. (Re)classification of land uses in these areas is something that all the planning systems try to avoid and prevent, distinguishing clearly urban and rural or non-urban land. This is also true for forest areas. These areas are defined at different planning levels and classified as special or critical areas. Local plans assume an important role as sustainable management tools (in Portugal there are municipal forest plans), particularly important when it comes to fire fight and prevention, since forest fires are increasing in frequency and magnitude affecting, in particular, Mediterranean countries in Europe. Portugal and Spain extended protection measures to land affected by forest fires to ensure that its (re)classification is not allowed in the short or medium run and, in this way, contribute to fight the criminal destruction of natural resources. Other singular aspects are the French protection forests to stabilize soil and prevent soil erosion, or the English green belts containing urban sprawl and ensuring a green proximity environment to the urban population.

EIA and SEA

As mentioned before, besides environmental sectoral instruments, analysis of EIA and SEA procedures where also the object of this work. Environmental assessment whether of projects or of plans and programmes is a very important tool to support the spatial planning system. EIA processes in different States were drawn from EU Directives but, in spite of this common original reference, they still present differences, both in the range of its application and in the timing of its implementation. Yet these differences are disappearing and the environmental assessment systems are becoming similar, increasingly. This evaluation process provides an independent instrument able to bring environmental concerns and corrective measures to project design and plan preparation.

This independent instrument is used in the French system in a rather transparent way, without subverting its nature and its supporting role to the decision making process in the spatial planning system. That seems not to be the case in Spain, where a somehow discretionary attitude led to a different use of EIA facing the public or the private development proposals. In Portugal, the mandatory character of the EIA declaration reinforced EIA's role as a complementary instrument to the licensing process based on the local plan, and introduced the possibility to improve projects in early phases of the development process, using environmental criteria. Evaluation conditions are more restrictive in classified or protection areas. Also the inclusion of post evaluation procedures strengthen the whole EIA process. France also presents an interesting feature in this field since EIA applied to transport infrastructure includes a cost analysis in terms of pollution and induced advantages, in order to internalize environmental costs in project evaluation.

Table 8. EIA and SEA processes

AIA	AIA	SEA	SPT
Portugal	EU Directives. Large range of projects subjected to EIA. Several dimensions included. Project characterization, local conditions, local affected environmental assets, predicted emissions, monitoring programmes. Environmental Impact declaration (mandatory): favourable or conditioned approval (alterations and mitigation measures). Classified areas: aggravated evaluation conditions.	Recent approval of legislation on territorial plan and programmes evaluation. First steps.	Support decision making process. Support licensing process of major development proposals and infrastructures. Sustainability contents appraisal.
Spain	EU Directives. Large range of projects subjected to EIA. Several dimensions included. Differentiated attitude towards EIA criteria application on private or public development projects.	Legislation approved in 2006 on territorial plan and programmes evaluation.	Support decision making process. Used as planning and management instrument. Sustainability contents appraisal.
France	EU Directives. Reports on predicted effects: original state and alterations. Prevention and mitigation measures. Transport: pollution and advantages cost benefit analysis.	Code d'urbanisme: environmental appraisal of DTA, SD, SCOT and PLU.	Support decision making process. Support licensing process of major development proposals and infrastructures. EIA contribution for local plan revision. Sustainability contents appraisal
England	EU Directives Environmental Statement: predicted effects; prevention and mitigation measures alternatives evaluation. Material consideration on planning applications.	Environmental Appraisal of DP: EIA principles applied to development plans. Environmental criteria integration.	Support decision making process Material consideration on planning applications Sustainability contents appraisal.

SEA provides a broader perspective, assuming a pro-active role in plan and programme preparation, using environmental criteria as well, but in this case to evaluate and (re)formulate spatial plans and sectoral programmes, and their sustainable and strategic nature. Interesting is the fact that the French "code d'urbanisme" already included environmental criteria in zoning definition in local plans and promoted the appraisal of the impacts of spatial planning instruments and mitigation measures, as well as the overall integration of the different instruments. The English system also includes environmental appraisal of development plans in a pro-active manner, anticipating scenarios and solutions and introducing changes in plan contents wherever necessary.

4 Conclusions

The objective of this research was to evaluate in what way planning systems, particularly local plans, have become responsive to environmental criteria and more efficient in implementing a growing ambitious environmental policy. From the analysis of the cases studied, we were able to conclude that local planning system seems to work better when it comes to land use regulation, establishing development conditions, particularly when territory and resource boundaries can be physically defined. It was also visible that different perceptions of the environmental impacts produce different ways of dealing with the problem.

But the main conclusion that resulted from this study has to do with the fact that though convergence is identified in environmental management systems, significant differences remain in spatial planning systems. The study allowed us to verify that, in spite of the resemblances and the effort to reconcile environmental policies at different levels, significant differences persist in the way local planning systems absorb and promote environmental protection: the shape of planning systems has not converged in the various States, even though environmental guidelines are the same. Our research showed a visible tension between the common framework of the European environmental policies, developed throughout the last three decades, and the profound differences between national

planning systems in Europe. The weight of institutional systems is still heavy, combined with a sence of sovereignty facing EU incursion, where the involved parts do not assume themselves as a geopolitical entity in its full extension, justifies the limitations that do exist around the introduction of relevant changes in the spatial planning systems.

In terms of environmental management the attitude is different, more open to change and we can perceive similarities at national level in most of the sectors studied, as a result of the increasing transposition to national legislation of EU Directives. These similarities are explained by the nature of these issues, which are more technical and less political. The final result is not a full standardization, since the transposition is not made in the same way or at the same time, and it is absorbed by planning instruments that possess different natures and objectives. So, profound differences between national planning systems in Europe still remain, where the same goals can be achieved through different paths. These differences are deeply rooted into the political and administrative country contexts, distinct past and present practices and national planning cultures. For how long this planning diversity holds, at least as far as environmental policies are concerned, remains to be seen.

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Planning and climate change: a local emissions trading scheme

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Existing policies on climate change have not been focused in land use planning and local level actions. The main objective of this study was to find a way of inducing good local practices to reduce climate change using a cap and trade programme. We have designed a market of emissions allowances between local authorities where national government is responsible to set greenhouse gases limits of emissions and removals for each local authority and to allocate them a quantity of allowances according to these limits. During the commitment period, local authorities have the flexibility to choose the best climate change mitigation policies and should return a number of allowances corresponding to the difference between emissions and removals in that period. If their policies have success and the difference between emissions and removals is less than their limits, then municipalities can bank the remaining allowances or can even sell them to other participants that exceed their limits. This system has been called Local Emissions Trading Scheme (LETS). Portuguese case was used to test the difficulties of implementing LETS. This system includes transport and land use, land use change and forestry sectors. LETS has good conditions to be implemented despite some vulnerabilities related to complexity and to the lack of information to calculate emissions from forestry. If this scheme is implemented than it can promote local policies to reduce anthropogenic impacts on climate change.

Keywords: climate change, cap and trade, local government, land use planning, transport

1 Introduction

Climate change is one of the main challenges for the humanity in the 21st Century. According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2007) human activities contribute to cause changes in Earth's atmosphere. The overall effect of those activities on climate has been a warming influence. The human impact on climate during this era greatly exceeds the impacts due to known changes in natural processes. Furthermore, the Stern Review on the Economics of Climate Change (Stern, 2007) refers that the costs associated to the damages caused by the effects of climate change in a business as usual scenario should be higher than mitigation measures.

The Kyoto Protocol establishes commitments for 2010 on the reduction of greenhouse gases emitted by industrialized countries. The European Union (EU) countries must reduce their total emissions by 8%. The Burden-Sharing Agreement redistributes this reduction among the EU countries. Luxembourg is the country with the strictest target (must reduce its emissions by 28%) and Portugal is the country that can increase more the emissions (its target is 27% above 1990's emissions). The European Union is facing difficulties to complete its objectives. In 2005, the overall reductions were around 2% (Eurostat, 2008) and even countries that can increase their emissions have already broken their targets. For instance, Portugal's emissions have increased 42%. This means that the EU Member States must put more emphasis on the policies to mitigate the climate change.

The climate change is a global threat but local and individual actions are essential to mitigate it. Combustions are the main source of the most important greenhouse gas (GHG), the carbon dioxide (CO_2) and they are needed in several moments of a common daily life (e.g. transport,

heating, electricity production). Every person is somewhat responsible for emissions of GHG and, in consequence, responsible for climate change.

Local authorities' policies can contribute to the mitigation of climate change. Cities are important producers of CO_2 and they have low capacity of storing this GHG (Whitford *et al.*, 2001). A significant part of the future energy consumption and, therefore, CO_2 emissions are preset when land use and urban form are defined (Sadownik and Jaccard, 2001). Built environment will always have a key role on sustainability (Crane and Scweitzer, 2003) but spatial organization and its impact on transportation has not been a priority for national and international authorities.

The influence of urban form on climate change is accepted in several studies. Density is defended to reduce trip distances, fuel consumption and, as a result, GHG emissions (Newman and Kenworthy, 1989, Borrego *et al.*, 2006). Land use mix associated with density is also considered an important factor to reduce emissions (Ewing, 1997, Mindali *et al.*, 2004). On the opposite side, urban sprawl can contribute to the growth of emissions.

Local authorities are responsible for land use planning in many EU countries. Land use planning is the main instrument to control physical development patterns which result on the control of CO_2 emissions and removals. They can also implement policies which can reduce human impacts on climate change in sectors like transportation (Cervero and Kockelman, 1997, Schlossberg and Brown, 2004, Banister, 2008), housing (Schmidt Dubeux and Rovere, 2007, Monni and Raes, 2008), energy (Sartogo, 1998, Tukker and Jansen, 2006) and waste management (Marmo, 2008, Mondini *et al.*, 2008).

We have chosen Portugal as a case study and we have three objectives in this paper. Firstly, we will diagnose local policies to reduce human impacts on climate change. Secondly, we will study how the Portuguese legislation affects policies for climate change. Finally, we will study a form of encouraging local policies on this matter and how to apply it to the Portuguese case.

2 Diagnosis of policies for the mitigation of climate change

In this section we will focus on the policies for climate change in Europe and in the case study (Portugal). In both approaches we will start with an overview of all policies for climate change and with an analysis of the EU's and Portugal's commitment degree.

2.1 European Union

2.1.1 Overview

One of the main policies in Europe is the European Union Emissions Trading Scheme (EU ETS). EU ETS is a cap and trade programme which covers several industries and energy plants. In this programme, member states' governments set emission goals to the entities involved and allocate them a number of allowances equivalent to those goals. At the end of each year, the actors involved should return a number of allowances similar to the emissions in that year. If their level of emissions is higher than the allowances given, they have to buy the remaining allowances to other actors or to use Kyoto Protocol mechanisms.

EU ETS only covers 39% of the European Union's GHG emissions and does not include important sectors like transport or land use, land use change and forestry (LULUCF). We must refer that transportation is the sector whose emissions have increased more in the last years.

In the future the EU is not considering including road transport and LULUCF in EU ETS.

The European Climate Change Programme refers that implementing measures on the transport sector is difficult but it is also an essential question. The recommended measures include a strategy for passenger vehicles, development of environmental efficient vehicles, a voluntary commitment for light duty vehicles manufacturers, a directive on road use and taxes, modal change, fuel taxes and air conditioning systems. Only two of them are non-technological measures. The first one (directive on road use and taxes) has been postponed and the second one (modal change) has not been defined yet (Commission of the European Communities, 2007).

EU has a main concern considering new technology as the main possibility of reducing transport emissions. For instance, the community strategy to reduce CO_2 emissions from passenger cars and light-commercial vehicles is based on three pillars: car industry's voluntary commitments (reaching the 90 gCO_2/km in 2020), consumer information (with the display of a label on fuel consumption and CO_2 emissions on all new cars) and the promotion of fuel efficient cars via fiscal measures (Commission of the European Communities, 2007). In all these pillars and, in addition, on the strategy on the implementation of bio fuels there is not an effective concern on trip reductions.

It is not true that there are not any concerns in EU on land use planning and mobility management matters. EU has strategies on the improvement of urban environment through specific measures which can also reduce GHG emissions and initiatives like CIVITAS which help cities to achieve a more sustainable and efficient urban transport system. For many authors, technological approach is important but cannot be the only way of reducing transport emissions (Crane and Scweitzer, 2003, Borrego *et al.*, 2006, Hickman and Banister, 2007, Zegras, 2007). They defend the integration between technological and local measures which cannot only mitigate GHG emissions but also local pollutants emissions.

Meanwhile carbon sinks are not included in EU ETS, the European Union defends more investigation on this area. Land use planning is a main instrument which can contribute to increase carbon dioxide removals. The participants in the EU ETS can buy allowances through the Kyoto Protocol mechanisms (Clean Development Mechanism and Joint Implementation) but however it is not allowed to buy those allowances if the programmes are related with carbon removals. There are still many doubts on the real removing capacity of carbon sinks so the policies on the LULUCF sector are not seen as a priority in EU. Besides that, the countries can take in account the removals on their annual emissions balance submitted to the United Nations Framework Convention on Climate Change (UNFCCC).

2.3 Portugal

Portugal is facing severe difficulties to reach its Kyoto Protocol targets. Although this country could increase its overall emissions by 27% between 1990 and 2010, in 2005 their emissions were already 40% higher than in 1990. The 2006 Portuguese Climate Change Programme (PNAC 2006) forecasts that the final balance of emissions and removals will be 2,975 Mt CO_2e higher than the goals. This means that the Portuguese government should spend 348 million Euro buying credits abroad. The EU ETS installations will be responsible for 43.9% of total emissions during the Kyoto Protocol commitment period (2008-2012) and there are projected measures on the other sectors to limit the emissions as initially forecasted.

According to the PNAC 2006 transportation will be responsible for 23.7% of total emissions during the Kyoto Protocol commitment period. The emissions in 2010 in this sector will be almost two times higher than in 1990. The main source of emissions is road transport (more than 96%), followed by air transport (2.2%), sea transport (1.0%) end rail transport (0.4%). Air transport is the mean of transport where the emissions should increase more between 1990 and 2010 (177%) followed by road transport (110%). The PNAC 2006 predicts a reduction of total emissions on rail and sea transport. The Portuguese Climate Change Programme indicates 22 measures to reduce emissions in this sector. There are technological and behaviour measures and some of them are related to local authorities. The measures related to local authorities include the construction of metro and light rail systems in Lisbon and Porto Metropolitan Areas and also in Coimbra, the acquisition of natural gas powered buses, the creation of Metropolitan Transportation Authorities in Porto and Lisbon and the reduction of taxi service days.

We have evaluated the results of these measures. According to the monitoring reports (Comissão para as Alterações Climáticas, 2008), only seven measures are having the PNAC 2006 expected results. This means that Portugal will face more difficulties reaching its objectives.

Portugal has chosen to use changes in greenhouse gas emissions and removals resulting from direct human-induced land use change and forestry activities to meet the commitments of the Kyoto Protocol. Land use planning plays a main role in these changes.

Using this instrument, the PNAC 2006 expects to reduce net emissions and removals by 4.7 Mton CO_2e in 2010. It has also measures to reach this objective. Two of them are related to forest management and another related to agriculture carbon sinks. Both measures in the forestry sector are far from the objectives according to recent monitoring. The monitoring of the other measure is being reviewed so there aren't any conclusions about its state.

We have also analyzed measures on the agriculture and waste sectors because both of them are related to local authorities. Both sectors are losing relative importance on total emissions. In 1990, agriculture and waste were responsible for 15.1% and 11.8% of total GHG emissions respectively and, according to the PNAC 2006, in 2010 they will be responsible for only 9.8% and 11.8% respectively.

These changes do not mean that there are less GHG emissions from agriculture. The PNAC 2006 expects a 4.3% growth between 1990 and 2010, even though far less than the 30.3% total expected increase. In the waste sector the GHG emissions should decrease 13.9%.

Like in the other sectors, the Portuguese Climate Change Programme indicates measures to mitigate GHG emissions in agriculture and waste. According to the last monitoring results (Comissão para as Alterações Climáticas, 2008) there is not any measure in agriculture and waste with the expected results which means an even worse scenario.

As we have seen, Portugal is facing several difficulties to meet its objectives under the Kyoto Protocol. Portuguese emissions are already above the country's commitments and the measures under the Portuguese Climate Change Programme are not having the expected results.

3 Portuguese legal framework

In this section we will analyse if Portuguese legislation encourages good practices to reduce GHG emissions and to increase removals by sinks at local level. We will start with a description of urban and land use planning legal framework followed by transport legislation analysis. Finally we will analyse if local governments funding induces implementation of climate change policies by these authorities.

3.1 Urban and land use planning

The Portuguese Framework Law on Physical Planning defines the different land management instruments and orders the relationships between the public administration's different levels and between authorities, citizens and stakeholders.

This framework law defines three different scales: national, regional and local. The first scale (national) defines the national strategic framework and the main guidelines for regional and local planning. The second scale (regional) defines the strategic framework for regional planning identifying the guidelines for local planning. The third scale defines local strategic options and manages land use planning.

The framework law defines the instruments under the national and regional scale as land development instruments and the instruments under the local scale as physical planning instruments. This means that national and regional authorities define strategies to guide development and local authorities are responsible for urban and land use physical planning.

The physical planning instruments are the Municipal Director Plan (*Plano Director Municipal*), the Urban Development Plan (*Plano de Urbanização*) and the Detailed Local Plan (*Plano de Pormenor*). Local authorities develop and ratify all of them and the regional authorities supervise the Municipal Director Plan. The Municipal Director Plan is the main spatial planning instrument which defines the rules for land use within a municipality. It influences land occupation, use and changes because it defines land classification (rural or urban areas) and land qualification (rules for land use according to the planned or existing activities).

Local authorities, namely the *Câmaras Municipais,* have the main responsibilities on land use planning. As we have referred to on the first section, land use planning is a form of reducing GHG emissions and of increasing removals. Local authorities have the possibility to mitigate climate change using their own instruments.

3.2 Transportation

Portuguese local authorities can define rules and manage public transport. According to the Automobile Transport Regulation, *Câmaras Municipais* can choose to operate local public transport service or to grant it to a single private operator. They are also responsible to draw the networks and to approve the bus stops places. These responsibilities influence the public transport planning and therefore its environmental impacts, including GHG emissions.

When a local authority operates its own public transport service, it can manage all the different scopes of public transport. Local authorities can buy less-pollutant vehicles, design the network, define timetables and frequencies and invest on passengers' comfort. It can also promote interaction between land use and transportation and between transportation and infra-structure (e.g. creating bus lanes and rail interfaces). All these measures can reduce transport sector's emissions by attracting car users to public transport.

When a local authority grants the service to an operator there are less opportunities to control GHG emissions. Despite that, local authorities are still responsible to set the bus routes and to promote passenger's comfort with investments on bus stops. They play always an important role on the development of public road transport in urban areas and on the reduction of the GHG emissions in the transport sector.

Local authorities are also responsible for taxi licensing and to set this transport's fleet. They also set the different parking schemes. In this case, local authorities have the flexibility to study which taxi parking scheme can be more efficient and how is the suitable fleet to reduce GHG emissions keeping the sector's competitiveness.

Finally, local authorities do not have the same influence on rail. The rail passenger services are usually associated to regional and national trips. The subway and light rail systems whose networks are limited to a small number of municipalities are exceptions. Only in these cases, where the *Câmaras Municipais* are usually partners of the operator, local authorities can influence management.

3.3 Local financing

As we have seen, local authorities and, in particular, *Câmaras Municipais*, have instruments to implement policies on climate change. Now we will evaluate if their funding encourages those policies.

According to the Local Funding Law, part of the municipalities' income is based on the revenues of municipal tax collection. The main municipal taxes in Portugal are the Municipal Property Tax (*Imposto Municipal Sobre Imóveis*), the Valuable Property Transfer Municipal Tax (*Imposto Municipal Sobre Transferências Onerosas de Imóveis*) and the Single Circulation Tax (*Imposto Único de Circulação*).

The first two taxes, which income goes directly to the municipalities, are related with construction and real estate activity. Buildings construction benefits municipalities' finances. Despite not existing a linear relationship, a local authority can expand the urban areas to reduce property values encouraging construction and therefore can have a higher income. A policy of this kind can

promote urban sprawl thus more GHG emissions in sectors like transport and fewer removals by sinks due to green areas reduction.

The municipalities have also more revenue increasing the number of motorised vehicles due to the Single Circulation Tax. Building road infrastructure and improving car accessibility are ways of attracting motorised inhabitants. This is also an unsustainable form of development causing GHG emissions growth.

An important source of income to the municipalities is the contribution from public resources. Part of the revenue from personal and corporate income taxes and from value added tax is distributed to the municipalities using parameters like total population, area, altitude range, and, in a very small part, the dimension of protected areas. Even though the last parameter can encourage the municipalities to protect natural resources, it does not have much importance in the total revenue (between 0.6% and 1.2% of the income from personal and corporate income taxes and from value added tax). Local authorities, with the objective of having higher incomes, are encouraged to attract more inhabitants. As we have referred to above, expanding urban areas is a form of reducing property values having more chances of attracting new inhabitants. The consequences for climate change are the same.

Finally, local authorities can retain part of the personal and corporate income taxes of persons and corporations seeded in their municipality. This means that to have higher incomes *Câmaras Municipais* must attract more inhabitants and more enterprises or inhabitants and enterprises with higher revenues. In this case, local authorities can have two strategies. The first strategy is similar to the previous: expanding urban areas, reducing property values and attracting more inhabitants and more enterprises. The second strategy is based on the attraction of inhabitants and enterprises with higher incomes. This means an important bet on municipality's competitiveness but is also a strategy which carries more risks. If the local authorities prefer the strategy with fewer risks they will choose policies which affect the mitigation of climate change.

As we have seen, the Portuguese local financing law doesn't encourage local authorities to have policies to mitigate climate change. This law can even induce them to expand urban areas and to contribute to urban sprawl thus to more GHG emissions and less removals.

4 A cap and trade scheme between municipalities

4.1 The main reasons

As we have shown in the previous sections, we find that Europe and Portugal need new policies on the mitigation of climate change. On the first section many authors suggested that local authorities are important administrative bodies which can create policies to reduce GHG emissions and increase removals by sinks. On the second section we have explained that Europe and (more roughly) Portugal are facing several difficulties to accomplish their targets under the Kyoto Protocol. On the third section we have analysed Portuguese legal framework and we have concluded that the *Câmaras Municipais* are able to define local policies for climate change but their financing induces bad practices.

If the Portuguese local administration bodies have instruments to reduce human impacts on climate change but they are not encouraged well enough, we have to find a way of inducing those good local practices. Our proposal is based on a cap and trade system similar to EU ETS but applied exclusively to local authorities.

As we will see along this section the proposed system tries to take advantage of the main qualities of the EU ETS and to exclude what went wrong in the first phase of this scheme.

We have analysed the criticism on EU ETS and the main difficulties were in the form of allocating allowances. Each allowance corresponds to one tonne of carbon dioxide and, at the beginning, it cost around 30€ but after some months, the allowances' prices were less than 1€. This fast fall was due to an over-allocation: most member states have allowed emissions in the EU ETS sectors to rise despite some of them needed to reduce their overall emissions (Egenhofer *et al.*, 2006). The system became inconsistent because the great majority of the covered installations did not need to reduce their emissions or to buy allowances. The main conclusion of this problem is that the allocations must be centralized in a unique entity.

Many authors defend the abolishment of the free allocation system and that allowances should be allocated by an auction (Böhringer and Lange, 2005, Grubb, 2006, Blanco and Rodrigues, 2008). The EU has accepted this suggestion and will auction the majority of allowances for the next commitment period (2013-2020).

Other authors prefer a carbon tax (Grubb, 2006, Zegras, 2007, Berrittella *et al.*, 2008, Grazi and van den Bergh, 2008). In a cap and trade system with free allocation, the polluters do not pay for all their emissions but only if they do not meet their targets. If they pollute but bellow their limits they can even earn money selling the remaining allowances. With a carbon tax they would pay for all their emissions.

The carbon taxes have two main problems. The first one is the opportunity to reduce emissions at the lowest cost. In a cap and trade system the emissions are reduced at the lowest cost and with a carbon tax there will be higher costs to reduce emissions. The second problem is the lack of feasibility. During last years, we have seen several attempts to implement a carbon tax, but there are always great resistance from the stakeholders.

The system that we propose will have only one entity responsible for the allocation of allowances and will be a cap and trade scheme.

4.2 Guidelines

The cap and trade scheme for local authorities will be called Local Emissions Trading Scheme (LETS). In this scheme central government of a country (in this case Portugal) allocates allowances to the different local authorities and at the end of each year (in this case between 2013-2020, the next commitment period) local authorities should return a number of allowances corresponding to the amount of emissions in the sectors covered on their municipality during that year. If there are more emissions in one municipality than the quantity of allowances allocated, the local authority must buy them in the market. If there are fewer emissions than the quantity allocated, the local authority can sell allowances or bank them for the following year. If the local authorities do not return the required allowances they should be sanctioned and must return those allowances in the following year.

The LETS should only cover sectors out of the EU ETS and cannot be linked with this scheme. Local authorities are not authorized to sell allowances to installations covered by the EU ETS and the same happens when an installation wants to sell allowances to a local authority. Systems are similar but have different philosophies. EU ETS objective is to reduce GHG emissions in installations at the lowest cost. LETS objective is to encourage local authorities to develop policies to reduce GHG emissions and to increase removals by sinks. In the first case the installations are the main responsibles for the GHG emissions and, in the second case, local authorities are not responsible for the emissions but can develop policies to avoid them. In the Table 4.1 we compare both schemes.

Table 4.1 Comparison between European Union Emissions Trading Scheme and Local Emissions Trading Scheme

	EU ETS	LETS
Covered entities	Installations	Local Authorities
Traded bjects	Emissions Allowances	Indirect Emissions Allowances
Allocation entity	EU Member States	National Government
System Type	Cap and Trade	Cap and Trade
Coverage	Emissions	Emissions and Removals
Objective	Lowest Cost	Encouraging Policies

The system must be closed in a country and must only have two levels. National government is the entity which allocates allowances and local authorities are the entities which take part of the scheme. We have found two main reasons to choose this option.

Firstly, we need to encourage local authorities to take part in the scheme. The local authorities' interest is crucial to the success of this scheme. In a closed market, the funds only flow between municipalities and this is a way to redistribute funds to municipalities according to their environmental performance. Local authorities will not see this scheme as a tax and will even see it as a way of receiving more funds.

Secondly, linking the scheme to other countries would cause some problems. Local administration bodies in the EU countries have different powers and cover territories with different dimensions. A European-wide system would create different imbalances. Furthermore linking schemes would imply different entities with allocation responsibilities causing the same problems seen in the first phase of the EU ETS.

Simplicity of LETS is also an important factor. While EU ETS covers large installations with market experience, LETS covers institutions with other objectives and other skills. The non-experts should understand the system easily. It must have few and easy-comprehensible rules. As we have seen on American emissions trading schemes, a good and simple legal framework reduces uncertainties and makes the implementation easier (Napolitano *et al.*, 2007a).

The emissions and removals monitoring is a very important issue. LETS must be credible and it depends crucially on a clear and objective accounting of emissions and removals. Annually, all the UNFCCC parties must submit national inventory reports with information on emissions and removals of greenhouse gases. The monitoring methodology should be similar to the methodology used in these reports. LETS and national reports have different scopes (the first requires a municipal accounting and the second a national accounting) and if it is not possible to use the same methodology it is very important to do a close approach to the national accounting methodology.

4.3 Allocation method

Despite many authors defend auctioning as the best form of allocating allowances in the EU ETS, we support an allocation based on historical emissions in LETS. This decision is due to two important factors. In the first place, local authorities are not responsible for the emissions and they should not have to pay for them. If we want to encourage local authorities' participation, they should not pay any initial fee. As we have referred to before, the system must be closed and the funds should only be transferred between local authorities. On other hand the problems observed in the EU ETS were due to a decentralised allocation. In this case we will only have two levels: national level and local level.

As we have referred to, the commitment period is between 2013 and 2020. According to the European Union targets, Portugal can only increase its emissions in the sectors not covered by the EU ETS by 1% between 2005 and 2020. This is the reason why the base year to calculate historical emissions is 2005 and the target year is 2020.

We have adapted the EU ETS' Portuguese allocation method to LETS reality. The first phase is a top-down approach where we verify the GHG emissions and removals accounted in the Portuguese National Inventory Report on Greenhouse Gases submitted to the UNFCCC (Ferreira *et al.*, 2008). The second phase is a bottom-up approach where we estimate municipalities' emissions and removals in the covered sectors with methodologies similar to the ones used by the National Inventory Report. In the third phase we have compared both results and controlled possible errors. After this comparison we have considered the share of each municipality on total emissions and removals. In the fourth phase we have defined the target emissions and removals for the whole country in the sectors covered by the LETS taking in account the increase allowed. Then, we have created an incentive reserve to correct possible market mismatches. This reserve is subtracted to the total emissions allowed in 2020 and the result is the total number of allowances to allocate. We have two kinds of allowances: positive and negative. Positive allowances correspond to GHG emissions and negative allowances correspond to GHG removals. These positive and negative allowances are distributed to municipalities according to their share of total emissions and removals in 2005. If a municipality receives more positive allowances, it can have more emissions than removals in the target year.

In the LETS, we have positive and negative allowances and this could increase the system degree of complexity. We think it is better to have two kinds of allowances than excluding removals by sinks from the scheme. The entity which will manage the system must be concerned about the importance of explaining this question to local authorities.

4.4 GHG included in the LETS

CO_2 is the only GHG covered by EU ETS. Despite not being the GHG with the highest global warming potential, carbon dioxide is the anthropogenic GHG which contributes more to climate change. That is why we see more concerns about this gas.

Unlike what happens in the energy producing sector, there are activities where the local authorities can interfere which are emitters of other GHG like methane and nitrous oxide. Agriculture

and waste sectors emit almost only these two gases. If we want to include these sectors we would have also to include methane and nitrous oxide.

We have decided to not include them due to the following reasons:

- Methane and nitrous oxide must be converted to CO_2e damaging the simplicity of the system;
- These gases are also emitted by the transport sector but it is very difficult to calculate those emissions at local level. Accounting these gases in some sectors and not doing it in others would create even more misunderstandings;
- Emissions in both sectors are reducing in EU and emissions in waste sector are reducing in Portugal. The LETS could not be as effective if we include sectors which are reducing their emissions.

The carbon dioxide is the only GHG included in the LETS.

4.5 Sectors included in the LETS

Sectors covered by EU ETS should not be included in LETS and in the previous point we have excluded agriculture and waste sectors from LETS. We have included the remaining sectors affected by local policies which have a significant dimension. They are transport and LULUCF. The first one is only responsible for emissions and the second one is responsible for emissions and removals.

In the transport sector we have included all CO_2 emissions. Although local authorities' policies influence more passenger transport's emissions the account methodology depends on fuel consumptions. In Portugal, fuel consumptions statistics are not divided in passenger and freight transport so it is impossible to consider passenger transport separately. This is not a major problem because if the local authorities can reduce emissions in passenger transport then that reduction is reflected on the overall values. The electric vehicles are not considered because they are already covered by the EU ETS.

The LULUCF sector includes CO_2 emissions in the forests (e.g. wildfires), CO_2 removals also in the forests and land use changes. The emissions and removals by forestry sector are considered in the same way as emissions in transport sector. Emissions and removals in the base year determine the allowances allocations. The land use changes are involved in LETS on a slightly different way. When an non-urban land use is abandoned there are CO_2 emissions equivalent to the carbon lost and when a new forest is planted there are CO_2 removals. These CO_2 emissions and removals are converted in allowances which can be given or returned from the municipalities.

4.6 System financing

According to the expenditures on the American systems (Napolitano *et al.*, 2007b), the costs of a scheme like this in the state budget would be residual. Furthermore the institutional framework of LETS can be the same of the EU ETS. This is a factor which can also reduce all the costs.

Additionally, in the next commitment period, EU ETS' allowances will be auctioned. The revenues from the auctions will be for the member states. Part of these funds should be invested on the mitigation of climate change and LETS can be an instrument for it. We defend that part of the revenues from the auctions should be the main funding source of LETS.

5 Allowances allocation methodology

The main purpose of this section is to find the main difficulties on the application of the LETS to the Portuguese case. In this paper we will not do a detailed explanation of all the methodologies to define the allowances allocated to each municipality. We will make an overview of the methodology referring to the main results and the weaknesses found.

5.1 Emissions in the transport sector on the base year

According to the Portuguese National Inventory Report (Ferreira *et al.*, 2008), CO_2 emissions in road transport are calculated with a methodology based on fuel consumptions upgraded with an analysis of driving types, speeds, vehicle fleet age and distances. The top-down methodology corresponds to the National Inventory Report accounting.

On the bottom-up approach we only have data from the fuel selling activity (Direcção-Geral de Energia e Geologia, 2008). There is not any rigorous information about driving types, speeds, vehicle fleet and distances at local scale so we have calculated emissions based only on fuel sales assuming that the fuel sold in a municipality is combusted there. As the original data was in tonnes of oil equivalent (toe) we have to convert it in tonnes and then in Meegajoules. After it, we have used the emission factors (which converts quantity of fuel in quantity of CO_2 emitted) of LPG, Gasoline and Diesel considered in the National Inventory Report (Table 5.1).

Table 5.1. Conversion factors and emission factors (Ferreira *et al.*, 2008)

Fuel	toe/ton	MJ/kg	Emission factor (ton CO_2 / MJ)
Petrol	1.035	43.31	72.41
Gasoline	1.070	44.80	71.06
LPG	1.160	47.31	61.87

We have calculated the values for three years (2004, 2005 and 2006) to prevent annual distortions. The results for all the municipalities in Portugal are in Figure 5.1. Then, we have summed it to obtain the values for the whole country and to compare the results from this approach with the results in the bottom-up approach (Table 5.2).

Table 5.2. Comparison between emissions accounted in both approaches

Fuel	Top-down (ton CO_2)	Bottom-up (ton CO_2)	Diference (ton CO_2)	Diference (%)
Petrol	5,703,366	5,130,432	572,934	10.0%
LPG	56,134	52,082	4,052	7.2%
Diesel	12,807,179	14,121,327	-1,314,148	-10.3%
Total	18,566,679	19,303,841	-737,162	-4.0%

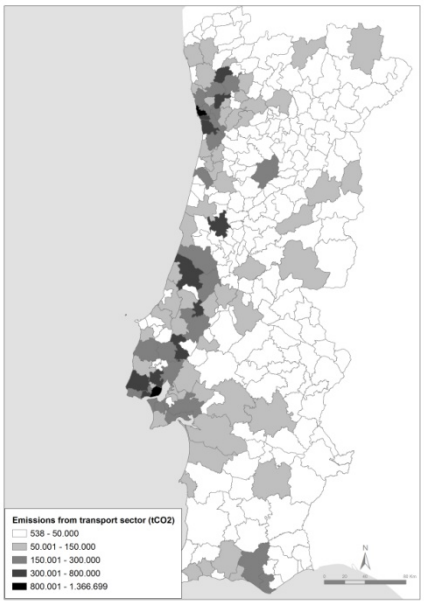

Figure 5.1. Emissions in the transport sector by municipality calculated by the bottom-up approach

The partial and total results from both approaches are very near (never more than 10%). The final difference is below the margin of error. Knowing these results we have decided to use the bottom-up approach in the LETS. The difference between the results from this approach and the official emissions is very low. Additionally, it is more important having an objective form of accounting whose results are near the official emissions than to have a methodology with non-objective estimates which can affect the credibility of the system.

5.2 Emissions and removals in the LULUCF in the base year

All the emissions considered in the LULUCF sector are from forestry. The Portuguese National Inventory Reports considers to kinds of emissions: emissions from wildfires and emissions from fellings.

The emissions from wildfires are calculated with parameters like the areas affected by wildfires, the biomass above ground reserves and fractions of biomass left in the forest and not affected by wildfires. Except the first parameter, all the others are tabulated in the National Inventory Report. The dimensions of the areas affected by wildfires in each municipality are available in the Portuguese Statistics Institute website (INE, 2008). In the bottom-up approach, we have calculated the emissions from wildfires with this data and the parameters used by the National Inventory Report. The emissions from wildfires by municipality calculated in the bottom-up approach are represented in the Figure 5.2.

Currently there is no data with the annual fellings in each municipality. Without this information it is impossible to calculate the emissions due to tree fellings. We will take in account these emissions when we address the land use changes. We will consider the fellings as a land use change where the forest is abandoned.

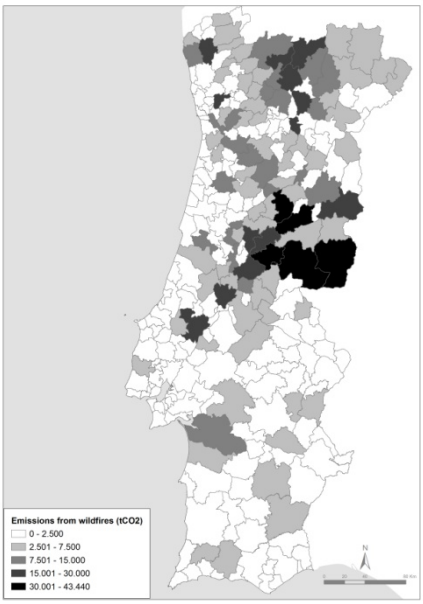

Figure 5.2. Emissions from wildfires by municipality calculated in the bottom-up approach

The accounting of GHG removals by the forest involves a more complex bottom-up approach. The removals depend on the characteristics of the different trees. Each specie has different characteristics and different levels of carbon uptake. We had to use data from three different sources. In first place, we have used the National Forestry Inventory (Direcção-Geral das Florestas, 2001) which has the distribution of the areas according to the species in a scale of 1:1,000,000. This scale does not have the desired accuracy and we have used the Corine Land Cover data to get a more exact estimate. In this case we do not have the areas of each specie but we have a more detailed description of the distribution of the forest areas in the whole country (scale 1:100,000). Using a Geographic Information System (GIS) we have intersected both data to have a more precise distribution of the forest areas by specie. Finally we have intersected this result (also with GIS) with the Portuguese Official Administrative Map (Instituto Geográfico Português, 2008) to calculate the forest areas by specie existing in each municipality. With this estimate we have calculated the annual carbon uptake in each municipality and, consequently, CO_2 removals. The removals estimated by municipality are represented on Figure 5.3

In the comparison between the carbon removals from these approaches (bottom-up) and the results from the National Inventory Report (top-down approaches) we have concluded that they are near but not as similar as in transport sector (Table 5.3). Despite that, the difference is low enough to use the bottom-up approach in the LETS.

The CO_2 emissions are very different because we have not considered emissions due to fellings and the wildfires fraction is very low. Despite that we will consider these emissions.

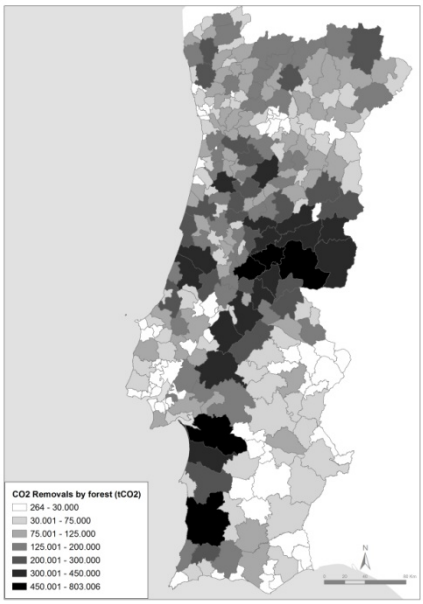

Figure 5.3. CO_2 removals from forest by municipality calculated in the bottom-up approach.

Table 5.3. Comparison between the top-down and bottom-up approaches on the forestry sector

	Top-down	Bottom-up	Difference (%)
Area (1000ha)	3,445,525	3,384,818	1.8%
Carbon gains on living biomass (ton C)	7,264,212	8,456,362	-16.4%
Carbon losses on living biomass (ton C)	5,082,575	305,433	94.0%
CO_2 removals (ton CO_2)	26,635,443	31,006,661	-16.4%
CO_2 emissions (ton CO_2)	18,636,109	1,119,920	94.0%

5.3 Allocating allowances

After calculating the emissions in the base year, we have defined the total emissions allowed in 2020. Portugal can increase its emissions by 1% between 2005 and 2020 so we have summed emissions from transport and forestry and projected them till 2020. After that, we have calculated a reserve to correct possible negative effects of the market. When the national government needs to encourage some kind of policies should give extra-allowances from this reserve. We have subtracted this reserve from the total emissions projected and the result is the total emissions distributed to the different municipalities. The removals were not considered for the reserve and the total values in 2020 should be equal to the values in 2005.

Each municipality has a proportion of total emissions and a proportion of total removals in the base year. In 2020 it should keep those proportions and the allowances given are the product between the proportions and the total emissions and removals. If the allowed emissions in 2020 are higher than the removals, the allowances are positive. If they are lower than the allowances are negative. The Figure 5.4 represents the allowances allocations for 2020. In the other years, from 2013 to 2019 the allocated allowances should have a linear evolution.

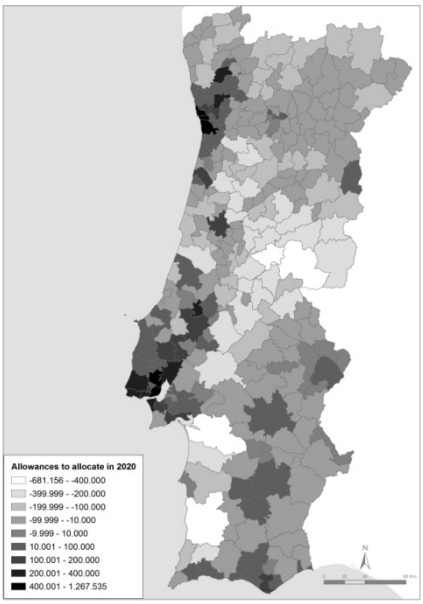

Figure 5.4. Allowances allocated in 2020

5.4 Land use changes

As we have referred to before, land use changes are considered in a different way. We have considered two phases. The first phase is before the land use change and the second one is after that change.

When a land use is abandoned there is a biomass loss and we must consider emissions. We have created a table based in the National Inventory Report with the emissions which result from the biomass lost when a land use is abandoned. When a land use is abandoned in a municipality, local authorities should return a number of allowances tabulated.

When the municipality starts a new land use which contribute to CO_2 removals, the process is similar but limited to a time until carbon stock reach equilibrium. During the years of this equilibrium time, national government will allocate annual extra allowances according to the sink capacity of the new land use.

6 Conclusions and discussion

We have concluded that implementation of a cap and trade between local authorities is not only feasible in Portugal but also recommended. The current legal framework does not encourage local authorities to implement policies on the mitigation of climate change and LETS can be an interesting way of inducing good local practices on climate change. This system is a clear alternative to conventional approaches where the state takes the command and control.

When a local authority cuts CO_2 emissions from transport sector or from wildfires or increases removals by the forest has economic benefits. On the other side, land use changes which decrease removal capacity are penalized.

We have found some vulnerabilities but all of them can be overcome. The first vulnerability is the possible complexity of the system for non-experts. With a clear information campaign we think all

local agents can understand the system operation. The second main vulnerability is the lack of information on tree fellings. We have overcome this problem considering tree fellings as land use changes where a forest land use is abandoned. To include tree fellings on land use changes LETS should have annual monitoring of land use changes.

It is also possible to see some kind of criticism because local authorities' objectives are far away from increasing the annual profits. Their main objective is to defend people's interests and to improve quality of life, environment and social conditions. However, in this case, the main objective is financing new projects or policies with funds from entities which cannot use them and not getting profits from allowances sales. For instance, a municipality with no public transport can implement it and then sell allowances according to the GHG which were not emitted due to their effort. A municipality which buys those allowances could be one which cannot invest more on public transport. The LETS is based on funds redistribution and not on getting profits.

LETS can be another way of contributing to the mitigation of climate change. It will not be the resolution for all climate change problems but can be an instrument among many others that together should reverse current trends.

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Part 3. Urban planning and housing

A new paradigm for the existing city, an approach

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This summary is intended to stimulate discussion on urban planning in these times of uncertainty we're living. Using a multidisciplinary and careful approach in the immediate future, the aim is to stimulate discussion of ideas, seeking various lines for action that, in an integrated way, will guide interventions in consolidated urban fabric to generate a widely positive reaction. City's urban fabric of ancient cities presents many interventions over time, witch influenced various reactions and, even despite all attempts, there isn't a prospect of a clearly positive and sustainable urban development. This paper is intended to develop the capacity for assessing interventions in the emerging socio-economic framework, resulting from the present global financial recession. First we will follow a comprehensive analysis of the strategy that guides the rehabilitation process and a specific study that focus on its various fields of action. Then, it is necessary to understand what have been the evidences that contributed to the establishment of the crisis in the real estate sector, and how it may affect the process of urban regeneration. Finally, the discussion about how to reshape inner-cities to face the present crisis has the aim to adapt urban fabric and mentalities to the next economic assumptions. As conclusions, it will look for assessing what can be done to stimulate city's physical and socio-economic development, understanding it as an interdependent system, and consequently not being possible to intervene in a single field, failing to influence the other, and guide policies for a matrix that is relevant to future economic assumptions.
Can the city be re-invented?

Keywords: urban rehabilitation, urban planning and management, sustainability, real estate, life quality

1 Introduction

In Portugal, the government offers several of instruments to encourage urban regeneration and motivate the real estate and construction sectors, away from the speculation that increases sprawl. However, the process for the revitalization of these areas and for the complete success of interventions is more complex, involving intangible factors, such as the habits and mentality of the residents in suburbs.

A simple renewal of the urban fabric and giving conditions for its occupation don't mean that people will intend to move to central areas. Cities need a combination of factors, based on socio-cultural changes, to move people from the periphery to the centre, having to give up space, car, and even homeownership.

However, recently a global phenomenon has happened, which may affect the way of life from now on. The question is: can the current financial crisis, particularly of the real estate sector, be useful to reshape the city to the next economic assumptions?

This paper is intended to stimulate discussion on the role of urban planning and rehabilitation in these times of uncertainty we're living. The final goal is to develop the capacity for assessing interventions in the emerging socio-economic framework, resulting from the present global financial recession.

To get to this point, we have to follow a comprehensive analysis of the strategy that guides the rehabilitation process and a specific study that focus on its various fields of action. Then, from the critical analysis of the studied process, it is necessary to understand what have been the evidences that contributed to the establishment of the crisis in the real estate sector, and how it may affect the

process of urban regeneration. It's also important to find how interventions have been structured, in a sector or integrated manner, in order to assess the impacts on each field of action. The comparative analysis of urban regeneration interventions in European consolidated urban centres may be useful to systematize positive and negative reactions, in cities and its people, which would bring better tools for the cities (re)construction.

Finally, the discussion about how to reshape inner cities to face the present crisis has the aim to adapt urban fabric and mentalities to the next economic assumptions.

2 The rehabilitation process

The evolution of intervention policies in urban centres has been always oscillating between a public character model and a mixed one, in order to obtain a broader perspective of the problem, but coming into conflict with the economical, social and cultural interests which these areas are also depending on. In this perspective, the role of local agents on urban planning and rehabilitation is crucial, as their presence and involvement increase the rehabilitation process, leading to a more participated one, closer to the real needs and, consequently, more integrated.

Presently, urban rehabilitation system is working, in spite of some weaknesses. At the moment, there is an instrument called "Plano Estratégico de Habitação 2008-2013" (Strategic Plan for Housing 2008-2013) which is to be published. Its aim is to rethink housing policies and reform the government's role in these interventions.

Indeed, the deep changes in society have been reflected in housing dynamics and, consequently, the necessity to understand the role of the government and to ensure a more effective coordination and cooperation is real. It's now urgent to structure them as part of a national strategy, as it is essential for the positive development of the urban rehabilitation (IHR, 2008).

As a way to start a truly cooperative and integrated strategy, this plan lays the challenge to create local programs for housing, at the municipal level, which meet the new premises of society and demands of political action (CML, 2009).

The Government has the role of taking structural decisions in line with the national reality and in relation to Europe. It has to be coordinator of the whole strategy, distributing tasks and arranging interests in order aim to ensure common interest (Guerra, 1999). In order to establish a coordinated strategy, in accordance to European territory management (article nº 26 of the Decree-Law nº 316/2007 of 19th September), Government elaborated the Programa Nacional da Política de Ordenamento do Território (PNPOT) -National Program of Territory Order Policies-, which is a strategic instrument for the articulation between the economic and social development policies as the Estratégia Nacional para o Desenvolvimento Sustentável (ENDS) -National Strategy for Sustainable Development- and the interventions considered in the Quadro de Referência Estratégico Nacional (QREN) -National Strategic Reference Framework- for the period of financial communitarian planning (QREN 2007-2013).

PNPOT indicates the following goals related to this issue:

- To structure the urban system and strengthen the polycentrism;
- Functional qualification of cities;
- Development of urban clusters;

- To structure the educational institutions network, as well as knowledge Institutions and Office areas;
- To increase accessibility to urban centres and suburbs;
- To avoid the negative environmental impacts of sprawl;
- To improve inter-cities social cooperation;
- To protect and improve heritage returns.

PNPOT proposes, as priorities, to "Encourage new partnerships to develop integrated programs of rehabilitation, revitalization and qualifying of urban areas, strengthen and make more efficient Urban Rehabilitation Societies and review the fiscal and financial operations under this program (2007-2009)*"* (PNPOT, 2007).

Once PNPOT has secured that European and National strategies are to be implemented, government constituent agencies develop sector strategies that shall be detailed on a regional scale. At this level, administration and regional development agencies build strategies and develop guidelines for the local level, in order to ensure that interventions are consistent with the national policies. Government also elaborates the legislation which will support, regulate the developing of the rehabilitation process and create the operative instruments to help the implementation of the strategy.

To start a process of urban rehabilitation, after the development of the strategy and the definition of its limits and goals, the area should be declared Área Crítica de Recuperação e Reconversão Urbana (ACRRU) - Statement of Critical Area of Recovery and Urban Conversion-, defined by Decree to be published by the government after approval of the municipality. This law is a declaration of public utility and allows fast expropriation. It should also be declared the right of preference, to the municipality, on the purchase of properties situated in the area. This measure also needs to be defined by a Decree and its main goal is the real estate counter speculation (Reis, 2006).

One of the problems of this process is the property distribution system. Being the owner mostly business owners or heirs (co-owners), and the buildings, most of them, are occupied by housing and services that pay very low rents, - not to mention the advanced state of degradation of some fractions, without the minimum housing conditions - that discourages anyone to alienate his property. This problem, combined with the low rents, totally destroys real estate investment. The financial programs for rehabilitation increment like the Special Regime of co-participation on leased houses rehabilitation - RECRIA – are possible solutions, in spite of being too complex and without economic benefits (Monteiro, 2006; Guerra, 1999).

In fact, recently, government defined a housing policy, by the implementation of laws that increase buildings rehabilitation. They were transformed into operative instruments, which are:

- Regime Especial de Comparticipação na Recuperação de Imóveis Arrendados (RECRIA) - Special Regime Support in Recovery of Leased Buildings- Defined by the Decree-Law nº 329-C/2000, 22/12 – lost fund assistance to conservation and beneficiation works on leased houses;
- Regime de Apoio à Recuperação Habitacional em Áreas Urbanas Antigas (REHABITA) - System Support Regime for the Housing Recovery in Older Urban Areas- Defined by the Decree-Law nº 105/96, 31/07 – lost fund assistance to habitation buildings reconstruction.

Contains RECRIA funds, and adds 10% more for Critical Areas of Recovery and Urban Conversion (ACRRU);

- Regime Especial de Comparticipação e Financiamento na Recuperação de Prédios Urbanos em Regime de Propriedade Horizontal (RECRIPH) -Special Support Regime for Financial Recovery of Buildings in Urban Horizontal Property- Decree-Law nº 106/96, 31/07 – lost fund assistance to works on the common parts of habitation buildings which have horizontal property system and that were constructed before the approval of the edification law (RGEU - 1951).

After not very good results with these 3 assistance instruments, Government decided to merge all of them in only one, in order to simplify processes, ensure a better accomplishment of the goals and a better financial support. On the other side, for the management and coordination of rehabilitation operations, Sociedades de Reabilitação Urbana (SRU) -Urban Rehabilitation Societies- were created. They are municipal societies who ensure a faster approval of the projects, the management of partnerships and supervision.

The operative instruments are tools for the local administration (municipalities) to implement the strategy that has been developed by the superior scales. The role of local administration is to be close to general population, being their representatives and creating partnerships to develop an "auto-sustainable" rehabilitation dynamics.

During 1990's, Gabinetes Técnicos Locais (GTL) -local administration and offices- were getting closer, in spite of recurrent opinion disparities. However, this was already a first positive step towards an integrated process. Their relationship had the aim of identifying priorities on operational aspects. The GTLs' practical and less strategic character provides a more close relation with the local reality.

The main fields of action of GTL's are:

- Elaborate public space and buildings rehabilitation;
- Increment and supervision of the projects and works;
- Creation of proposals for temporary accommodations of residents;
- Divulgation and participation improvement;
- Management of the municipal rehabilitation budget (Serdoura, et al, 2006).

However, there were still some lacks that making it impossible to complete agreed objectives, namely in what concerns the participation of GTL's on consultant structures and operation monitoring. On the other side, the extension of the GTL's skills has turned the process more complex, besides the loosing of the previous proximity between GTL's and local residents (Magalhães, 2000).

Beyond municipalities as GTL's, "quartier" authorities and local population, there are other agents with a fundamental impact on rehabilitation process, as private corporations with social concerns, associations or sponsors. These institutions help to overcome difficulties on measures implementation and on the financial aspect.

On the other side, Media has become even more an important partner on what concerns the actions divulgation and reporting positive and negative aspects of interventions, increasing participation.

Knowing that the population-target of the urban centres rehabilitation is mostly young (up to 40 years) (Magalhães, 2000; Guerra, 1999) and that the attractiveness of these areas, despite the work already in course, is not enough, it becomes essential to question about the existing tools in order to successfully operate strategies.

The public agents for the operations are:

- SRU - element for coordination of operations;
- GTL - technical team to develop action plans, supervises their implementation and to negotiate partnerships;
- Funds support.

The reasons for the poor results of these operations are mostly related to the complexity of technical procedures and a lack of financial capacity to purchase the property and / or the procedural charges.

It is true that the increase of entities can create conflicts of interest, lacks of communication and can make the process more complex. Thus, merging the entities which supervise projects of construction and rehabilitation could become useful.

However, the success of the urban rehabilitation is dependent on a range of concerted factors. If one of them fails, the whole process can also fail. Thus, the creation of supports as tax exemptions, reductions, or tax deductions for the construction, rehabilitation and purchase of property, as in France (Martin, 2006), would be a complementary measure to wake up the rehabilitation market, contributing to the success of the strategy.

Therefore, the above mentioned conditionings (lack of financial capacity and procedural complexity) would be minimized, making urban centre housing more possible to the young population.

2.1 The fields of action of urban rehabilitation

At the present time, the cities where we live are a consequence of several evolutionary problems. One of the most important is the degradation of urban centres (Figure 1). This phenomenon affects society at all levels, namely physical, social and economic ones.

Several urban centres suffered with this change, experiencing a decrease of real estate interest as well as other investments (Ribeiro, 2008). Houses were empty and in the streets daily commerce was declining, since it was starting a period of residential function decrease and a rise of commerce and offices pressure (CML, 2005). Seixas (2004) refers to the statement of LeFèbvre in 1970, that we were facing an “Urban Revolution” towards a globalization of urban space, affecting city life and shape. The consequences of this deep change were directly related to the growing diffuse city which caused a spiral of desertification and insecurity, and consequently growing social and economical problems. Since people moved to peripheral neighbourhoods, urban centres were becoming more empty. Buildings degraded with time, daily commerce lost its dynamism and strength

and these areas turned into Central Business Districts (CBD). During day, they are lively and full of people in the streets. However, as the night falls and offices close, streets become darker, emptier and insecure. Existent social problems like robbery and drug trafficking grow, while these areas become more degraded and unpleasant to residents.

Figure 1. Downtown desertification and buildings deterioration

Increasing urban population and their will of space and proximity to social facilities, allied with the growing traffic, caused a great expansion of the city and construction of infrastructures, promoters of accessibility. On the other side, inner-city was losing its resident population. The decadence of overseas trade, as well as the industrialization progress also contributed to this change. The lack of public space and high density was another problem which led to a need of leisure spaces and parking. These problems discouraged people dislocation into the area, increasing even more urban insecurity, as well as degradation of economic activities (Guerra, 1999). The major symbol of this phenomenon is the 1988 fire that destroyed one of the most important areas of Baixa Pombalina, Chiado (Seixas, 2004). Baixa, as a commerce and business activities area, still represents the second place for jobs in Lisbon, after the called Avenidas Novas district (CML, 2005). It was through this change of urban uses that this area has become a reference, as the dwelling has never been its most characteristic activity (Seixas, 2004; Guerra, 1999). In fact, originally, Baixa was for governmental and administrative centralization, as well as economic and commercial.

Today, in a world of urban sprawl and degraded historical urban fabric, the most reasonable way to continue developing urban environment, in relation to accessibility, mobility, energy resources, life quality and, in general, sustainability, appears to be restructuring urban centres and adequate them to the emerging parameters. Indeed, rehabilitation, together with territory management, can work as powerful improvers of inner-cities development and revitalization.

The measurement of urban regeneration impacts has to agree that city and citizens should be understood as an interdependent system of its various components, (for example, restructuring of public space will lead to other factors such as social relations, economic activities, etc.) and cannot have a basic approach, subject to interfere with the whole system.

Successful interventions can only be implemented by a comprehensive strategy that coordinate scales of intervention and ensure that there is a guideline to its coherent evolution. Every degree or scale of goals accomplishment is headed by an authority or private agent for urban planning. On the other side, interventions have to be implemented in an integrated form. It's not

possible to call people back to inner-cities if there is a sense of insecurity, or if there are no facilities around, even if there are good houses.

The great challenge for urban rehabilitation is the development of strategies that respond to two aspects of the problem: the traditional city and urban sprawl (figure 2) (Teotónio Pereira, 2005).

Figure 2. Sprawl is a waste of resources and a simplistic way of understanding the city

In fact, rehabilitation of urban centres is not only about revitalizing urban fabric or to increase the supply of properties for sale or rent. If this is the goal to achieve, we have to take into account the urban sprawl problem, on the opposite side of the city. The strategy must be comprehensive, in order to give a sense of urbanity to the whole central area. However, its inflated size turns the global achievement of urbanity very difficult, and the main reason is simply because there aren't enough residents to live in such great citiy areas. There must be a strategy that increases gradually life quality to each city zone.

Particularly for urban centres, life quality improvement concerns to a global intervention, in each field of action possible to influence it. It's not only about an improvement of housing conditions (Serdoura, 2006). It's about a global challenge that relates to each issue of urban life, namely:

- Urban planning and management;
- Houses and buildings;
- Public space and accessibility;
- Economic activities;
- Social environment;
- Heritage.

As already mentioned, the promotion of a strategy for the process of urban rehabilitation is very important. The urban planning and management have, as central goal, the achievement of sustainable development of the society, both in space and socio-economic aspects.

According to Haughton (1994), Sustainable Development is the one that "meets the needs of the present without compromising the ability of future generations to meet their own needs".

This field of action is essential to create a basis to restructure the city. It is the first thing to implement after strategic decisions. Finally, it is from the urban planning and through its management that measures are executed.

The theoretical basis for cities rehabilitation is the awareness that the urban environment must be scaled with the needs of the population (figure 3). Based on this issue, the balance between distance and time factors (accessibility) establishes the following principles for urban design:

- Functional diversity;
- Mobility;
- Accessibility for all;
- Environmental quality.

Figure 3. Example of a rehabilitation process on the way

In spite of the conditioning urban fabric of ancient cities it's essential to improve these qualities on the public space and private areas, in order to achieve the sustainable development of cities and territorial cohesion.

Other field of action is the buildings rehabilitation which is one of the major providers of growing enthusiasm and self-esteem of residents in relation to their neighbourhood, since it is one of the most visible ones, leading to the understanding and supporting of the performed work from the general public.

The public sector is the major agent in the case of public buildings, alone or in partnership. The positive effects are evident for the residents. It is important to ensure the quality of public services through the buildings conditions, on one side, because it encourages resident population to stay and, on the other side, it can be a factor in the attractiveness of the area for new residents.

For the rehabilitation of other buildings, the operations may be the initiative of the following agents:

- Public sector - in the case of expropriation, coercive works, alone or in partnership. The initiative may come from the government (for example, in the case of buildings of historic value) or the municipality through the GTL's.
- Private sector - the owners of the buildings can use investment funds and other supports that the municipality (GTL) can provide.

Concerning to interventions in existent public space, they are characterized by a careful approach, appropriate to the local reality. Indeed, interventions in existent urban environment involve a constant search for the balance between what is considered "good" and "possible", within the parameters of public space quality.

The improvement of public space may influence both the image and the way to live the city. Therefore, the following aspects should be taken into account in its design:

- Spaces for outdoor activities;
- Public transport and ways of dislocation;
- Diversity of environments and spaces;
- Balance between meeting spaces, space for economic activities and space for urban mobility (Serdoura, 2006).

In general, urban centres' public spaces already have their own character, which may be conditioner for the results of the intervention. Therefore, it's important to find the best possible relationship between "form and function, movement and ways of dislocation, (...) the ability of communication between the passersby and the significance of space" (Serdoura, 2006:69).

Understanding the public space as the urban environment where human activities are performed, it is possible to say that it is a habitat, establishing a close relationship with its environment, either with the different habitats that are the buildings around or with the field or the nature in general. Besides being the place that handles the majority of urban activities, the public space establishes much of the human relationship with the environment, by the way in which the public space is used and designed.

Territorial cohesion, as the ultimate goal of urban rehabilitation, directly influences environmental sustainability. The intervention in public spaces of urban centres should therefore have a greater concern with sustainability, as the urban activity in these areas is more concentrated.

One of the major problems with sustainability of urban areas is the pollution related to public and private transports. The public space design can minimize the costs of dislocation, improving mixed-use areas, high density centres, which discourage private transport. In fact, there are evidences that land use mix affects car ownership and transport mode choice for city travel (Van and Senior, 2000).

For the achievement of an intensification of the urban form, there are several ways to intervene:

- Developing new urban areas;
- Rehabilitation of existing buildings or previously developed sites;
- Subdivision of properties and conversions of use in existing buildings;
- Addictions and extensions of built area to an existing building or previously developed site (Jenks, 2000).

The ultimate goal for intensifying urban areas is to increase activity in the inner-city, in order to achieve a better mobility for the residents without having to use private transport. However, this is a drastic change on the way of life for the majority, which means that the probability of success is a little bit small than it may seem. In an urban centre almost free of private transport, people would have to give up cars to live in car-free housing, which may be understood as a loss of freedom for some people. Other problem that has been pointed to the increase of urban density is the higher

exposure to air pollution, because of the intensification of activities and, consequently, a higher number of people are affected.

On the other side, vanish of traffic congestion (figure 4) and improvement of air quality and public space would have a role on the overall satisfaction. The understanding of the positive and negative consequences is an actual discussion, but there is a common agreement that it's a possible solution for the increment of territory cohesion.

Figure 4. Traffic congestion

3 The Real Estate Crisis

Since September 2008 the world has been spectator of the decline of economic assumptions which governed the entire twentieth century. With the emergence of changes in the markets and, consequently, with the decrease of the ability of investment and decision, one of the first economic sectors to acknowledge difficulties was the real estate one.

The weakness of banks has turned the acceptance of large value loans to be more difficult, which, as a result, delayed property sales. Moreover, the difficulties of middle-class families related with unsustainable economic living (there were cases of total debt), led to an increase of the properties sale. The ever growing supply and lower demand have been reducing the selling price, without success. This economic spiral has only brought more suspicion by investors and the general public.

The necessity for the rehabilitation of city centres urban fabric is in direct conflict with the housing problem described above, because the revitalization of urban functions is dependent on the market agility, the mobility of economic activities and on the existence of demand from young families.

If, on one hand, the compact city principle is presented as a measure to combat the waste of energy resources, besides improving the overall quality of life, it also appears as an alternative to the low-density city. The use of existing buildings and their adaptation to new urban functions as well as the optimization of public space provide the necessary conditions for a new appropriation of urban centres. Moreover, with the real estate burst, urban rehabilitation appears as an alternative to the construction of new buildings and expansion of the city, preventing real estate speculation, which was one responsible for the current recession.

If we pursue policies to encourage rental housing, controlled costs housing, facilitating the acquisition of rehabilitated buildings, these centres can actually win a new life, taking advantage of the current crisis.

The vicious cycle is initiated on the following of industrial revolution, when two factors were joined. First, as several factories and companies needed larger areas, near the cities, they moved to the periphery of rural character, which generated some demand for housing close to these workplaces. Secondly, the hygienist mentality argued that people could live in more healthy places, outside of the inner-city, which was dense, polluted and with no green areas.

This double phenomenon has generated an excessive migration over to the periphery. The cities grew in an uncontrolled way, with low density areas, while in their centres most offices appeared, residential function disappeared and some areas, which were considered less healthy or with less accessibility, degraded with time.

The mass construction in previously rural areas led to the creation of residential clusters which were dependent of the city and where a sparse population led to an excessive spending on construction of infrastructure and social facilities. The suburban population has become dependent on transports (public and private), as the only way to deal with the traffic congestion at the entrance of city centres, where most of the jobs were located.

The behaviour that led to the real estate bubble burst has been repeated for decades in the suburbs, causing the sprawl expansion. In these areas, the economy was mainly related to real estate and construction, creating this vicious cycle (Florida, 2009).

The rapid growth of cities has instilled energy in the real estate and construction markets in these areas. Credit accessibility and property evaluation by banks and insurers led to a gradual increase in the prices of houses, even already used ones, without affecting, at first glance, the purchasing power of most people.

Thus, since houses were much more valued, the demand was higher, as people expected to purchase a house with the same capacity of valuing, in order to optimize the investment. The more construction activity, more people bought, the money was circulating, and therefore economy rose. The economic base of these suburbs was only his own construction, or even nonexistent, because they were dependent on the metropolis. So, they grew out of control (figure 5), building houses continuously and increasing their prices (Florida, 2009).

Figure 5. Lisbon's stencils saying "So many people with no home, so many nobody's home" and "Housing is a right!"

Besides, with the excessive development of these areas, people have become increasingly dependent on transports. The response of government, markets and society in general was the aggravation of this situation, building up and extending motorways, in order to improve accessibility to the centres.

Suddenly the vast majority of people in any social class realized that they were in a serious problem, consuming more than they could, being stuck to asphyxiant loans. As a way to solve the problem, many people wanted to sell its home in order to exchange for another one, more suitable to their economic capacity. The irony of this problem is that, despite lower prices, people are unable to change homes because, first, they are all waiting for the prices down further and, moreover, the banks no longer accept the old credit terms, making it more difficult to obtain permission to take out a loan for housing.

The situation has become totally unsustainable, because the construction and real estate companies were completely dependent on this cycle of indebtedness and growth of the suburbs.
The current overall recession marks a turning point in the entire financial system, making society impossible to recover as it was in the past.

The city as a human habitat is a reflection of the society condition. Thus, assuming the new premises, where the exchange of ideas no longer depends on interconnection - accessibility - but on their fusion and innovation, we can say that the compact city model responds more effectively to the problem. Indeed, in a place where a variety of people live intensely, different cultures, habits, in an area full of life and dynamism, inner cities reach a level of more rapid and intense innovation. Urban centres, filled with culture, tradition and diversity, are the space-keys.

The question is: how can we overcome this crisis in real estate and construction sector, in order to revitalize economy, according to the new premises?

There may be many suggestions and points of view of the problem, but on this issue in particular, and after examining what is happening in the inner-city in physical, social, psychological, administrative and even legal terms, we can say that we must take a new vision of the city. One of the keys to solve the problem is the loss of importance of property acquisition.

When people spend an entire life to buy a house, they are stuck with a loan, which will be an eternal barrier to other investments such as education, health, and so on. Not everyone can buy a home with the best location, so if the rental market is enhanced, a rent in the centre means greater mobility, less need for transports, less government spending in infrastructure; in short, means that the urban population could contribute more to the desired territorial cohesion.

In a first stage, in order to balance the economy, Florida (2009) proposes that the government could implement, in partnership with banks, a measure that instead of removing the houses that the owners could not afford to pay the loan, would offer the possibility to rent each home to the previous homeowner, at market rates, for some period of time, until it was given the option to buy the same house, at the prevailing market price. Thus, with a more dynamic and healthy rental market, the option to seek a better home for rent appears to be more favourable for many people.

Secondly, Florida (2009) proposes to find solutions that encourage the establishment of people in the city centre, while developing a broad and integrated rehabilitation process of these areas. By then, people should already be free from the old mentality, and thus more open to the

option of renting a house that, although small, is at the heart of any urban life, with all facilities, leisure places, and near most of the jobs.

However, it is important to remember that a balanced market is the one that offers opportunities to all people, no matter social class.

4 The case of Lisbon Downtown

During the last decades of 20th century, Baixa Pombalina has suffered a loss of centrality and functions, along with an increasing degradation of the buildings. The main presented problems by local population for an urban restructuring are the following:

- Sense of insecurity – as there are fewer shops, houses and thus, less natural surveillance;
- Lack of parking – discourages people from going shopping or from living there;
- Decrease of economic activities – is a consequence of the whole system, as insecurity, lack of parking, aging population, lack of social facilities, etc. are all factors to create this phenomenon.

The decrease of economic activities generates less people on the streets; increasing sense of insecurity and even criminality (Figure 6).

Figure 6. Baixa Pombalina degradation

On the other side, the lack of parking and social facilities also contributes for the housing desertification, transforming downtown in a non-attractive area, in spite of its geographic centrality, identity and heritage value.

During the 1990's, the small budget and public only initiative were still insufficient to ensure successful interventions. On the other side, the way of intervening was almost restricted to the recovery of buildings in critical condition, disregarding interventions on the public space, urban facilities, employment and other issues of socio-economic order (Magalhães, 2000).

In spite of the loss of economic activities, this area preserved some importance relatively to employment posts, partially due to the financial and communication services, as well as the administrative and governmental sector (all economic activities belonging to EBC – Economy based on knowledge – sector) as Baixa is historically linked to. However, the major problem for this area at the present time is the lack of Advanced EBC activities (EBC Avancada), which are economic activities based on an advanced knowledge, like high technology, research, or consulting (Figure 7). Urban Rehabilitation goal in Baixa Pombalina is to revitalize its economic and social fabric, keeping its cultural identity.

Later in that decade, there were created the “Projactos Integrados” (Integrated Projects) that had the aim to involve external shareholders in occasional interventions. Although this strategic change obtained some results, it was so far insufficient, since the use of external partnerships only in specific projects didn’t promote a comprehensive rehabilitation.

Over time experience between local authority and external agents led to significant improvements in Lisbon. Despite being limited interventions, the continuity of investment, as well as the involvement of local agents led to a gradual change in residents and visitors from various parts of the city life quality.

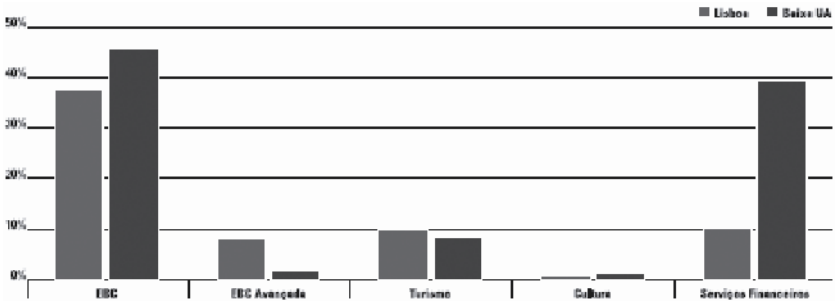

Figure 7. Employment characteristics of Baixa Pombalina and Lisbon (Source: Seixas, 2004, p. 78)

Nowadays, in spite of its slow evolution, it’s already visible that there are small changes happening in Baixa Pombalina. Although there is still a tendency to aging population in this area, it is already perceptible an increase of these neighbourhoods attractiveness to young people from other parts of the city, leading to a “gentrification” process.

“Gentrification” is already installed on some areas of Lisbon that have some advantages, as better accessibility or bigger areas of the houses. Most of the new residents are foreign to the neighbourhood, being often from other countries (Magalhães, 2000). Its consequences are still a discussion issue in terms of integration of so different ways of life of the locals and the foreign ones. There are still some doubts on the preservation of a cultural identity that is present in the area and can be recognised by its traditional population but which can be threatened by a new dynamic. On the other site, this new residents have more consciousness of the positive effects of urban rehabilitation on the environment and quality of life, as well as their higher scholar qualifications and more favourable professional position allow them to have more available resources to contribute to the process development. Thus, mixing different types of population can improve a more participated and enthusiastic role on rehabilitation without putting in risk social fabric.

From a survey conducted by Isabel Guerra (1999) to understand what were the structuring measures considered by Baixa Pombalina visitors to implement, it was found that they value the achievement of three areas of action:

- Baixa Pombalina "culturization" - through the provision of cultural facilities and high quality leisure and culture services;
- Strengthening housing activity - allowing the use of public space at night and on weekends and intensifying street policing, thus reducing the insecurity feeling;

- Buildings and public space rehabilitation – fighting against deterioration of heritage and rethinking parking and traffic.

4.1 Legal Planning Instruments for Lisbon's downtown

Today, urban development policies try to find the better use of these degraded areas and, in a wider perspective, indicate to three main intervention vectors, economic, physical and social aspects. The most recent policies implemented in Lisbon, in accordance with these principles are:

- Submission of Lisbon's Pombalina inner-city to World Heritage List (figure 8) - approved on 19th May 2005 with the Proposal nº 352/2004. Recognizes the immense value of inner-city skills and promotes this area;

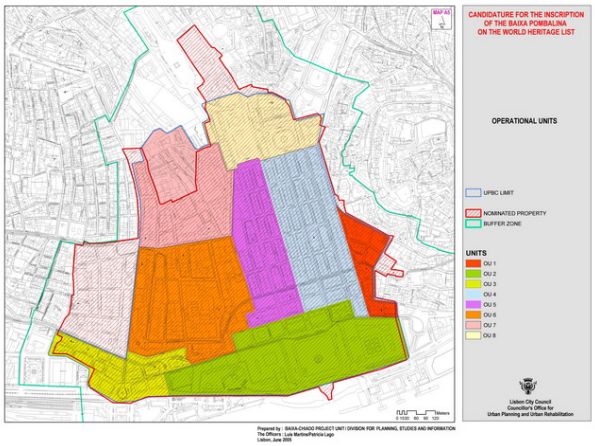

Figure 8. Submission of Lisbon's Pombalina inner-city to World Heritage List (Source: CML, 2005)

- Área Crítica de Recuperação e Reconversão Urbanística (ACRRU) -Statement of Critical Area of Recovery and Urban Conversion of Baixa-Chiado- and right of first refusal of the municipality of Lisbon - through the Proposal nº 92/2008 approved on 19th March 2008 and legally declared by the Decree-Law nº 9/2009 on 2nd March 2009. This kind of instrument makes the administrative procedures and enforced intervention of Lisbon Municipality (CML) easier in private buildings, in order to implement strategies for rehabilitation;

- Revitalization of Baixa-Chiado Program - submitted in September 2006 for subsequent submission to the Municipal Assembly in September 2006 and approved by Proposal nº 120/2008. It consists of the planning of actions to be taken to effect the implementation of proposals able to undo the degradation process of Baixa-Chiado, in generating new sustainable activities and call people back to town (CML, 2006);

- Plano de Pormenor (PP) -Detail Plan of Lisbon's Pombalina inner-city- Proposal nº 90/2008, approved on 19th March 2008. It consists of the implementation of revitalizing strategies for an effective planning tool. Thus, these policies take the force of law and are developed in the form of concrete measures to implement, with cost and timing expectations;

- Establishment of the Plano Geral de Intervenções na Frente Ribeirinha de Lisboa -General Plan of Lisbon waterfront- approved on June 25th, according to the Proposal nº 504/2008. This tool

has already a more global view of the city as a system and operates mainly in the articulation of the various waterfront zones.

In these days, it's being discussed the proposal for the "Programa Local de Habitação" (Local Housing Program) for the Lisbon municipality. We hope that it will be a great step towards more integrated housing policies and, consequently, a good help on the rehabilitation of Lisbon's downtown.

4.2 What about the reflexions of the recession in the real estate activity of Lisbon's downtown?
Lisbon's downtown is a paradigmatic case for the present issue. This is a central area of the city with great heritage and history, but with serious problems of accessibility and functional desertification.

Unfortunately you cannot estimate how this area will respond to the crisis in the real estate sector as it is an urban fabric special case.

Urban areas that already have difficulties in their development and urban integration are also the weakest in these difficult times. However there are aspects that can be positively used for these areas in times of real estate and construction recession.

People are indebted, they want to sell their house to buy a cheaper one and thus reduce costs. Prices fall. Nobody buys. Prices fall more. The construction of new housing plots becomes unfeasible, because they will never be sold. When people can sell their houses, they have to switch to another that is more economically sustainable, that is, smaller and more central.

If the policies of housing and urban rehabilitation are coordinated, we think it will be possible to rebalance the distribution of functions in the city of Lisbon. This is the time!

5 Conclusion

The awareness of urban centres rapid deterioration and of the urgency to act efficiently and effectively is the main reason for the deepening of the methodology and policies to be implemented in order to achieve a more positive reaction of the city, understanding it as a system.

To reach a new way of intervening, first it is necessary to analyze the existent problems, as well as how far have gone the past interventions on site, which aspects have been raised and with what degree of deepness, in order to evaluate the overall effectiveness in each stage of implementation of an urban rehabilitation strategy.

We cannot predict the success of measures implementation, even if we want to, but we can evaluate the viability of actual tendencies, knowing that there are several factors which can influence reality in a medium term future. This will create more realistic expectations on the effectiveness of the ongoing strategies. To be more precise, if we develop a close study of the changes that have happened in recent months in the economic field, particularly in the real estate sector and a prospective analysis of the behaviour of the population in the coming years; it might be a key factor to regulate the underway activities in order to develop a critical scenario, integrating this factor of deviation from expectations.

Measures as the adaptation of existing buildings to new urban functions or the optimization of public space can afford the conditions for a new appropriation of urban centres that is coherent with the changes that will appear in consequence of the real estate burst. As a matter of fact, urban

rehabilitation appears as the alternative to the low-density and higher consumption city, preventing real estate speculation. Policies of encouraging rental housing, controlled costs housing and facilitation of acquisition of rehabilitated buildings are useful instruments to fight against real estate recession.

There are some central issues that influence success of rehabilitation process, as improving housing conditions and complementing it with other related measures that allow life quality to increase. Lisbon's downtown, as well as other cases, needs to correspond to the new life frame and parameters of urban quality, as well as a good media divulgation, in order to attract residents that give it a new dynamic.

To increase the success of rehabilitation strategies execution it's necessary to take into account the evolution of certain quality parameters of urban environment, such as:

- Life Quality parameterization - to improve life quality and, consequently, promote social and urban rehabilitation, it is needed to focus on residential question, but also on comfort patterns, tradition, local and general accessibility, parking, education, health, and commercial skills. Particularly for urban historic fabric, interventions involve an additional effort on the reach of a balance between "good" and "possible", within the parameters of public space quality;

- Social, economic and environmental sustainability - knowing that people are beginning to show up new social, economic and environmental concerns, it's urgent to understand that urban environment must be scaled with the needs of the population. The reach for dense urban areas leads for an attempt to increase economic activities, in order to achieve a better mobility for the residents without having to use private transport, as well as an economic sustainability. Some encouragements as tax exemptions, reductions, or tax deductions for the construction, rehabilitation and purchase of property would be a useful to increase dynamics on the rehabilitation market;

- Identity and Heritage - the interventions articulation with heritage preservation and its return improvement must be taken into account.

In fact, a simple material intervention on the creation of housing conditions doesn't mean success. Buildings and public space rehabilitation indeed grant enthusiasm and self-esteem of residents in relation to their neighbourhood, since it is one of the most visible intervention fields, leading to the understanding and supporting of the performed work from the general public. But we need a material intervention mixed with social strategies that fit with socio-cultural changes, in order to move people from the periphery to the centre.

Besides, these operations fail not only for the "one view" interventions but also because of the complexity of technical procedures and a lack of financial capacity. Thus, merging municipal instruments could help to the achievement of an urban cohesion.

Increasing divulgation and active participation of locals and residents is another factor for success. The knowing of what is a rehabilitation plan, what is its relevance and how can population be involved to help upgrading life quality is important for the general encouragement. Besides, we know that the population-target of these interventions is mainly young and that the present urban attractiveness is not enough, so it becomes essential to spread the message of helping cities to

achieve sustainability, to encourage people to think of what is the best way to successfully integrate these areas and to participate in local decision making.

Urbanity is a condition of human being. And City is the material result of society. Today, we have to assume the leadership of our society (City), which has been disappearing through a speculation process. Thus, assuming a renewal of the premises, where the exchange of ideas mainly depends on their fusion and constant innovation, we can say that the compact city, filled with culture, senses, information and diversity, is the space where changes are.

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Public housing renovation plus space transformation

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In the 1950s, the "Plan of Improvements for the City of Porto" (*Plano de Melhoramentos da Cidade do Porto*, 1956-66) set off the construction of many public housing complexes to solve the need for housing, as industrialization had caused migration to cities. By that time, one main code was published – the *Regulamento Geral das Edificações Urbanas* (1951) – which till now is the most important document to regulate construction activity. This code covered certain legal aspects, but it was quite general with respect to building restrictions. Public housing complexes built in Porto in the 1950s, 60s and 70s do not present nowadays satisfactory quality level (constructive, but also architectural and residential), failing to comply with some of the present regulations and living standard expectations. In the last few years, some of these urban morphological units have been renovated in order to fulfill current Portuguese codes of practice (under revision, following recent EC directives). The renovation strategy is targeted on technical improvement of housing envelopes, sometimes improving outdoor space, and rarely addressing interior spatial transformations. One municipal housing reference case from 1953 in Porto, presently under deep renovation, shows how architecture may be instrumentally capable of positively transforming these housing complexes, dignifying both interior and external residential spaces. This paper recalls the urban regeneration that might result if deeper housing refurbishment is contemplated on a municipal strategy. In times of uncertainty, is it reasonable to claim renovation *plus* space transformation without necessarily a much higher investment?

Keywords: urban and residential quality, public housing renovation, interior space enlargement, typological transformation, minimum areas

1 Introduction

"In an ever smaller world, the permanent home of the human adventure, finiteness opens new opportunities to an Architecture with ethical responsibility, social relevance and physical meaning" (Rodeia, 2006). Though architecture is commonly seen as a "luxury" – especially when considered in limit situations of very low economic capacity – to plan with economic concepts and restrictions may be also seen as a "strategy" (Adrião and Carvalho, 2006). To Jean-Philippe Vassal (teaming with Anne Lacaton), this strategy is not just useful in developing countries, but also in developed ones, leading us to another perspective in which *good design* is much acclaimed as a form of "adding value" (*Urban Design Compendium 2*, 2007). This "instrumentalization" of architecture is believed to be useful in public housing renovation, towards a higher dignity and urban quality of related areas. To identify the characteristics of the public housing reference case discussed in this paper, an understanding of the historical context of social housing in Porto is needed.

2 Public housing in Porto

2.1 Historical and political context until the 1980s

A historical overview of public social housing in Porto leads us back to the beginning of the 20th century, although the humanitarian worries about health and salubrity of the working class dwellings had started long before, in the 19th century.

The industrialization process in Portugal caused significant migration to cities during the second half of 19th century, highly increasing resident population in the cities. In Porto, the scarcity of dwellings for the arriving population was the main reason for the development of a particular form of housing – the "*ilhas*" ("islands") – which was generally built by private initiative and became the most adopted solution to provide housing for the emerging working class at that time. This specific accommodation typology was normally built in the backyards of middle-class houses, and "(...) consisted, in most of the cases, in rows of small houses (ten and a little more), generally with ground floor, arranged perpendicularly to the street, along narrow lots, generally with 5.5m of width and 100m of depth [a consequence of the *Almadas* urban policies between 1758 and 1813], to which one entered through a narrow corridor. In addition to the space exiguity there was the lack of sanitary infrastructures in the interior of the accommodations which only had collective latrines and bathing units outside." (Pimenta and Ferreira, 2001a) The ground-floor "cells" usually had 16 m^2, and the still existing *ilhas* units (normally enlarged by a second floor) present an average area from 30 to 40m^2 nowadays (Pimenta and Ferreira, 2001b).

In the end of the 19th century, close to 30% of the population of Porto lived in *ilhas*, and in 1939 close to 20% of the population was still living in these accommodations without satisfactory hygienic and salubrity conditions (Pimenta and Ferreira, 2001a). Indeed, the over occupation of this particular form of housing and its insalubrity, along with the extreme poverty of the resident populations, highly contributed to disease proliferation, as tuberculosis among others, which emerged as a threat to public health, demanding an urgent intervention (Pimenta and Ferreira, 2001b).

The "General Code of Health" (*Regulamento Geral de Saúde*) was published in 1901, being followed by the publication of another regulation in 1903 – the "Code of Salubrity of the Urban Constructions" (*Regulamento de Salubridade das Edificações Urbanas*), both codes contributing to dissuade the construction of new *ilhas*. The first social housing in Porto for workers and population with no economical capacity - a municipal partnership with a local newspaper, "*O Comércio do Porto*" - was built in the early 20th century, however fulfilling only a very little part of the housing needs of that time.

It was therefore during the second decade of the 20th century that Portuguese Government begun to provide economic support to housing, coming in the aftermath of the demise of monarchy and meeting the republican worries about housing needs. As referred by Coelho (2006), from 1918 till 1933, scarce but interesting urban and residential typological experiences were built, prevailing small multi-storey buildings and single family house typologies, with accurate urban design and planning.

After 1935, following previous regulations, the Government Central Administration was responsible for building more than 2000 "Economic Houses" in Porto, for rent in a "resoluble

ownership" scheme[35] (Pimenta and Ferreira, 2001a), which gave tenants the opportunity of becoming owners by paying a monthly amount (rent) during a 20-year period.

However, it was the "Plan of Improvements for the City of Porto" (*Plano de Melhoramentos da Cidade do Porto*, 1956-66) that set off the construction of many of the public housing complexes one may find in Porto nowadays. Actually, this 10-year period plan to build 6000 dwellings (beginning on January 1957) was already a consequence of a preceding plan to improve salubrity in *ilhas* - the *Plano de Salubrização das Ilhas do Porto* (1956). The "Plan of Improvements" - that carried out the construction of 6072 dwellings in the scheduled time - was a large scale intervention with considerable urban and social consequences: 15% to 20% of the population living in Porto central area at that time moved to the peripheral "areas of expansion" (Pimenta and Ferreira, 2001a). Even so, and considering also the 5-year extension made to the "Plan of Improvements" from 1967 to 1971 (which built only 1674 dwellings from the expected 3000), housing needs persisted.

Among the attempts to face social housing scarcity that followed, particular reference is made to *Serviço de Apoio Ambulatório Local* (*SAAL*), a program from 1974 to 1976-78 that presented a completely new perspective to the city – a strongly participated mode of building social housing.

The construction of public housing slowed down in the 1980s and 1990s, as the Government changed its social housing strategies, gradually creating legislation to encourage the private sector (increasing private house ownership) and by incrementing Housing Cooperatives investment[36].

2.2 Legislation and planning restrictions before *RTHS* publication in 1985

Though risking missing important data, a brief chronology will be presented of the regulations regarding public housing promotion. However, only regulations establishing restrictions to building conception and planning were included. Attention was paid to the evolution of Class, Category and Type definitions; room number; minimum/maximum areas.

One Code from 1918, Decree Law (*Decreto-Lei*) D.L. nº 4137, regulated economic housing construction (destined to the working class). This code established the constitution and renting values of the four Classes (I, II, III, and IV) for houses. These Classes were distinguished by the number and minimum area of rooms, as well as for having kitchen and bathroom facilities (Coelho, 2006).

The D.L. nº 16 055 in 1928 and the D.L. nº 23 053 in 1933 regulate the construction of Economic Houses. D.L. nº 23 052 in 1933 establishes two Classes of houses (A and B) with three Types each as well as lot minimum areas (Decreto-Lei nº 23:052, 1933), to distribute in a "resoluble ownership" scheme.

In 1943, D.L. nº 33 278 establishes the construction of a great number of Economic Houses in a "resoluble ownership" scheme (more than 4000 in several cities), adding two classes of houses (destined to Middle-Class families). Therefore the code establishes four Classes (A, B, C, D, being C and D to the Middle-Class) with three Types each. Lot average areas are also distinguished

[35] In a "resoluble ownership" scheme (*fórmula de propriedade resolúvel*) tenants become owners only after a pre-defined tenancy period. This was a sort of "mixed tenure housing scheme" but more limited (as typically, in a "mixed tenure housing scheme" one might be able to buy outright, rent, or opt to part buy property on a 'shared ownership' basis with the provider).

[36] Though private house renting legislation was not referred, it was partly responsible for the ever growing gap between rent and property values since 1940s till 1980s decades. This fact increased not only tenants "protection" but also private renting buildings degradation, today disqualifying main cities centres in Portugal.

according to the Classes (Decreto-lei nº 33:278, 1943; Coelho, 2006). It was now clear the *Estado Novo* housing policies promoted single family house as the most adequate typology (Pimenta and Ferreira, 2001a).

A law from 1945, Lei nº 2007, regulated public rent-controlled housing, defining its development – as building typology (ground-floor plus tree floors), two Classes (1st and 2nd) of houses, minimum number of rooms for each Class (3 and 5 respectively, in addition to kitchen, pantry, toilet and bath, and which exceptionally could have the minimums of 2 and 4 rooms) – but also defining construction management. Quite relevant is the fact that multi-storey buildings became more "accepted" for social housing (Lei nº 2:007, 1945; Coelho, 2006).

The *Regulamento Geral das Edificações Urbanas* (*RGEU*) published in 1951 (1997) - the most important legal document to regulate construction activity till today - replaced the former "Code of Salubrity of the Urban Constructions" (*Regulamento de Salubridade das Edificações Urbanas*) from 1903. *RGEU* (and its updates) would effectively define some legal aspects (e.g. minimum distance between buildings, technical requirements, dwelling minimum areas and related interior living spaces) but it was quite general with respect to construction quality requisites.

Regarding the City of Porto, in 1956 the D.L. nº 40 616 approves the "Plan of Improvements" (*Plano de Melhoramentos da Cidade do Porto*, 1956-66), which envisaged the construction of 6000 municipal rent-controlled accommodations in a 10-year period, to re-accommodate population from *ilhas* and other degraded housing to be demolished. Besides the reintegration of the resulting demolition areas in the centre, D.L. n º 40 616 also referred the city "expansion areas" to be created, as well as the urbanization of *Campo Alegre* area. In what concerns restrictions for house buildings, these should be in accordance with *RGEU* dispositions (Decreto-Lei nº 40 616, 1956).

As referred by Teresa Heitor (*apud.* Coelho, 2006), until 1959 the distinction between economic dwelling units depended on their room number. The cost/area ratio was only introduced by D.L. nº 42 454 from 1959, and house buildings where then distinguished by quality level and conception type, according to different Categories (Cat. HR, I, II, II and IV).

A study by Nuno Portas published in 1969, *Funções e exigências de áreas da habitação*, introduced a "unique Category" concept (that would be adopted in later legislation), influencing as well many other studies that followed (Coelho, 2006).

In 1970, D.L. nº 576/70 presents new classification in Categories (house unit level) and Types (number of rooms and respective occupants), being the Categories distinguished by usable area (floor area), finishing materials and equipment quality, occupants/usable area ratio, and rent/income values ratio (Heitor *apud.* Coelho, 2006).

Portaria nº 759/74 from 1974 establishes a unique Category contemplating five Types (T0 to T5), as disposed on D.L. nº 608/73. Only in 1975 Portaria nº 449/75 clarifies the unique Category definition, putting it in accordance with *RGEU* from 1951 (updating minimum areas) – a process that some years later would originate the "Project Instructions for Government Promoted Housing" (*Instruções para Projectos de Habitação Promovida pelo Estado, IPHPE/FFH)* in 1978, and the later subsequent publication in 1985 of the "Social Housing Technical Recommendations" (*Recomendações técnicas de habitação social*, 1994) (*RTHS*). Actually, *RTHS* publication in 1985

(Despacho 44/MES/85, subsequent to Despacho 44/MES/83) had been announced in a previous regulation, which was Portaria nº 580/83 from 1983 (updated in 1988 by Portaria nº 828/88).

The above regulation review brings up the idea that till 1975 the several Classes, Categories and Types for housing promoted by the Government were defined in various Codes and Regulations, which evolved in accordance with the different needs and housing policies, from a national but also local perspective, so as to meet the specificities of the population to be re-accommodated.

2.3 Socio-economic context and recent municipal strategies for public housing renovation

One study based on a municipal census from 1999, published by *Câmara Municipal do* Porto in 2001 (Pimenta and Ferreira, 2001a), provides important data for better understanding not only the social and economic situations of social housing in Porto, but also the ongoing renovation strategies and trends.

According to this study, general indicators show that the decreasing population in Porto is also getting older (Martins *apud.* Pimenta and Ferreira, 2001a). It is also referred that close to 15% of the resident population in Porto live in public housing (Pimenta and Ferreira, 2001a). Actually, the national census of 2001 shows that 16% of total housing in Porto was public property (*Censos 2001*, 2001), which represents a high percentage when considering that in Portugal only 3% of total housing was public property (Czischke, 2006). Furthermore, a great part of the public housing residents in Porto are considered insolvent population, who mostly cannot afford public housing occupancy after rehabilitation, even with subsidies. The 1999 municipal census also indicates that a high percentage of municipal housing residents would like to change home (mainly due to general degraded conditions) without changing city area (Pimenta and Ferreira, 2001a). Another important fact is that the percentage of over-occupied accommodations (10%) was then inferior to the percentage of the under-occupied ones (16.2%) (Pimenta and Ferreira, 2001a). In spite of the conclusions this data can lead to, it is also referred that the socio-urbanistic reality of the inquired housing developments is far from being homogeneous, and that the given indicators do not convey the singularities of some particular situations (Pimenta and Ferreira, 2001a). The same is said about the heterogeneity of these housing development conditions and their “social singularities and local specificities” dismissing any attempt to generalize (Pimenta and Ferreira, 2001a).

An understanding of the available possibilities to improve social housing developments in Porto, despite its local specificities, demands a more general integration in national housing strategies. A recent preparatory study to a future “National Housing Strategic Plan” (*Plano Estratégico da Habitação*) originated three documents (*Contributos para o Plano Estratégico de Habitação 2008/2013*, 2008) which give detailed socio-economic information about housing in Portugal. According to these, in what concerns housing situation, Portugal is much closer to the South European countries than to other Western countries in Europe. Following this study, the 2001 census shows that there were close to 177000 dwellings lacking, while close to 544000 were empty, which leads to the conclusion that dwellings are not balanced enough nor equally distributed. Regarding public housing, this study also underlines social dwellings property alienation of the last two decades, as public housing gradually passed from Central Administration to municipal

management. Within these documents, Housing Cooperatives and municipal “Local Housing Programs” are seen as important agents for the housing policies of the near future.

Concerning municipal strategies for public housing renovation in Porto, and following the above mentioned 1999 study, till the 1990s there were no maintenance programs applied to social house buildings (Pimenta and Ferreira, 2001a), which naturally became highly degraded. This partly explains why public housing complexes built in Porto in the 1950s, 60s and 70s do not present a satisfactory quality level nowadays, not complying with many of the current regulations and living standard requisites.

In the last few years the city centre of Porto went through a process of large urban regeneration and revitalization, in the context of the 2001 European Capital of Culture in Porto. This was also an opportunity to set off a municipal housing renovation activity. Some of this social housing have been under renovation in order to fulfill current Portuguese codes of practice (under revision, following recent EC directives). The renovation strategy is mainly targeted on technical improvement of housing envelopes (external walls and ceilings), sometimes improving outdoor space, sometimes including accommodation maintenance and rarely tackling interior spatial transformations. However, most of the social housing complexes that were built in Porto, mainly those built by the “Plan of Improvements” (not complying with nowadays ‘standard’ minimum areas, as analyzed on 2.2.) could have been more positively *transformed* if a deeper[37] renovation was to be considered, for which a higher initial investment had to be made (possibly bringing other long-term benefits).

3 The “Plan of Improvements for the City of Porto 1956-66” housing developments

The 10-year “Plan of Improvements for the City of Porto” (*Plano de Melhoramentos da Cidade do Porto*, 1956-66) carried out the construction of 6072 dwellings in the scheduled time. This large scale intervention was responsible for re-accommodating a considerable part of the centre of Porto resident population in the peripheral “areas of expansion”.

3.1 House buildings general characterization and dwelling guidelines

In order to fulfil the Plan initial target - 6000 dwellings in 10 years -, the housing planning followed a previous detailed study (financial but also social), based on inspections of the living conditions of the families to re-accommodate. Building conception had to be highly optimized regarding global cost/total number of dwellings ratio, for which site plan strategies and local traditional construction methods were also recommended.

A publication from 1966 (*Plano de Melhoramentos da Cidade do Porto 1956-66*) shows the areas that were considered for the different Types (T1, T2, T3 and T4) of the three distributive schemes (solutions A, B and C) contemplated for the elected typology: multi-storey buildings (ground floor plus 3 floors).

As referred by Nuno Portas, the housing typologies built by the commonly called *Plano das Ilhas* “(...) achieved the lowest «standards» ever practiced in [Portuguese] economic housing (50 m2

[37] By "deep" the authors mean a more "intensive" level of the intervention, beyond its physical extent. Within this perspective, the higher this level becomes, the more positively transformation occurs.

for Type 3/6 occupants), rising again, shortly afterwards (...)" in a subsequent intervention in Lisbon within a different legislation context (Portas, 1969).

D.L. nº 40 616 from 1956 (that published the "Plan of Improvements for the City of Porto") establishes the dispositions buildings should obey. Following the article 6 of the legislation, building project-type conception should also regard (between others) the applicable dispositions of *RGEU* from 1951, though not compromising the "(...) rigorous economical conditions to achieve the controlled rent aim."[38] (Decreto-Lei nº 40 616, 1956).

3.2 Minimum areas analysis

Table 1 gathers up data regarding minimum and maximum area analysis. It was not possible to find a common "area" value for comparison (as *RGEU* provides minimum values for "gross area" and "habitable area", while "Plan of Improvements" presents "usable area" values). Consequently, the maximum value for "usable area"/"gross area" ratio established in *RTHS* was applied, in order to find acceptable "gross area" values for comparison. The comparative analysis suggests that the average areas established for the "Plan of Improvements" dwellings are above the minimum values established in *RGEU*.

4 *Plus* "concept" by Druot and Lacaton&Vassal: social housing renovation in France

Plus, the study by the French architects Frédéric Druot, Anne Lacaton and Jean-Philippe Vassal (Druot *et al.*, 2007) proposes a new approach to the modernist housing developments built in the suburbs of Paris in the 1960s and 1970s. Following Ilka and Andrea Ruby, these housing developments population is generally from lower income social groups, and the present social and ethnic segregation leads to "(...) high unemployment levels and criminality. The social tension created by this situation has given the *banlieue* a notoriously bad image that politicians want urgently to improve. For them the medium of this negative image is the architecture, the large residential towers that represent (…) the failure of French integration policy. Due to their ideological contamination the intention is to demolish most of these buildings (...)" (Ruby and Ruby, 2007). Consequently, Druot, Lacaton and Vassal set off a campaign proclaiming the possibility of renovating these buildings foreseeing in "*Plus*" its potential by its radical transformation.

The "attitude" behind this study cannot however be detached from Lacaton&Vassal previous architectural work. In their projects, "luxury" acquires a proper understanding far from the idea of "expensive" and much closer to "space generosity". By planning with economic concepts, these architects adopt an *existenzminimummaximum* concept offering to their clients the *existenzmaximum* space for the *existenzminimum* budget (Ruby and Ruby, 2001). It is the modernist *existenzminimum* concept, (on which most of 20th Century social housing in Europe was based) that Lacaton&Vassal seem to be always trying to surpass, providing a "miraculous transformation of *surplus value* into *surplus space*" (Ruby and Ruby, 2001).

[38] The original text (Decreto-Lei nº 40 616, 1956): *"Art. 6.º Os prédios para habitação a construir pela Câmara Municipal nos termos do artigo 2.º obedecerão a planos de urbanização e a projectos-tipo a aprovar pelo Ministro das Obras Públicas, elaborados de harmonia com as disposições aplicáveis do Regulamento Geral das Edficações Urbanas, sem prejuízo das rigorosas condições de economia de realização inerentes ao objectivo de modicidade das rendas."*

Table 1. Comparative analysis between: housing minimum areas in *RGEU*; social housing maximum areas in *RTHS* (Port. 580/83); housing areas in "Plan of Improvements"

Minimum areas in *RGEU*, 1951*	unit	T1	T2	T3	T4
Habitable rooms: minimum area					
Double room	m^2	10.5	10.5	10.5	10.5
Twin room	m^2	-	9	9	9
Twin room	m^2	-	-	9	9
Single room	m^2	-	-	-	6.5
Living-room	m^2	10	12	12	12
Kitchen	m^2	6	6	6	6
Supplement (to distribute between living-room and kitchen)	m^2	6	6	8	8
Minimum Habitable Area (AH)	m^2	30.5	43.5	54.5	61
Bathroom minimum area	m2	3.5	3.5	4.5	4.5

Minimum areas in "Plan of Improvements", 1956	unit	T1	T2	T3	T4
Habitable rooms: minimum area					
Double room	m^2	10	10	10	10
Twin room	m^2	-	8	8	8
Twin room	m^2	-	-	8	8
Single room	m^2	-	-	-	6.5
Living-room	m^2	14	14	16	16
Minimum Habitable Area (AH) (no kitchen)	m^2	24	32	42	48.5
If kitchen was considered (+ 6 m2 cf. RGEU)	m^2	30	38	48	54.5

Areas comparison	unit	T1	T2	T3	T4
Gross Area (AG)					
Minimum (*RGEU*, 1951)	m^2	52	72	91	105
Maximum (*RTHS*, Port. 580/83, 1983)	m^2	65	85	100	114
Maximum (*RTHS*, Port. 828/88, 1988)	m^2	65	85	105	114
Usable Area (AU)					
Average ("Plan of Improvements", 1956)**	m^2	32.4	40.2	50.6	61.1
AG ("Plan of Improvements", 1956) (estimated AG = AU x 1.33) ***	m^2	43.1	53.5	67.3	81.3

* *RGEU* is under revision; minimum areas increase is expected in revised code
** Average values from different types/kinds areas in a *CMP* publication (1966)
*** Following *RTHS* (Port. 580/83, cf. 4.2.1.2.), the AG/AU ratio for multi-storey housing should not exceed 1.33

Considering each housing development as a singular case (thus refusing a general approach), Druot, Lacaton and Vassal point out a kind of premise: "never demolishing, subtracting or replacing things, but always adding, transforming and utilising them" (Druot *et al.*, 2007). Following Frédéric Druot, "yet more luxurious" means "yet more spacious, more sunny, more simple, more economic" (Druot *et al.*, 2007).

The *Plus* transformation strategy to social housing developments is based on two ideas: (i) adding a second and depth glazed facade - giving a new image to the buildings and simultaneously enlightening the interior spaces; (ii) increasing the living space - transforming the existing typologies, enlarged by the new offset facade and sometimes linking the original flats if necessary. These large scale public housing developments are then regarded as having great potential. Nevertheless, this architectural strategy depends on two characteristics of these buildings: "single ownership", and a good structural condition.

Spatial quality upgrading, beyond dwelling enlargement and illumination, is achieved through the transformation of communal areas (for more dignity but also for increased safety). Within a cost-effectiveness perspective, these buildings become accessible by disabled, and construction quality

and thermal performance are technically upgraded, minimizing the number of occupants to re-accommodate.

New parking areas, new services and equipments occupying the towers ground and first floors are proposed, changing the original monofunctional condition of these peripheral housing areas, all contributing to a durable but also sustainable development. A global cost balance is presented in the study, showing that this renovation *plus* spatial transformation (inside/outside buildings but also improving external areas and urban quality of the studied housing developments) costs less than it would cost to demolish and rebuild the same number of accommodations, with additional benefits (social, environmental, etc.).

5 *Bairro Rainha D. Leonor*: a municipal housing complex in Porto under renovation

5.1 Original project (1951-53) and ongoing renovation (2005-...)

The municipal housing complex *Rainha D. Leonor* in Porto was built in two different phases: the first ended construction in 1953 (150 dwellings in low-density two-storey house typologies), and the second in 1956 (100 dwellings in high-density multi-storey house typologies).

This paper focuses only on the first housing development (1951-53) of 150 dwellings, before the "Plan of Improvements for the City of Porto" (1955-66). As other social housing examples built before 1956, *Rainha D. Leonor* was part of a municipal strategy to re-accommodate population from housing with no salubrity conditions. This housing development was a kind of pilot-project for the "Plan of Improvements" as it allowed to understand that two-storey house typologies (adopted in many previous Economic Housing examples) was not as cost-effective as desirable. The subsequent municipal housing programs adopted therefore higher density provided by multi-storey buildings.

When the present ongoing renovation is finished, the original 150 dwellings will be reduced to 90. The renovation project from 2005 is authored by atelier *Inês Lobo Arquitectos Lda.*, after a competition in 2004. Buildings deep renovation and typology enlargement (by adding or linking the original ones) was part of the competition program, as well as the maintenance of the original architectural character of the two-storey houses. Actually, this character had to be "recovered", as the second group of requests regarded exterior spaces: house garden project including illegal construction demolition.

The renovation project worked out a careful typological transformation, for which a new window-type was proposed, corresponding to the addition of two existing window-types. The new sunnier typologies have now a dignity also given by the generosity of the new interior spaces. Indeed, the areas of the new typologies - duplicating the original ones - are now in accordance with current regulations.

This paper proposes an analysis of *Rainha D. Leonor* municipal housing from 1951-53 and its ongoing renovation. This was the only example of municipal housing under "deeper renovation" that was found in Porto. The authors believe that the renovation strategy adopted in this reference case can bring other benefits in *plus* (social and urban) beyond those more "concrete" that can be now quantified. Housing units quantification, typology characterization and minimum/maximum areas are compared and analysed in Figures 1 to 7 and in Table 2.

Figure 1. General view of the ongoing renovation works on *Bairro Rainha D. Leonor* in Porto

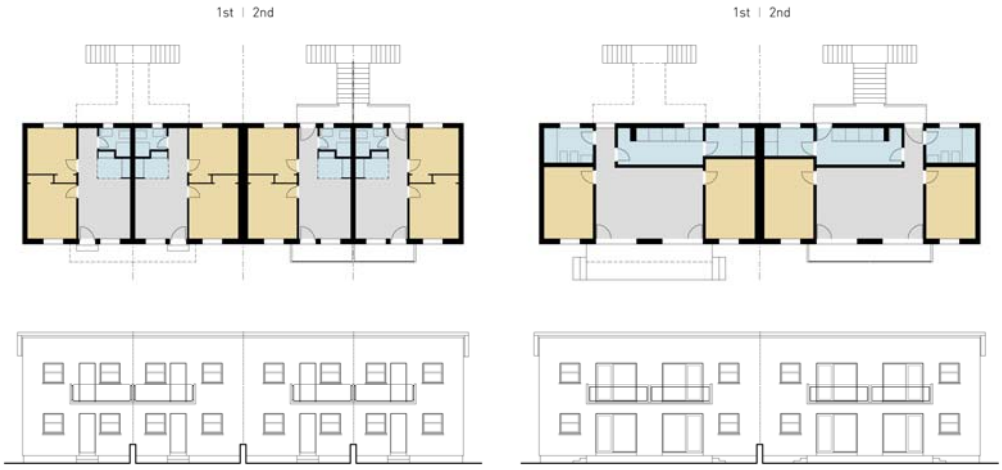

Figure 2. Left: set of four original Type2 (8xT2) houses. Right: renovation proposal typology (4xT2)

Figure 3. Foreground: set of four renovated houses (4xT2). Background: original Type2 house

Figure 4. Left: set of two original Type3 (4xT3) houses. Right: renovation proposal typology (2xT3)

Figure 5. Left: new typology T3 enlarged living-room. Right: set of two original Type3 (4xT3) houses

Figure 6. Left: set of four original Type4 (4xT3) houses. Right: renovation proposal typology (4xT1)

Figure 7. Foreground: renovation works and transformation of a set of original Type4 houses

5.2 Typological transformation: minimum area analysis

According to available information, the original project (municipal process for obtaining construction license) dates from January 1951 (while *RGEU* dates from August 1951). Despite the fact that the new typologies duplicate the area of the original ones (by linking the original typologies) their gross area is only slightly over the minimums defined in *RGEU*.

Table 2. Comparative analysis: original / new dwelling typology gross areas

	BEFORE RENOVATION			AFTER RENOVATION			
	Un.	m2	Gross Area (m2)	Un.		m2	Gross Area (m2)
House “units”	90			90			
Dwellings	150			90			
Type2 house (T2)	88	37	72 (min: *RGEU*) 85 (max: Port 580/83)	44	(T2)	74	72 (min: *RGEU*) 85 (max: Port 580/83)
Type3 house (T3)	32	44.7	91 (min: *RGEU*) 100 (max: Port 580/83)	16	(T3)	91	91 (min: *RGEU*) 100 (max: Port 580/83)
Type4 house (T3)	30	55.3	91 (min: *RGEU*) 100 (max: Port 580/83)	30	(T1)	55.3	52 (min: *RGEU*) 65 (max: Port 580/83)

5.3. Preliminary study of a comparative balance

It would be particularly interesting to compare the global cost of a hypothetical solution (total demolition + re-accommodation + total new construction) to that of a “deeper” renovation solution. However, due to its complexity such study will be a further development of the present paper.

Table 3 presents three scenarios for a first general approach to a comparative balance, putting in evidence different “levels” of renovation global costs. The considered reference value (=100%) corresponds to a “basic level” intervention: envelopes technical upgrade (through External Thermal Insulating Composite Systems), window framing and glazed areas improvement, and communal circulation areas refurbishment and enclosure. Dwelling maintenance or refurbishment is not included

in this reference value. Actually, the 100% percentage corresponds to an average value for the renovations carried out by *DomusSocial E.M.* in several housing developments in Porto in recent years. However, it must be noted that this reference value has increased up to 150% in the last interventions undertaken by *DomusSocial E.M.* (achieving the "middle level" in Table 3). The increase is mainly due to the growing envelope technical demands, a consequence of the Portuguese codes of practice revision (following recent EC Directives).

One final note regarding data on Table 3 concerns the values on which the percentage for a "higher level" renovation was based: this refers to a two-storey house typology, while the other percentages regard multi-storey buildings.

Table 3. General comparative balance (preliminary study)

MOST ADOPTED RENOVATION SOLUTION - "Basic level" [(1) envelope renovation + (2) light intervention on exterior spaces] + (3) dwelling maintenance			
Number of dwellings	150	(1) + (2)	(1) + (2) + (3)
Reference average cost / dwelling	-	100% (Ref.)	200%-250%
Cost increase (family re-accommodation)	-	-	-
UPGRADE RENOVATION SOLUTION - "Middle level" [(1) higher quality of envelope renovation + (2) intervention on exterior spaces] + (3) dwelling maintenance			
Number of dwellings	150	(1) + (2)	(1) + (2) + (3)
Reference average cost / dwelling	-	150%	250%-300%
Cost increase (family re-accommodation)	-	-	-
DEEPER BUILDING RENOVATION in *Bairro Rainha D. Leonor* renovation - "Higher level" (1) building envelope renovation + (2) exterior residential space renovation + (3) typological enlargement			
Number of dwellings	150		(1) + (2) + (3)
Number of empty dwellings (in 2006)	44		
Number of dwellings (interior demolition)	150		
Dwellings *loss*	60		
New renovated enlarged dwellings (typological transformation)	90		
Parking area	yes		
Lot gardens	yes		
Communal spaces	no		
Reference average cost / dwelling	-		450 - 500%
Cost increase (family re-accommodation)	-		*

* No estimate available/ found

5 Final considerations

The ongoing research might possibly conclude that a strategy based on *"public housing renovation* plus *space transformation"* is compensatory, from the economical point of view, only if compared to a radical option - to demolish and to rebuild - as the *Plus* study tries to demonstrate. Nevertheless, in a

deeper public housing renovation, the budget increase (when comparing to a basic level intervention) can bring other benefits in *plus* (social and urban) beyond those that can be quantified and qualified - as the authors tried to show through the example of the ongoing renovation of *Rainha D. Leonor* municipal housing in Porto.

Despite the fact that only a "deeper renovation" can really upgrade these buildings to present living standards and regulations (as the minimum area analysis shows) a large gain will very probably result from the occupants' satisfaction. Though not possible to measure in an initial balance, the upgrade in the occupants' living standards also contributes to their higher integration in society. Furthermore, the inherent social and architectural regeneration (to "the inside") of a renovation strategy like the one observed, also reverts to the city (to "the outside"), contributing to an invaluable urban requalification of the related areas. It is this double dignity that is being achieved in the *Bairro Rainha D. Leonor* renovation.

There are other aspects that must be considered as common obstacles to deeper public housing renovation, which among others are social costs, planning management, and temporary re-accommodation of part of the residents, despite the obviously higher economical investment, and probable insolvency of part of the residents (not affording its occupancy after rehabilitation, even with subsidies). For this same reason, as described in *Plus*, each singular case must be analysed, for which many agents are needed (sociologists, economists, planners, architects, etc.) in order to achieve a more complete evaluation of the reasonable level of renovation. Localization, number of buildings/dwellings/occupants, level of degradation and potential of transformation may justify or dismiss a deeper renovation.

The further development of this study will be part of the ongoing PhD research by Joana Restivo. The preliminary analysis of the reference case presented in this paper will be continued and extended to other case-studies in Porto.

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Inter-municipal coordination and spatial planning: a cross-national comparison between Portugal, France and Italy

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Thanks to increasingly sensitive social, economical and environmental concerns, inter-municipal governance is becoming a relevant issue in both research and political discourse. Yet there is no systematic research on the relationships between institutional arrangements and planning systems at this scale, notably in Latin-European countries such as Portugal, France and Italy. Sharing some legal and administrative traditions, these three countries evolved in significantly different ways. The paper aims to identify the most remarkable changes produced in the last few decades in these three countries, at this level, along with their major outcomes and risks for the future.

Keywords: planning, institutions, inter-municipal governance, coordination

1 Introduction

Over the last few decades, thanks to increased mobility, more sophisticated economies and escalating demands for quality and efficiency, "municipalities became under-bounded" (Hulst & Van Montfort, 2007:3). They have now to deal with their neighbour's decisions, beyond those of higher levels of government.

This trend has obvious impacts on spatial planning systems. Metropolitan areas are often targeted for the introduction of much-needed innovative practices designed to target physical and institutional fragmentation problems (Gualini and Salet, 2001). As a result, a wide range of approaches is now observable across Europe. While some territories try to promote inter-municipal arrangements, based either on cooperation or on competition, others rely predominantly on vertical, multi-level arrangements (Kantor, 2008; Salet *et al*, 2003).

This is also true in Southern Europe, where some deeply rooted planning practices have been questioned. The paper is focused on the planning systems of Portugal, France and Italy[39], which have been evolving in different ways in the last few decades, while sharing some common roots. In Portugal, most inter-municipal problems are still addressed at national and municipal levels, while French reforms fostered institutional arrangements and strategic planning at inter-municipal level and Italy enhanced the coordinative role of intermediate subnational authorities.

We aim to conclude about the potential achievements and drawbacks of these three different ways of articulating planning systems and their institutional settings. The paper seeks to address three more specific questions: first, which are the most relevant innovations introduced in these countries, in terms of inter-municipal governance landscapes? Second, how are these innovations linked with their correspondent planning systems and how do they contribute for broader changes on

[39] As each Italian region has its own planning legislation, the Italian case is focused in Emilia-Romagna, which offers an interesting contrast with the French and Portuguese experiences.

territorial concepts and policies? Third, which are the main outcomes and risks of these changes for the future?

The paper is organized in five sections. The next section introduces the most relevant theoretical issues related with the increased relevance of inter-municipal scale in planning debates. Sections 3, 4 and 5 describe the most recent developments of inter-municipal governance landscapes in France, Italy and Portugal, respectively, along with and their relations with planning systems. Section 6 discusses the main differences and similarities, while section 7 introduces the main conclusions and suggests avenues for further research.

This presentation is part of a research programme that is under way in the University of Porto[40], which aims to identify the role of creativity and innovation in urban policies definition and implementation.

2 Inter-municipal cooperation as a driver for planning systems change

Contemporary scientific debate on territorial policies is usually concentrated on the transformation of governance landscape through the rescaling of state policies and the involvement of local actors in the definition of development strategies. “Rescaling” theorists argue that we moved from a time when welfare states expressed the key role of the national level in the definition of public policies to the present “network paradigm” (Brenner, 1999) based on enlarged responsibilities and accountability of sub-national governments and the transfer of powers and responsibilities between levels of decision (Salet *et al*, 2003).

Nonetheless, there is a need to link governance with new ways of thinking about territory. We have been witnessing the shift from "euclidean" views of territories as contiguous, integrated units endowed with a physical, social and economic coherence, which interact between each other through a hierarchical system of spatial relations, to “relational” views of territories as complex webs of often immaterial relationships, forming a “variable geometry” of nodes and networks (Healey, 2007). They are at the crossroads of multiple dimensions and evolve along unpredictable, contingent, trajectories.
Some rescaling and relational theoretical views often converge with the so-called “new regionalist” approaches, who advocate that the region, rather than the nation or the municipality, is the privileged scale of intervention to tackle some of the most severe problems territories need to face. The thriving literature on “new regionalism” advocates the need for specific governance mobilization at this level (Herreschell & Newman, 2002; Keating, 1998; Heinelt and Kubler, 2005).

A “region” does not necessarily means a new level of administration, but increased coordination among local authorities (Heinelt & Kubler, 2005). However, as Kantor (2008) points out, coordination may assume different forms, including the one that emanates from competition. In fragmented contexts, competition prevails, while inter-municipal issues are usually relegated to agencies with no direct political representation and charged with specific operational tasks. Coordination is the product of random agreements, not strategic processes. Regional policies become a product of discrete decisions taken by successive “loosely coupled” arenas that may reduce transaction costs (Benz & Erblein, 1999). Yet there is the other side of the coin, such as high

[40] Support for this research from FCT/National Foundation for Science and Technology (Project PTDC/AUR/68407/2006).

levels of spatial inequalities and environmental problems associated with decades of selective dispersion of population and activities (table 1).

Inter-municipal cooperation, based on extensive networking, solidarity and inclusive consensus-building among municipalities, "aspires the best of two worlds" (Hulst & Monfort 2007:8), since it tries to conciliate flexibility and cohesion at local level. Institutional cooperation has its drawbacks, however, notably those related with the quality of decisions (the most consensual solutions are not always those of higher political and technical value), with high decision costs associated with the need to conciliate frequently strong divergences of aims and interests, and with political representation, as most institutional arrangements do not incorporate direct democratic legitimacy (Hulst & Van Monfort, 2007). Above all, it frequently needs to face strong resistance from local authorities. Perhaps for all these reasons, the number of true successful experiences of this kind is relatively modest (Kantor, 2008).

The "vertical" approach is more common. It means that a higher level of administration (either regional or national) provides powerful guiding and supports vertical policy networks (table 1). While horizontal networking may be fragile, continuous building of local/regional or local/national relationships may avoid the most acute conflicts over inter-municipal issues. When successful, the vertical model may achieve significant convergence on a supra-municipal level. Nonetheless, the vertical model is not exempted from shortcomings. It may increase distance between citizens and policy makers and lead to higher levels of bureaucracy. It also may increase multi-level tensions and conflicts when communication vessels do not work.

Table 1. Models of inter-municipal coordination

	Competitive approach	Cooperative approach	Vertical approach
Political framework	Fragmented	Associative	Vertical networking
Decision mode	Bargaining	Debate/consensus	Administrative
Main benefits	May lower decision-making costs and may fit better with complex institutional landscapes	May fit better with changing environments	May produce more coherent spatial strategies and may clash potential conflicts (when multi-level communication works well)
Main drawbacks	May lead to increased negative externalities, such as social/spatial inequalities	May increase decision-making costs and may produce sub-optimal decisions	May lead to increased rigidity and bureaucracy, and may increase conflicts in the absence of adequate multi-level vessels of communication

Adapted from Kantor (2008)

As Kantor (2008) argues, we may find hybrid forms of political coordination in virtually any liberal democracy, though some of them may prevail in certain national or sub-national settings. In our opinion, there is a strong need for emphasizing the role of relationships between these institutional settings and planning systems as a way to tackle the most acute inter-municipal problems. This probably means more fundamental research on the subject, notably in Portugal, France and Italy, which have been gradually "reshaping" their planning systems while introducing important reforms at local level administration.

3 Between purpose and reality in a "Cartesian" context: The French experience

The French planning system evolved from a highly regulative approach to a more flexible one, in which intermediate levels of decision play an increasingly relevant role in its design and delivery. France has now a long-standing tradition of local concertation policies, deeply rooted in a contract culture developed in the 70s and 80s. After a first period focused on deprived neighbourhoods, the inter-municipal level emerged since the 90s as a relevant scale for urban and territorial policies based on contracts.

Under 1999 *Voynet* Act, the *Projet d'agglomération* and the *Charte de pays* were defined as strategic reference documents for the medium-term (about 15 years), establishing the main goals priorities for public intervention in inter-municipal areas (DATAR, 2001). They articulate political choices concerted among local actors, in order to be used as a basis for negotiation with other levels of administration for one or even two generations of *Contrats d'agglomération* and *Contrats de Pays* (DATAR, 2004).

The move to wider, inter-municipal-oriented urban and territorial contract policies was accompanied by reform in other two important areas, local government and land-use planning (Booth, 2003; Négrier, 2006; Nicholls, 2005). Inter-municipality, which has a long history in France, turned to an even more widespread formula after 1999, when the *Chèvenement* Law created new forms of inter-municipal grouping. In 2006, there were 2573 institutions of this kind (Booth, 2003). *Communautés Urbaines, Communautés d'Agglomération* and *Communautés de Communes* differ mainly according with the range of provided services and funding models. Many of them are now able to raise their own tax-base, in order to equalize business tax rates among municipalities and to provide an important source of funding (West, 2007).

The formal planning system was also facing sharp changes in the same period. According with Booth (2003), the 2000 Urban Solidarity and Renewal Law (*Loi SRU*) introduced three important institutional innovations in French spatial planning system, notably the link established between land-use planning and urban policy, the purpose of making land-use plans a tool for increased inter-municipal cooperation and the reinforcement of a prospective, strategic dimension related with sustainability.

Loi SRU broke with French predominance of land-use issues over strategy (Booth, 2009). The *Schéma de Coherence Térritoriale* (SCOT) is an inter-municipal strategic plan, aiming to articulate territorial visions in a wide scale. SCOT and the local level plan, the *Plan Local d'Urbanisme (PLU)* have a stronger commitment with strategy, sustainability and social justice than previous instruments, since they should include a *projet d'aménagement de développement durable* (PADD), specifying the precise measures and intensions in the medium-term.

The three pieces of legislation should produce a coherent, almost "cartesian" series of intertwined frameworks. As Booth (2009:690) put it, "SCOT would be informed by a *project d'agglomération*, which in turn would be the vehicle for funding through the contracts with the state". This spatial planning framework would be embedded in administrative reform, notably the new inter-municipal arrangements provided by *Loi Chèvenement*. These intertwined laws attempted to confer "coherence" and "integration" to the whole system, synthesized in the expression "a territory, a contract, a project" (DATAR, 2004).

Nevertheless, as several authors point out (Booth, 2009; Négrier, 2006; West, 2007), there is a considerable mismatch between intentions and actions. In most cases, inter-municipal areas were formed on the basis of conflicting and converging political will and interests, of negotiation and antagonism between power bases, rather than on planning criteria (Booth, 2003; Nevers, 2002; Nicholls, 2005; West, 2007). As a result, many *Communautés d'Agglomération* and *Communautés de Communes* are much smaller than their respective functional areas (Négrier, 2005), and the single-purpose bodies created to prepare SCOTs are not the same as those created to prepare *Projets d'agglomération* and *Chartes de Pays*.

As a consequence, and in spite of all the cooperative purposes of national legislators, the competitive mode remains relevant in French agglomerations, since local governance changes are in a large part the result of political competition (Pinson & Le Galès, 2005). This is particularly salient in the case of planning, where evidence suggests a significant mismatch between rhetoric and action.

Having fostered strategic planning throughout the country, French reforms did not seem to produce such a good job in tackling the country's institutional complexity. In spite of increased concerns with inter-municipal planning and the partial elimination of fiscal competition through the single business tax, competition remains in other areas, such as residential attraction or employment opportunities (West, 2007). On the other hand, as the French Court of Audit points out in an evaluation report (Cour des Comptes, 2005), costs have been rising steadily, raising "many questions about accountability and control" (West, 2007:87).

Reform did not introduced direct political legitimacy, an increasingly sensitive issue as inter-municipal institutions move from operational tasks, such as service-delivery, to coordination subjects, such as strategic planning. This fact may hinder the success of some promising planning innovations such as SCOT. As Booth (2009: 690, 691) argues "given the sanctity of the commune and the continuing round of negotiation that takes place between mayors, presidents of inter-municipal groupings and professional officers, the likelihood must be that the new SCOT will accommodate existing local plans rather than the other way round".

4 Planning and programming in a cooperative environment: the experience of Emilia-Romagna (Italy)

As France, Italy accelerated planning and local level reform in the 90s. Simplification, decentralization and the introduction of both co-operative and competitive practices through a "contract culture", became recurrent subjects in both scientific literature and political discourse (ESPON, 2007; Governa & Salone, 2002; Mazza, 1997; Salone, 1999). These gradual shifts represented a broader move from a plan-centred culture to a programme-centred one (ESPON, 2007), which may be considered a remarkable shift in a country where, in the words of Pichierri (2002:701) "the legal culture has probably helped to exalt the moment of legislation over the moment of accomplishment".

The new programmes brought in plurality in the decision arenas (Governa & Salone, 2002; Cremaschi, 2002). Despite the varying results of the many experiences (Cersosimo & Wolleb, 2006; De Rita & Bonomi, 1998; Gambaro *et al*, 2005; Gualini, 2004), they are usually considered relevant tools for promoting agreements between neighbouring authorities. The new, programme-centred approach was in a large extend designed to ease previous formal planning system rigidities, notably

the difficulties of its main instrument, the *Piano Regolatore Generale* (PRG), in coordinating different operations in the same area and providing guidance in periods of fast change (Davico & Mela, 2003; Gelli, 2001; Ricci, 2005).

Transition from more rigid planning approaches to more flexible programming accompanied Italian decentralizing process, often called *devoluzione*. One of the mains changes is related with the emergence of regions and municipalities and, in a lesser extend, provinces (the intermediate level between them) as entities having increased responsibilities on planning and other territorial-related issues.

Regions increased role on the country administrative system is often seen as one of the major reasons for the fragility of inter-municipal formal institutions in the country (Hulst & Monfort, 2007). Some early experiences, such as the *comprensori*, lasted no more than ten years. “Mountain Communities” and the more recent “Unions of Municipalities” remain too attached to service-provision responsibilities rather than to policy formulation (Fedele & Moini, 2007). “Metropolitan Cities”, established for the first time in 1990 (Law 142/90) and reinforced in 2001 after a constitutional amendment, remain a promise, since no institution of this kind was created since then.

In the 90s, the Province emerged as a possible answer to some of the country most pressing inter-municipal challenges (Jouve & Lefèvre, 1997). Provided with constitutional recognition, increased powers since 1990 and direct democratic legitimacy since 1993, its main possible flaws are bordering rigidity and increased bureaucracy, associated with the empowerment of another tier in the country’s already heavy administrative system (Moretti, 2002).

Decentralisation meant that institutional arrangements assumed diverse trajectories in the 20 Italian regions. Such is the case of coordination between programming experiences and the formal planning system, including the role of Provinces in this process. For this reason, the paper is concentrated in the case of Emilia-Romagna, a region well-known for its long-standing tradition of institutional innovation (Putnam, 1993).

Emilian Provinces have responsibilities in “reading” territorial phenomena and providing coordination among local communes and other public and private actors. The Provincial Territorial Coordination Plan (*Piano Territoriale di Coordinamento Provinciale - PTCP*) became a prominent tool for supra-municipal planning in Emilia-Romagna (Cavalcoli, 1999). As a *master plan* for provinces, the PTCP may have an important role in tackling sustainability problems at this scale, since it should provide guidance and medium-term structural choices valuable for the elaboration of local-level plans (Ricci, 2005) The PTCP is recognized as the “meeting point” among multi-level administrative systems. It directly relates medium-term “structural options” at inter-municipal level with (municipal) strategies and more operational plans, “linking plan and project through a logic and methodological connexion” (Ricci, 2005).

“Planning Conference”, as is called this process, culminates in a “Planning agreement” that defines the main structural choices in terms of infrastructures, the environment and economic development. It provides guidance for local-level structural municipal and inter-municipal plans, promoting flexible “territorial agreements” between municipalities and other institutions related with specific projects.

The Bologna PTCP process, as any other planning procedure, is deeply embedded in its cultural setting (Booth, 2009). Emilia-Romagna is known for its strong civic culture and deep cooperative traditions (Putnam, 1993). The so-called "red political culture" (from the political dominance of the former Italian Communist Party), although somewhat eased after successive years of economic stagnation and the political turmoil that swept Italy in the first half of the 90s (Bonora, & Giardini, 2003), still echoes in the form of dense intergovernmental networks.

"Solidarity" remains a key word in today's Bologna institutional setting and spatial planning procedures but, as Kantor (2008) points out, this strongly cooperative model is not exempted from risks. Deeply established social networks may stabilize at the point of crystallization. They may produce political inertia and obstruct institutional innovation.

On the other hand, deeply embedded cultural and social conditions are not easily replicated elsewhere, producing strong institutional divergence within the country, as our interviewees involved in PTCP preparation in other Italian regions, such as Veneto and Campania, have underlined.

5 Scalar mismatch between institutions and planning: the Portuguese experience

While at the beginning of the 90s the Portuguese planning system was clearly underdeveloped (Rosa Pires, 2001), by the end of the decade the country was covered by Municipal Director Plans (PDM), the most important instrument of Portuguese spatial planning system. Nevertheless, this intensive activity, due to legislation published at the beginning of the decade (Law decree 69/90), was linked with opportunities and penalties related with European-funding rather than with the recognition of a central role of spatial planning (Breda-Vázquez & Oliveira, 2004).

The PDMs approved in the 90s have relatively simple technical requirements and approval procedures (Cardoso & Breda-Vázquez, 2007), a situation that would change considerably in 1998-99, when new legislation[41] tried to consolidate a strategic dimension to the system (Rosa Pires, 2005). Even so, this legislation can be considered conservative for four reasons. First, land-use regulatory procedures remain dominant, at the expense of development guidance (Rosa Pires, 2001, 2005). Second, state apparatus leads the different phases of planning procedures, particularly the elaboration and approval of plans, and relegates public participation mechanisms to a final stage of the decision-making process when consulting, rather than concertation or dialogue, is the only form of participation at the reach of most citizens (Cardoso & Breda-Vázquez, 2007). Third, the Portuguese planning system remains away from the dynamics occurred in other areas of public intervention with strong territorial impact, such as EU-funded integrated programmes (Oliveira & Breda-Vázquez, 2007).

Above all, the Portuguese Spatial Planning System remains highly hierarchical. The new legislation turned clearer the distinction between different categories of plans, in terms of their aims, principles and scope (Table 2). The National Programme for Territorial Planning Policy (PNPOT) defines the principles and objectives of spatial planning and gives orientations to lower-scale plans, such as Regional Plans (PROT).

[41] Law 48/98 and Law decree 380/99.

Table 2. Spatial planning instruments in Portugal

Instrument	Content	Scale	Elaboration
PNPOT	Strategic	National	National government
PS	Programmatic (for sectoral areas, such as transportation or water resources)	National	National government
PEOT	Regulatory (for specific issues, such as natural or heritage protection)	National	National government
PROT	Strategic	Regional	National government (regionally decentred bodies)
PIOT	Strategic	Sub-regional	Local authorities (in association), ratified by national government
PDM	Strategic and regulatory	Municipal	Local authorities, ratified by national government
PU	Regulatory	Sub-municipal	Local authorities
PP	Regulatory	Sub-municipal	Local authorities

Source: Cardoso & Breda-Vázquez (2997)

PROT not only integrates PNPOT proposals as other national-level orientations, identified either in sectoral plans (PS) or in special plans (PEOT). They also provide a framework for local level plans, such as (compulsory) Municipal Director Plans (PDM), which must translate above-level options in municipal-level spatial strategies. The PDM remains, however, a regulatory tool, constituting the framework for the elaboration of even more detailed plans, targeted only for parts of municipalities, namely the Urbanization Plans (PU) and Layout Plans (PP). In an attempt to limit this strong hierarchical orientation, recent legislation (Law decree 316/07) increased responsibilities of local authorities, which may now conduct the elaboration and approval of statutory plans with a larger degree of autonomy.

Some aspects that are crucial in terms of addressing inter-municipal problems remain unrevised, however. Although the legal framework produced in late 90s includes the PIOT (Inter-municipal Plans for Spatial Planning), which define principles and objectives for spatial planning in supra-municipal structurally interdependent areas, this remains an optional instrument for local authorities, which is rarely used. This leaves to regional plans (PROT) the task of tackling the most acute inter-municipal problems. Nevertheless, most PROTs cover a too wide scale, in most cases much larger than any inter-municipal functional area. On the other hand, PROTs are in fact emanations of national-level PNPOT. Unlike Emilia-Romagnan PTCPs, which have a mediating role, or French SCOTs, which attempt to integrate municipal visions, PROTs incorporate PNPOT national guidelines and spatial models, and then try to shape them in local adaptations. The absence of regional devolution and the fragility of inter-municipal institutions largely contribute to this procedure, since PROTs are coordinated by Regional Planning Commissions which are, institutionally and in their practices, regional arms of the national government.

This situation reflects the weaknesses of meso-level institutions in this deeply centralized country (Reis, 2005). Portuguese administration is still dominated by a national rationality, though thanks to its direct political legitimacy, the local scale also has strong visibility. Inter-municipal cooperation, however, remains a rather limited phenomenon (Reis, 2005).

The first experiences of inter-municipal cooperation in democratic Portugal go back to the beginning of the 80s, when Law Decree 266/81 created associations designed to target the lack of human, technical and financial resources of municipalities. Even though several associations of

municipalities were created across the country in the following two decades, they remained limited in their aims and scope. By the end of 80s, the two largest agglomerations, those of Lisbon and Porto, were still lacking a transversal, multi-purpose coordinating institution. In an attempt to overcome this situation, Law 44/91, created the two metropolitan areas of Lisbon and Porto. In spite of ambitious institutional proposals produced at the beginning of the 90s (Planum *et al*, 1993), Lisbon and Porto metropolitan regions remained weak institutions lacking power, resources and technical staff to promote a metropolitan agenda (Silva, 2004).

A new wave of inter-municipal coordination legislation was presented as a response to the sub-optimal results of previous experiences. Laws 10/2003 and 11/2003 produced a complex patchwork of inter-municipal institutions that included "Greater Metropolitan Areas", "Urban Communities" and "Multi-purpose Inter-municipal Communities", covering about 85 % of mainland Portuguese territory. These were conceived as predominantly "bottom-up experiences", since municipalities were given freedom to define their administrative limits, although within some general criteria related with their population, territorial contiguity and the number of associated municipalities. Five years later, a new socialist government substituted the 2003 system by a more "top-down" approach, constituted by nationally delimited metropolitan areas in Lisbon and Porto agglomerations and Inter-municipal Communities in the rest of the country. During this period, several single-purpose models were also introduced in successive acts, such as inter-municipal corporations (Law 58/98), regional development agencies (Law decree 88/99) and transport metropolitan authorities (Law Decrees 268/03 and 232/04, and Law 1/09).

Almost three decades of successive legislative measures on inter-municipal coordination may suggest a highly diversified governance landscape (Table 3). Each local authority may belong to several inter-municipal bodies, each of them endowed with its own borders, mission and temporal cycles and prospects. In certain cases, there may be some juxtaposition – even confusion – between the role, statute and objectives of different institutions.

Table 3. Inter-municipal institutional coordination in Portugal

Year of creation	designation	Juridical form	Legal diplomas	Purpose
1981	Associations of municipalities	Public law	LD 266/81; LD 412/89 and Law 172/99	Multi-purpose or single-purpose
1991	Metropolitan Areas	Public law	Law 44/91	Multi-purpose
1998	Inter-municipal Corporations	Private law	Law 58/98	Single-purpose
1999	Regional Development Agencies	Private law	Law 88/99	Single-purpose
2003	Greater Metropolitan Areas, Urban and Inter-municipal Communities	Public law	Law 10/03 and Law 11/03	Multi-purpose
2003	Single-purpose Associations of municipalities	Public law	Law 11/03	Single-purpose
2003	Transport Metropolitan Authorities	Public law	LD 268/03; LD 232/04 and Law 1/09	Single-purpose
2008	Metropolitan Areas and Inter-municipal Communities	Public law	Law 46/2008	Multi-purpose
2008	Single -purpose Associations of municipalities	Public law	Law 45/2008	Single-purpose

However, we may distinguish several similarities among these models, along with some differences. Border definition is one of the most significant divergent aspects. This is particularly obvious in the case of multi-purpose associations. As shown in table 4, bottom-up and top-down processes of municipal association rotated. While municipalities were given freedom to join in 1981 and in 2003, though within criteria defined by national government, a more explicit top-down approach was experienced in 1991 and 2008.

On the other hand, competencies and political modes of representation are rather similar. With the exception of the first municipalities associations, explicit competencies such as coordination of inter-municipal investment and public service provision are always present. Territorial competencies were also included, such as the elaboration of spatial plans or more vaguely defined "territorial management", for instance (table 5).

Table 4. Border definition of inter-municipal multi-purpose institutions in Portugal

Year of creation	Designation	Membership	Border definition process
1981	Municipalities associations	Voluntary	Locally defined, though according with criteria defined at national level.
1991	Metropolitan Areas	Compulsory	Municipalities belonging to the AM's are designated in national legislaytion (Law no. 44/91)
2003	Greater Metropolitan Areas, Urban and Inter-municipal Communities	Voluntary	Locally defined, though according with criteria defined at national level.
2008	Metropolitan Areas and Inter-municipal Communities	Compulsory	Borders should coincide with those of EU statistical units (NUT III)

Source: *Diário da República, Laws 44/91, 172/99; 10/03; 11/03; 45/08; 46/08 and Law Decrees 266/81 and 412/89*

Table 5. Competencies and modes of representation of inter-municipal multi-purpose institutions in Portugal

Year of creation	designation	Competencies	Model of representation
1981	Municipalities associations	Municipalities were given freedom to choose among their competencies, those which should be transferred to associations.	Executive body, which members are designated by the deliberative body. Deliberative body, elected by each town council.
1991	Metropolitan Areas	Investment and public services coordination; elaboration and management of inter-municipal spatial plans; feedback about nationally and EU-funded investment programmes.	Executive body, composed by the mayors of associated municipalities. Deliberative body, composed by members of each town council. Consultive body, including members of Regional Planning Commissions and other publicvodies.
2003	Greater Metropolitan Areas, Urban and Inter-municipal Communities	Investment and public services coordination; economic, social and economic strategic planning and management; territorial management.	Executive body, composed by the mayors of associated municipalities. They may delegate functions to an executive manager. Deliberative body, composed by members of each town council. Consultive body, including members of Regional Planning Commissions and other public bodies.
2008	Metropolitan Areas and Inter-municipal Communities	Investment and public services coordination; economic, social and economic strategic planning and management; participation in EU-funded programmes management.	Executive body, composed by the mayors of associated municipalities. They may delegate functions to an executive commission. Deliberative body, composed by members of each town council. Consultive body is optional.

Source: *Diário da República, laws 44/91, 172/99; 10/03; 11/03; 45/08; 46/08 and Law Decrees 266/81 and 412/89*

Given the increased autonomy of municipalities and their multiple opportunities of association, these trends would suggest a growing influence of the cooperative approach in Portuguese local government system, notably in relation with spatial planning issues. Yet as evidenced in their activities reports, neither of these competencies is used in a systematic way.

There is a considerable mismatch between the ambitious purposes of legislation and the modest achievements of existing institutions. With some exceptions, such as the Ave Valley Association (AMAVE), which developed a pioneering activity in the country in terms of inter-municipal strategic planning (Breda-Vázquez & Oliveira, 2008), they usually exclude coordination functions and lack technical and material resources (Quaternaire, 1997).

The outcome of this trend is the persistence of what Reis (2005) defines as the "binary" character of Portuguese administration, in the sense that it includes only two rationalities, the national and the local, and a considerable *vacuum* between these two levels. This has obvious implications on the spatial planning system, which remains a predominantly national competency, regardless some devolution to the local level.

Hierarchy remains the prevailing political mode of inter-municipal planning coordination. The most visible outcome of this centralized approach is a mismatch between the scales of intervention of instruments and institutions. Regional plans (PROT) cover wide and heterogeneous areas, usually much larger than urban functional areas. As emanations from national guidelines, they usually tend to ignore or understate both local-level strategies and inter-municipal institutions.

6 Discussion

In the previous sections of this paper, an effort has been made to analyse the most relevant innovations introduced in France, Emilia-Romagna (Italy) and Portugal, in terms of inter-municipal governance landscape and its links with planning systems and more general territorial policies. In this final section, we synthesize the main differences and similarities between them.

The three experiences are all based on a hybrid conception of territory, mixing elements of "old" Euclidean aspects and "new" relational approaches (Table 6). In France, the enhancement of cooperative formulas through the expansion of inter-municipal institutions, visions and planning tools reflects the increased influence of relational approaches of territorial issues, although, under the umbrella of an "Euclidean" set of intertwining legislative structures that paradoxically has contributed to increase complexity at some level.

In the Italian region of Emilia-Romagna, the relational move for a more flexible system of planning that attempts to integrate plans and agreements in a continuous process of interaction, is mediated through an intermediate level - the Province – which has rigidly defined borders, that may hardly fit with functional realities in other city-regions beyond Bologna.

In Portugal, the strong hierarchical nature of the planning system contrasts with successive inter-municipal experiences that attempted to introduce a "variable geometry" of bottom-up cooperative arrangements.

In all three experiences, it is remarkable the sharp contrast between the intensions of legislators and the actions of local actors, between discursive rhetoric and reality (Table 7).

Table 6. Euclidean and relational aspects of institutional and planning reforms

	Euclidean aspects	Relational aspects
France	Highly integrative reforms, producing a desirable coherent system: "a territory, a project, a contract".	Emphasis on a "variable geometry" of inter-municipal planning instruments and arrangements.
Italy (Emilia-Romagna)	Emphasis on the mediating role of rigidly-bordered institutions (Provinces).	Interactive processes of multi-level planning.
Portugal	Highly hierarchical planning system.	Emphasis on a "variable geometry" of inter-municipal institutional arrangements.

Table 7. Intentions, actions and risks of reforms

	Intentions	Actions	Risks
France	A cooperative mode of coordination in the form of inter-municipal institutions and planning instruments.	Hybrid forms of competitive and cooperative institutional arrangements, often within the same agglomeration.	Mismatches between planning and institutional areas of intervention and institutions may produce incoherence and increased complexity.
Italy (Emilia-Romagna)	A cooperative multi-level regional system of planning. The vertical institutional setting is mitigated by cooperative traditions.	Cooperative planning processes mediated by provinces.	Too homogeneous territorial coalitions may generate resistances to change and institutional innovation.
Portugal	A hierarchical (vertical) planning system within a mixture of hierarchical and cooperative institutional prescriptions at inter-municipal level.	A predominantly vertical (hierarchical) system of inter-municipal cooperation dominated by national government agencies.	Mismatch between planning scales of intervention and institutional arrangements may obstruct the resolution of inter-municipal problems.

In France, the cooperative mood of reform did not hamper the competitive attitudes of local mayors, menacing the coherence and simplifying purposes of reformers. In Italy, some top-down, national-led reforms collided with the cooperative culture of Emilia-Romagna. In Portugal, the failure of inter-municipal cooperative proposals, both related with institutional arrangements and with planning instruments, is in a great extend the product of power relations within the country multi-level administrative system. The regulative power of the national level in this centralized institutional setting and the continuous resistance of local authorities to transfer power to inter-municipal institutions, have been hampering the accomplishment of the more cooperative aspects of legislation.

7 Concluding remarks

The paper aimed to identify the most relevant institutional innovations introduced in the last decades in the three targeted countries, their relations with the correspondent planning systems, the main outcomes and the risks for the future. French, Italian and Portuguese institutions and planning systems share the same roots based on Roman law and the Napoleonic administrative tradition. They all emphasize written law and the codification of abstract rules, rather than their accomplishment. At a time when territories face increased fragmentation and complexity, and the traditional definition of "territory" based on integration and cohesion is being challenged by approaches that attempt to incorporate uncertainty and discontinuity, the foundations of Latin-European local government and planning systems are increasingly questioned.

The way in which these challenges are being tackled in the three countries varies considerably. Nevertheless, it seems to be evident that in all three countries, reforms are producing

results that diverge considerably from the intentions of legislators. Fragmentation and complexity is often the outcome of reforms that attempted to simplify and produce "coherence", such as in France. In some places, such as Emilia-Romagna, local and regional political cultures based on cooperation contradicted national-level "vertical" purposes, while in Portugal the "divorce" between institutional and planning reforms generated strong scalar mismatches. In all three cases, political processes may be at the centre of this bias.

Although it is widely recognized that spatial planning activity is deeply embedded in its social, political and institutional context, there is no systematic debate in literature on the relationships between inter-municipal coordination and spatial planning, particularly at scales which frequently do not have associated a territorial jurisdiction. Lessons learned from the three case studies evidence the need to deepen knowledge regarding scalar relationships between institutions and planning at inter-municipal level. It seems to be clear that rather than aiming for an "optimal" solution for inter-municipal problems, research should be increasingly focused on the political processes that structure both local government and planning system reforms.

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The use of knowledge in the Policy Process for the renewal of Via Anelli

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The paper aims at providing the basis for the discussion on the scenario created by a planning exercise which felt like foster social and spatial justice in a context of social diversity, dealing with the analysis of the case study of Via Anelli, within the urban area of Padova, Italy. The research work wants to evoke planning paradigms used to construct the policy process for the renewal of Via Anelli quarter and wants to debate the necessity of revising frameworks and paradigms producing planning exercise in contest of social diversity. To this extent, the research work aims to analyze the process of construction and reproduction of marginalized communities within the metropolitan area of Padua, giving relevance to the organizational processes of local communities, individual and collective actions affecting movements within the urban area and the role of social and cultural elements in social changes. In this way, the work gives significance to the spatial dimension of social, economic and environmental process, enquiring planning exercise as a scientific discipline (functionalist framework), then giving relevance to social and historical process within the policy process. Thereby, the paper will debate about the use of knowledge (Lindblom, 1979), debating the use of ex ante knowledge (knowledge of experts) compared to the use of "in action" knowledge (ibidem, 1979) within policy process in context of social diversity; the analysis, in this way, deals with political participation and social inclusion. In this sense, the paper could go into the role of planning research working for sustainable and socially sensitive future, exploring new possibility of use of knowledge.

Keywords: Planning, knowledge, social diversity, case study, social change.

1 Introduction

The paper presents the scenario created by an urban policy that intended to foster social and spatial justice in a context of social diversity. It deals with the case study of Via Anelli, in the city of Padova, Italy. The research aims to address the governance framework within which the urban policy has been pursued, trying to question the use of knowledge (Lindblom, 1979) within the policy process. In particular, it debates the use of *ex ante* knowledge compared to the use of "in action" knowledge (ibidem, 1979) for the rehabilitation of an urban neighbourhood in conditions of social conflict.

The research methodology focuses on individual and collective actions shaping the social movements in the city stressing the role of social and cultural elements in social change. In particular, the research looks at the spatialization of the low-income population, undermining the notion of planning as a scientific discipline (functionalist framework) while stressing the social process in the construction of local responses.

When looking at the planning paradigms used in Via Anelli rehabilitation experience, the paper questions the frameworks within which planning is usually implemented. The case study approach "concerns its ability to move with the reality of dynamic factors" (Heclo, 1972) while assuming policies as moving courses of action or inaction, rather than linear programmes based on rational decisions at a given moment in time. One action can have widespread effects on policy-making if it is conceived as an on-going policy rather than the mere implementation of a rational choice. In this perspective, focusing on changes through time becomes crucial (ibidem, 1972).

The paper analyses the role of planning research in the construction of a sustainable and socially sensitive future, capable of exploring new possibilities of the “use of knowledge” in planning experiences.

What shape the “local context” are first and foremost the relationships among the multiple actors active in discussing any specific issue in a given territory. The “local context” is looked at beyond its spatial dimension. It is seen as paradigmatic of the relationship between different policy levels (local, national, transnational) and shaped by planning routines procedures/norms, policy frames and day to day practice in the given context. Hence the policy process for the rehabilitation of Via Anelli is analyzed taking into consideration the channels of communication established among different stakeholders and channels contribution (if any) to different policy stances. A systematic analysis of policy initiatives over time might highlight those groups which are excluded or are less involved in the choice of alternatives (Heclo, 1972), even though this may not generate any conflict.

Finally under the assumption that the local context is a way of understanding the relationship between territory and paradigms within which local governance is conducted, the paper investigates the relationship between planners and people, contributing to a broader discussion on local democracy.

2 Via Anelli and social production

Being an immigrant in Italy has very distinct meanings according to regions and cities. Such variations result from the deep differences existing among local systems of governance, paradigm of local policies and differences relating to the migrants’ presence (i.e circular migration, permanent migration).

In 2002, 56.8% of all migrants lived in the North, 29.1% in the Centre, only 13.4% having settled in the South and the islands. At the beginning of 2008, the share of the North had increased to two thirds of registered migrants. The Northeast hosts a large share of the migrant population in the country (26,9%), almost 2 out of 5 living in the main cities of the three regions making up the North East. The foreign population in the area accounts for 8.1% of the total population and 7.2% of urban residents (Caritas Migrantes Report, 2008).

As far as Padova is concerned, currently there are approximately 27.000 foreign migrants (14.000 of whom are women) compared to less than 20.000 in 2006, representing at the moment more than 10% of total urban population. Data available for 2006 and 2007 provide the distribution of nationalities among the different areas of the city. The northern districts host the largest percentage of migrants (27%), followed by the south-eastern neighbourhoods (19%) and those to the east (18%). The spatial distribution of migrants in the city varies widely: compared to an average of approximately 10% foreign residents in Padova, in the northern districts immigrants represent 15,7% of the total population of the area. The largest share of Moroccans live in the eastern part (29,4% of the total population) while Nigerians concentrate in the northern (26,7%) as well as the eastern neighbourhoods (23%).

The Serenissima Residence, in Via Anelli, in the eastern part of the City, was built some thirty years back as a residence for university students, with almost thirty square metres flats.

“We know now that the demand for this type of housing (small flats) is becoming more interesting, not only for students who stay in Padova several months per year, but also for managers, workers, who find Serenissima Residence a comfortable place for modern living.”42

The small flats were intended to satisfy the needs of students as well as temporary workers in a city were the rental market is particularly tight due to the insufficient supply of low-cost housing.
In the eighties, housing prices in the central areas of Padova, as in most cities in Italy, were falling for lack of public investment in the older parts of the city and lack of housing maintenance. As a result students started moving to the city centre, and 60% of the apartments in Via Anelli were put for sale. By the beginning of the nineties, a high percentage of international migrants arriving in Padova started settling in Via Anelli, sharing apartments in the Residence initiating a process of population substitution (migrants Vs Italian students) that in only five years ended up with the Serenissima Residence being totally inhabited by international migrants.

In 2003 there were 900 international migrants and 300 temporary hosts (people using Via Anelli as temporary accommodation) (Padova Police Department, 2003). Between 1998 and 2003, 813 people applied for a flat in Via Anelli, 90% of them being migrants. Based on residence permits in 2003, 32% of the residents were Nigerians and 31% Moroccans.

The possibility of co sharing the flat, reducing the cost of renting, was highly attractive particularly for incoming migrants who did not have any other alternative for housing. Together with this process of “ethnicityzation” of the neighbourhood, the cost of the flats started to fall. In 1997 a flat in the Serenissima Residence could sell for 45-50 million Italian liras, 50% less than 1989 value: in 2000 prices were down 80%. However, by renting out to several renters, landowners could still get a significant amount of money from their flats even though the building values were continually going down due to cohabitation.

In the same period the area became a magnet for prostitution and drug dealing, as well as a target for police patrols and raids. In 2001 a new police station was established next to Via Anelli, while Italian families living in the areas next to the Serenissima Residence started moving out thus adding to the process of residential substitution. The reference to Bronx when speaking of Via Anelli became widespread, both in the media and in the common city jargon. The urban stigma conveyed Via Anelli inhabitants as criminals: those who lived in the Residence became invisible in the urban imaginary and the media started to focus on Via Anelli, highlighting its features as a core of illegal and criminal. Citizens increasingly urged the government to take action and local committees and associations were created to respond to the “danger” Via Anelli represented.

"Policies are practically oriented because the aim is to transform the environment starting from the current state of art, that is unsatisfactory. The point of departure is the manifestation that there is something wrong, something that makes problems" (Crosta, 1998).

Via Anelli became in these years the centre of local political debate in the filed of social and spatial inclusion of international migrants and of policy choice for the rehabilitation of urban areas under crisis conditions.

In 2005 the Municipality of Padova started to relocate Via Anelli migrant population to other areas of the city.

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[42] “Residence Serenissima” Construction Project, Padova, March 1970

3 Urban policy analysis

3.1 Diverse use of public space vs insecurity: where the problem lies

The observation of the interactions that take place in the policy arena indicated the emergence of a conflict about "what acted as a problem" in via Anelli. The policy analysis highlights those frames that contributed to the definition of policy stances. Differences, frames, interpretations are all considered as relevant in examining urban policies implemented in a context of social and cultural diversity.

In particular, the analysis of the policy process shows very dissimilar frames used to convey Via Anelli's constraints: some actors emphasize the conflict about the use of public and private space considering Via Anelli as a social protection against work and legal precariousness of migrant population. On the contrary insecurity seemed to be the core frame of referring to the situation, highlighting the problem as a conflict among local people and migrants settled in the quarter.

News worked as a form of knowledge (Park, 1960) within the policy process: events linked to Via Anelli issues ceases to be simply news as soon as the public attention was directed to some other features of the problematic situation. Once discussion has been started, the event under discussion turned from the news to the issue it raises (ibidem, 1960). In other words, the existence of an ethnic quarter in the urban area started to challenge notions as urban security, access to public space and services in a multicultural context. Via Anelli challenged the more general issue of the "right to the city" (Lefevbre, 1968) for immigrants.

3.2 The policy arena

The existence of multiple actors in the policy arena, with different frames for the situation analysis, imposes to consider policy-making as a political game among multiple rational actors rather than a decision-making process based on instrumental rationality. "From a problematic situation that is vague and ambiguous each story selects and names different features that become the "thing" of the story" (Schon, Rein, 1994). According to this vision, each story constructs its views of social reality trough a complementary process of naming and framing. Relevant things are selected following the frame that has been used to interpret reality. This is the crucial point, from data to recommendations, from fact to values (ibidem, 1994). Policy frames are relevant in order to observe the process by which actions evolves over time, at different levels of the policy making process.

Via Anelli policy arena was populated by heterogeneous actors, institutional and non institutional, such as associations, committees, and single active citizens, both immigrants and native. Local, national and international medias were also very active in producing knowledge on Via Anelli. Different frames seemed to "facilitate" interactions within the policy arena.

In 1999, following a general meeting with the population settled in Via Anelli, the "Against the Ghetto" (ATG) committee was created.

"According to ATG the problem of Via Anelli is not linked to ethnicity or criminality. Via Anelli materialises the constraints in accessing housing and secure jobs for immigrant population. Padova Municipality is legitimating actors that referred to Via Anelli as to the City Bronx, focusing on security issues and posing migrants against discriminations". (ATG director, 2007)

ATG committee worked in the field of politics, referring not only to local elements but also to national and transnational policies, giving relevance to the immigration policies state of the art and to the global dimension of migration. The committee was strongly opposing the Municipality, except for a short period of fragile collaboration among the two parties.

“Sestante Cooperative” (SC) was subcontracted by the Municipality of Padova to manage cultural mediation within the new residence for Via Anelli inhabitants. The Cooperative implication in the policy process can be defined as technical.

“Our work in the field of cultural mediation cannot be replaced, on the contrary the ATG works at political level and their actions are linked to political games, not valuable to migrants settled in Via Anelli”. (SC director, 2007)

According to SC, the idea of relocating the population to other parts of the city was the only way to ameliorate migrants’ social and economic status. The cultural mediation was a mean to control the urban stigma towards Via Anelli inhabitants.

“Stanga 6 Committee” (S6) was active in lobbying for the closure of Via Anelli focusing on security issues. The S6 conveyed Via Anelli as a problem of concentration of illegal migrants involved in micro-criminality actions. Clash of civilisation was the frame used to put into words the situation.

“The majority of people settled in Via Anelli are criminal, even if we know that there are also families and babies within the Complex. We referred to migrants as “dirty black” because they don’t have a job and continually disturb our life in the quarter. We have to teach them which are their duty, not only their rights. Migrants are ignorant, and cannot understand what institutions are”. (S6 committee director, 2007)

The desire of Padova Municipality was to build a participatory process to define a policy for the rehabilitation of Via Anelli. The slogan of community participation and the bottom-up strategy was constantly used to convey the framework of public intervention. As SC, the Municipality linked the dismantling of the ethnic neighbourhood with the amelioration of the social and economic situation of immigrants. In addition the Municipality framed the policy intervention as functional to improve the sense of security in the area.

“We organized a participatory table in order to discuss with all the stakeholders and collaborate in the implementation of the public policy”.

“The policy making for Via Anelli can be defined public because the main actor involved in the process was the Municipal actor. It guaranteed a process of social and spatial inclusion of international migrants within the City of Padova” (Deputy for Housing and Immigration, Padova Municipality)

According to this vision, the public aspect of the planning action is guaranteed by the formal role of the implementer that has to be public. The “public” is not an eventual result produced by the quality of deliberation among actors.

Media act a major role in the production of metaphors about Via Anelli situation: as stressed before, events linked to Via Anelli ceased to be simple news as soon as the attention of the public focused on some other features of the problematic situation. The spatial concentration of foreign population (the news), arise a discussion among the right for migrant population to access to the city and its services, generally speaking.

Migrants' involvement in the policy process was marginal because they acted as the target population of the public intervention rather than active stakeholders in negotiating possible approaches for action. Migrants themselves seemed to be interested in the short term outcomes of the intervention, in order to have new flats outside the quarter. Only a small proportion of Via Anelli inhabitants, were active within ATG, trying to sensitize the population about the social and political condition of migrants within the City. No immigrants were invited at the participatory table organized by the Municipality.

"For some twenty years….social policy ought to be considered as problem-solving enterprise. In opposition to this view, I have become persuaded that the essential difficulties in social policy have more to do with problem setting…more to do with ways in which we frame the purpose to be achieved rather than with the selection of optimal means for achieving them" (Schon, 1978).

The existence of diverse interpretative frame impose to consider Via Anelli as a social product of the interaction among multiple actors. Their frames are socialized in the policy arena contributing to this construction. Frames by which Via Anelli was conceived were conflicting because of a very dissimilar interpretation of "news" (Park, 1960) about Via Anelli. Moreover the conflict derived from the existence of very dissimilar metacultural frames (Shon, Rein, 1994) for the situation analysis.

Policy problems are not given, but constructed by human beings in their attempt to make sense of the situation, which is complex. At the same time things to refer are selected and named in such a way as to fit the frame used to construct reality.

This interpretation of reality challenges the notion of policy as a means to solve social problems by following a rational program of intervention. The existence of conflicts imposes to revise urban policies as arbitrary choices beyond inquiry. The use of knowledge for the identification and implementation of policy intervention should be discussed.

3.3 Diverse uses of knowledge

Controversy within the policy making process has been conceived as conflicts in action frames. Conflict arose about the nature of Via Anelli and about the ability of policy intervention in social problem solving.

The presence of multiple actors in the policy arena with different frames for the situation analysis, gives evidence to the necessity of considering policy-making as a political game of multiple rational actors, rather than a decision-making process based on instrumental rationality. This social design process (Shon, Rein, 1994) is political: the system is shaped by a coalition of actors who have their own interests, freedoms and powers. The interaction among the system of actors and the environment is inevitably political. In other words, the conflict among actors could not be separated from the existence of a local context (migrant policy analysis), a national context (immigration policy analysis) and a transnational one (international migration flow trend analysis).

The practice of considering Via Anelli as an isolated microcosm depoliticizes the policy intervention. At the same time, the depolitization occurs when the policy situation is not considered as "collectively socially constructed" (Blumer, 1971). According to this framework, frame analysis takes policy into politics.

According to the functional approach, the consequences of an hypothetical policy intervention are completely predictable and definable ex-ante, thanks to expert knowledge accumulated until then. In this scenario the interactions among actors have to be included in a precise pattern of roles and functions defined by ordinary powers. This pattern will be able to not generate unexpected consequences that could mine the decision-making process and consequently the policy results. The functional paradigm is able to determine the process, contrary to what happens in a "transaction" (Dewey, 1971) where the identity and role of actors are built along the way, in practice, with the possibility of not expected consequences. According to the interactionist paradigm, the communication process is not finalized one way to achieve consensus between the parties, but is problematic, living in his being practical.

If the policy-making process is a “process plan” (Crosta, 1998), then knowledge is produced during the planning action, as the roles of participants and their interpretative frames. This argument opens to the theme of participation: in a functional vision the actor of planning is not considered as problematic but seen as the expert. Moreover, the relationship between planners and planned is perceived as a potential factor of instability to be solved.

Whenever the dialectic relationship between planners and planned is conflicting, an inclusive selective process is built up by experts following procedural norms following the logic that "the planning is concerned as an asset able to remedy the failure of social institutions, directed to a population defined as recipients rather than actors in the plan" (Ceccarelli, 1974). In this way the society is reduced to "social demand" and planned population are led by planners in the dialogue, reducing the impact of non expected consequences. The functional solution is the creation of a strategy in order to convey the policy as “common good” productive. The publicity of the action is, in other words, non eventual.

Via Anelli generates a conflicting debate within the policy-making process. The Municipality used the participatory framework to conceive the policy intervention, declaring that a shared understanding of policy constraints and policy options were necessary to social problem solving. To this extent the Municipality built up a participatory arena, inviting the more active committee and association (the ones described in the previous section) together with technician from the Municipality, experts in the filed of urban regeneration and governance of migration. A participatory observation of the communicative relationships within the arena shows a situation that cannot be described as “transaction” (Dewey, 1971): the deliberative arena were built up in order to arrange new flats for immigrants and to organize cultural mediation within the new buildings. According to these reasons, the table could be defined as technical rather than deliberative: interaction among actors seemed to be unnecessary to the redefinition of the policy options. The arena’s main function was to manage policy actions decided in advance. No change in the role of participants (Dewey, 1971) occurred. Only SC participated actively to the table, while ATG and S6 committee gave up. According to them, the quality of deliberation was insufficient and the capability of influence main decisions objectionable. In fact relevant issues for ATG and S6 committee, such as social and working condition of immigrants and the future destination of Via Anelli were not discussed at the table.

Just after the second table session, the Municipality presented the Project for the renewal of Via Anelli quarter to the citizenship: "…the intervention will consist on actions for promoting access to public housing to immigrants who have a residence permit. The operation consisted of two main actions: improving of the urban areas and moving the population outside Via Anelli. Cultural mediation in new houses will be guaranteed by a cooperative officer. The rehabilitation of Via Anelli will consist in a reduction of the number of apartments, in order to prevent overcrowding phenomena. Building 25 will be demolished and a large green space will be provided instead" (Padova Administration Project, 2004).

The policy intervention was conducted for achieving a pre-determined result, the dismantling of the ethnic quarter where criminal episodes were ordinary. Results analysis demonstrates that all the immigrants settled in Via Anelli were housed in a public housing outside the quarter, in most cases close to the place of work. The condition of housing improved in terms of "physical" conditions. Moreover, urban stigma started to cease with the change of residence.

Technically, the policy for the rehabilitation of Via Anelli focused on the decongestion of the quarter and on the improvement of housing quality for immigrant population carrying a valid residence permit. In addition the cultural mediation tried to ameliorate the relation between the local population and immigrants in the new housing. A result based approach shows the policy intervention as well conducted but at the same time reminds the necessity of considering "not local" element in the social process.

"The attention paid to the distribution of poverty within the urban space and to social exclusion leads to loose sight of the macroeconomic effects, above all the role of neoliberal policies in the labour market, the redesign of welfare, and the impact of immigration policies in the reproduction of marginality" (Alietti, 2004).

There are two categories of policies concerning migration that have to be considered in order to assess the impact of their connection: "immigration policies" and "migrants' policies". Though inevitably related, they often follow quite different paths, the former increasingly focusing on security and control measures, the latter having to respond to the daily needs of migrants and their "demand for the city" (Balbo, 2009). Globalization has brought about a process of decentralization worldwide that has entrusted local authorities with the responsibility to implement urban policies, including those concerning international migration. The relationship, sometimes contradictory, between the two level of policies (immigration and migrants policy) must be assessed within planning research in order to problematize the task of finding local solutions to global contradictions (Bauman, 2005), role that often makes urban policy an inconclusive agent.

4 The connection among immigration and migrant policies: the materialization of Via Anelli

Inclusion cannot be defined easily, since its boundaries are determined socially and historically. In addition it depends on the different migration strategies adopted by migrants themselves (permanent vs circular migration for example) and practices they perform within the City. Moreover, inclusion depends on types of policies multicultural cities postulate (Balbo, 2009).

Space plays a major role in urban inclusion. Among the main obstacles to migrants' inclusion is housing that high rents or sheer barring prevent them from accessing. As a result in many cities,

communities of migrants concentrate in specific areas contributing to the social and spatial fragmentation of urban space, thus undermining the very idea of the city as a space of exchange. Any use of public space diverse from the “norm” is seen as a threat to security, simply because it is unfamiliar (ibidem, 2009).

Via Anelli is a clear example of such social phenomena, as an "ethnically oriented" quarter that coincides temporally with the intensification of migratory flows coming to Italy. Some immigrants settled in via Anelli after searching for housing in other parts of Padova. However, most migrants knew before they started their journey that they were going to end up in the Serenissima Residence as a safe place where to receive the support of fellow citizens in terms of working protection in situations of illegality. Via Anelli was also known as a resource in terms of informal activities: some apartments of the Complex were used as bar-restaurants and a barber was working on the stairs of the buildings. Via Anelli simply confirms "the fundamental contribution of migrant community networks in determining some stages of the migration process" (Mezzadra, 2004), both for the newcomers and for the channel of information for the would-be migrants. To this extent, where migrants policies are fragile mutual help networks are the sole response to the needs of migrants, particularly so when settling for the first time.

In recent years, national immigration policies have increasingly focussed on national security and public order. The aim is to limit the number of migrants entering the country by imposing more stringent requirements for the delivery of residence permits and tighter border controls. Among the consequences of restrictive measures there is certainly an increase in irregular migration and the change of status, from legal to illegal, for many immigrants already in the country (Balbo, 2009).

Immigration policies have a strong influence on migrant policies. As stated before, the production process of Via Anelli cannot be analyzed without referring to immigration policies and their effect on individuals. The urban area performed as a marginal quarter within the city of Padova due to migrants’ difficulty in finding houses outside that area.

“The ghetto cannot be reduced to the easy explanation of a culture of poverty…or of racism…The ghetto is a product of historical discrimination and although present-day discrimination has undoubtedly contributed to the deepening social and economic woes of its residents…The understand of the problems requires the specification of a complex web of other factors, including shifts in the American economy” (Wilson, 1993).

From 1977 to 2004, 1,233 residence permits were delivered to migrants stating they were living in Via Anelli: 76% of the permits were given thanks to temporary jobs (Fincati, 2004). Between 2000 and 2003 illegal migrants settled in Via Anelli were estimated at 39% of the total population living the Complex.

These data are particularly important when bearing in mind that Italian migration laws binds the delivery of residence permits to having a work contract obtained before entering the country. As a result, temporary jobs can easily undermine the possibility of being legal. To this extent Via Anelli was protecting migrants who could not enter the official labour market or were illegally inhabited the city. Accordingly, Via Anelli can be looked at as a “stabilized area of transit” of marginal population, with scarce pressure of the population exit the quarter and, on the contrary, with large number of immigrants asking for bed places. In a context of work precariousness, illegality becomes a potential

protection in the case of unemployment, guaranteeing a minimum salary. The streets next to the Serenissima Residence were in parallel a place where to easily find illegal or informal occupations. Immigrant population settled in Via Anelli is “included with exceptions” (Mezzadra, 2004), referring to a community that can visibly use the city and its services but cannot exercise the same grade of citizenship than natives. The term marginality, in this sense, enquires concepts as access to housing, public space, services and security, linking them to the notion of citizenship.

Via Anelli also helps to problematize the framework by which foreigners, most of who take up difficulty and “dirty” jobs eschewed by Italians, are for this same reason accepted and socially recognized by local population (Diamanti, 2007). Via Anelli challenges the issue of “employment” as a mechanism facilitating both economic and social inclusion, legitimating a sort of unquestionable “right to be in the territory”. The “urban stigma” that Via Anelli became attached through time delegitimized the “right to the City” also for legal workers settled in the area.

Even if migrant policies should be much more oriented to the promotion of the right to the city, conflicts within the local context are closer, clear, and emotional. In recent years, an increasing number of Municipalities have framed their migrants’ policies essentially around the issue of urban security, fight of illegal migration and decongestion of ethnic quarters (Balbo, 2009).

5 Via Anelli and territory control

"Via Anelli became a matter of security from the years '96-'97 when the total control on the “mala del Brenta” creates a vacuum that was filled by other less structured gangs that use cheap migrant labour in the marketing of drugs". (Deputy for security issues, Municipality of Padova, 2007)

Although there are some shades of difference, the interventions implemented by the right and left political party in the area of Via Anelli, in the period from 1994 to 2004, performed in the framework of territory control. “This was the period when the security issues flowed strongly in the media influencing policy intervention. Migrant policies were security framed by virtue of the positive results that they seemed to achieve in the short term, especially in terms of increased perception of citizens’ safety "(Vianello, 2006).

In 1995 the Municipality theorized the necessity of “a permanent surveillance of public parks and gardens ... a systematic control of the territory ... and prevention of immigration flows from the country of origin, promoting better living conditions there”. In 2001 the Stanga Police Department was created in Via Anelli in order to more easily patrol the area. The idea of “neighbourhood police” was conveyed by the left party as a different kind of territory control, able to guarantee citizens security (or the sense of) without acting as a disturbing action.

Besides the territory control through the use of police forces, the Municipality carried out some social-welfare interventions. The main objective of Open Windows Office, based in Via Anelli, was the social rehabilitation of the immigrant population, through the establishment of a point of reference for social and cultural mediation, work consultancy and housing information.

The police control of the quarter sharply increased with the intensification of the public debate on Via Anelli quarter and with the escalation of criminal episodes.

"In 2006 we ordered a massive involvement of police enforcement in Via Anelli. In fact during the summer there was a violent episode next to the Complex, a settling of accounts between North

African and Nigerian for the control of the drug market. We face about 300 people armed with axes and machete. The police were able to act in a timely manner, avoiding serious damage. Since that moment Via Anelli was permanently controlled by the police presence and was closed to traffic. (Carrai, 2007)

As a consequence, in 2006 80% of the arrests (520 in total) were made in Via Anelli and 95% were directed to immigrants. What is relevant is the high propensity of the native population settled in the quarter in reporting criminal acts, progressively increasing over time, in parallel with the process of degradation of the urban area (Vianello, 2006). The analysis of incidents reported to the police shows that "criminal" episodes deal more with “outsider attitudes” rather than with threats to safety. Therefore "the demand for security comes from individuals, but more often by groups who are more or less consolidated (as a committee, for example) and it incorporates the claim for an exclusive right of constructing the social space on not negotiable criteria (Mosconi, 2001). Such actions seem to be conducted in the frame of the "broken windows theory", immediately combating smaller incidents within the public space in order to limit the outbreak of serious crime. In this way social and spatial order is restored. The public opinion creates a strategy for claiming public intervention: "abnormal" and "antisocial" (night crowds, loud music) behaviour were conveyed as criminal and dangerous. Even illegal activities such as drug and prostitution were denounced for their immorality, rather than for the risk for the population settled in that area. "The mass of precarious population is a danger because of its residential mobility, non-compliance behaviours and professional instability. These are some of the features that denies the safe representation based on production and property rights" (Scalia, 2005). Asking for security becomes a vehicle of communication with the public institutions. This process becomes a "chance" for the news to become knowledge (Park, 1960).

The massive use of police forces (most with spectacular interventions), the definition of check points, the construction of the Via Anelli “wall”, are all material production of the schizophrenic relation between migrant policy and immigration norms. Moreover the emphasis on territory control becomes the framework within which the migrant policy is conveyed.

Back to illegal activities dealing with drugs, national data demonstrates that only 2.2% of people arrested for drug use and possession have the residence permit (Scalia, 2005). As conveyed before, there is a relationship between immigrants’ legal status and their involvement in activities related to drug possession. The peculiarity of the drug market makes the business of selling an easy strategy to resist against working and legal precariousness. Via Anelli, in this sense, appears as a well structured microcosm, where selling drugs in not really on the road, but within the protection of a marginal quarter. These kind of protections, reinforced by criminal social networks populating Via Anelli, become useful against effective police control.

6 Conclusion

Via Anelli, conceived as a marginal urban area in the city of Padova, is the physical representation of contradictions that have been analyzed during the research work. These contradictions materialize within the dialectic relationship among different levels of policy, conveyed as immigration and migrant policies. The genealogy of the process of production and reproduction of Via Anelli challenge the

notion of “voluntary choice” of living in Via Anelli in order to find a social, physical and economical protection in marginality.

Factors such as migrants’ social networks, the need to find housing at low cost in the absence of proper policies at local level and the necessity to earn easy money in a condition of labour precariousness, have contributed in different ways to the creation of Via Anelli quarter.

The terms “marginality” has been constantly problematize during the research work: if the immigrant is not considered as an entity completely embedded in traditional family networks and community" (Mezzadra, 2004), but as a person who lives in a complex relationship with its membership and physical and social environment, Via Anelli becomes the spatial representation of these multiple relationships. The marginal urban area is therefore not tightly closed, deliberately constructed, waterproof from the outside. Via Anelli inhabitants have experienced a different level of access to housing in the absence of proper policies through time. As a consequence, immigrants have experience a different grade of access to services, public space and security than native population. The materialization of Via Anelli as a space of marginality started to arise in the 90’s. The massive policy intervention has been defined and implemented starting from 2005. Migrant policies were totally absent in the early production of marginalization, while the policy intervention has been directed to the dismantling of the urban area that its absence had contributed to create.

The case study demonstrates the existence of a local response (a migrant policy) to a territorial problem through the implementation of a process of emptying the quarter and transferring populations residing in marginality. Immigrants that acted as a problem in Via Anelli have settled in other areas within the city, in order to avoid ethnic concentration. At the same time, the research work shows the importance of "non local" elements in the production of marginality, as the strong correlation between housing and legal condition, and legal condition and employment. The purely legal aspect, the existence of a state law on immigration seems to belong to a different "political, national space", but its repercussions on the local urban context are strongly visible.

The dialectic among local national and transnational elements in the production of urban space should be taken into consideration if planning research does not want to technically evaluate the policy process according to the functionalist approach. This practice is blind to political elements in social change. Via Anelli has in fact been conveyed as a “non place” where migrant subjectivity is structured in terms of process, influenced by the material conditions of the "outside" society.

Via Anelli population has not been considered as "excluded" but “included with exception”. Policy action, in other words, needs to work on the dynamics factor that make the inside and the outside relate to each other. Via Anelli and the city, immigrant population and natives, different cultures and ways of living both private and public space are some of these dynamic factors. Migrant policy has to intervene on the "boundary" (Zanini, 1997), rather than direct policies to include within the urban space. The terms inclusion has to be problematize in a broader framework of being an immigrant and not yet citizen in the country. Policies directed to the governance of visible effects of social dysfunction may also have the effect of producing a special status for the immigrant population in positive discrimination. The notion of inclusion means primarily providing migrants with opportunities similar to those which residents have access to.

The policy intervention for Via Anelli renewal demonstrates the tendency of guaranteeing a safer city through police controls, physical barriers, and the pursuit of migrants invisibility. An example of this emphasis on invisibility was the tendency of not revealing the new residences of migrants after the closure of the Complex. The policy intervention performed on "visible" dysfunctions and was easily communicable through categories such as "urban regeneration", "town safety "and “assistance of excluded”.

In regards to the planning process analysis, the research work wanted to focus on the use of knowledge and on the form of interaction among actors in the policy arena. The terms “actor” has been problematize during the research work; knowledge is considered as the “knowledge of everyone who takes it as a basis for some commitment o action” (Lindblom, 1979). According to this vision, ordinary knowledge plays an important role in the policy-making in order to give evidence to the professional one. Social learning becomes an alternative to Professional Social Inquiry (ibidem, 1979). Interaction is the basis for “interactive social problem solving” that can substitute for the mere analytical one; these suggestions open the analysis to the issue of inclusion within the policy-making process: in the social learning the preferred outcome generates without anyone’s having analyzed the given problem and achieved a solution performing as an expert policy maker. This position conceives the role of planning research as challenging man and his position within society and politics. The social learning model does not accept the delegation to public officials or to a few people, but assigns the responsibility to society as a whole. Moreover, the social learning seems to produce both outcomes and implementation together, considering planning as a social process. The idea is that problem solving approach rarely is able to really solve social problem, who are indefinitely complex. Interaction is an available means of taking some steps towards a more inclusive society, theoretically self-guiding. The interactive problem solving identifies action and interaction as an alternative to knowledge in the planning process. The model in this sense is opposite to the decision-driven model, played by decision-makers, and the knowledge-driven model based on research as an opportunity that can be capitalized on.

A common failure to achieve an authoritative solution to a problem derives from the scepticism about the possibility to correctly define policy problems: Via Anelli case study conveys different interpretative frames confirming that the policy problems have been constructed through time, as a social process. Policy problems are constantly under construction, with difficulties about their comprehension and about strategy definition.

The analysis of the participatory framework demonstrates that actors involved in the policy-making were combined according to a pre-design procedure rather than through a collective process of reinvention through social interaction (Gelli, 2005). The methods for the resolution of the “social problem” were previously decided, evoking a decision-driven model for planning practice. The depoliticisation of the planning process is conveyed by the absence of the immigrant population at the deliberative table, which returns to the Aristotelian distinction between “men that are able to use the word” and “ to recognize what is right” and animals “which can only identify the sensation of pain and pleasure using their voice” (Rancière, 2007). The terms marginality used within the research work wants to place a stress on the boundary between inclusion and exclusion within the urban and social space, working for the promotion of an effective “right to the city”.

In regards to the role of planning research, the cognitive work could involve the researcher in pointing out new relations among phenomena, giving a different interpretation feed by multiple actors' frames and interpretations. The planning research has the responsibility to make know to the public the complexity that forms social problems and their spatialization.

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Creativity, urban resurgence and urban policies: exploring policy implications of creativity spatial patterns

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Creativity and urban resurgence are now main issues in literature dedicated to urban dynamics, according to which cities that want to attract talented people and flourish economically, need to generate a favourable and distinctive "atmosphere". The qualities of cities centres – namely social diversity, functional mix, heritage and attractive public space - are seen as a crucial issue to creative location decisions and urban revival. Consequently, urban strategies are strongly committed to the improvement of physical, social and cultural conditions in inner-cities. However, these approaches are also criticized for promoting a limited vision of urban renaissance and of urban policies. Location decisions of creative activities and their employees do not always necessarily rely on such soft factors. Some research stresses the negative effects of creative cities policies too, particularly those related with gentrification and social mix. This paper aims to contribute to these debates. It analyses creativity spatial patterns in Porto Metropolitan Region and addresses, subsequently, significant policy implications regarding city-centre regeneration.

Keywords: creative cities, urban resurgence, creative location patterns, regeneration.

1 Introduction

Theoretical debates about "the creative city", the "creative class" or the "creative economy" are closely intertwined with those related with urban resurgence. Much literature on the subject emphasizes the role of "urban amenities" - such as the historical and symbolic value of cities, and their social and cultural diversity - in attracting the most talented employees and the most dynamic activities to city-centres, emphasizing their contribution to new urban regeneration policies too. Relationships between the resurgent city and creative economy have led to a renewed interest for new strategies and urban agendas focused on city centres. This is the case of policies directed to the promotion of "positive gentrification" strategies, searching for socially mixed neighborhoods in city-centre in order to attract skilled and talented people and capitalize on the conditions for urban resurgence.

Yet empirical studies in many cities and urban agglomerations have been challenging at least some of the more salient assumptions of these approaches. Many creative and knowledge-intensive activities do not evidence the kind of location preferences suggested in theoretical literature. On the other hand, as the so-called "creative class" is not as homogenous as the notion of "class" would suggest, it produces many different kinds of spatial residential patterns, some of them far away from those of the archetypal preferences of talented people. These trends and patterns have important implications on creative cities policies, above all those related with gentrification and social mix.

This paper aims to explore these issues drawing on material from a research project[43] that is under way, which aims to identify the role of creativity and innovation in urban policies definition and implementation, along with their social and territorial implications, notably in relation to the coordination between competitiveness and cohesion objectives. The studied territory is Porto Metropolitan Region, defined here as a broader area than existing administrative Porto Metropolitan Area (see section 3). Being one of Portugal's major urban areas, this territory faces acute challenges, such as the transformation of its urban fabric in a socially sustainable way.

The problem statement of this paper is the following: to what extend are the locations decisions of creative activities and their employees self-oriented? By focusing on this question the paper intends, firstly, to discuss the hypothetical association of the patterns of creative economy and its workers with centrality, that is, with specific "urban amenities"; and, secondly, to offer a preliminary judgment on how these patterns challenge regeneration policies in particular. The paper is structured as follows: the next section presents the more recent theoretical findings about the "creative city" debates and their relationship with the urban resurgence proposals, along with their implications on urban policy. Section 3 includes the mapping of spatial distribution of creative and knowledge-intensive activities in Porto Metropolitan Region, as well as their workers residential preferences. Section 4 presents the main conclusions and suggests avenues for further research.

2 The "creative class" and the "resurgent city"

2.1 The raise of the "resurgent city"?

After having been recognized as the main source of many societal problems for several decades, cities emerged in the last few years as dynamos of innovation and regional and national prosperity. This approach has been increasingly shared by academics (Cheshire, 2006; Turok & Mykhnenko, 2006), government departments and international organisations.

Much literature on the so-called "urban resurgence" (Storper & Manville, 2005) is related with the increased recognition of the role of cultural activities on urban competitiveness strategies. In several countries, there has been a shift from policies focused on the support of some sort of traditional "high culture" towards a more resolute attention on the "young", "trendy" and "cool". As a consequence, culture transited from a marginal, "fun" sector of public affairs to a powerful engine for economic development. In the words of Garnham (2005, p. 27) "from circuses to bread". This move was been accompanied by the substitution of the more restrict notion of "cultural industries" by a broader concept of "creative industries".

"Creative industries" are defined by the UK Department of Culture, Media and Sport as all those activities that incorporate individual talent and creativity and have a potential for job and wealth creation through intellectual property benefits. They include advertising, architecture, the media sectors, music and performing arts, crafts, publishing and design, among other activities. Although these sectors are at the core of creative industries definition, many authors stress the need for a broader definition, in order to include a wide range of knowledge-intensive occupations that are

[43] Research project entitled "Urban policies, creativity and cohesion: the case of Porto city-region".
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strongly interrelated with the creative ones. Such is the case of Information and Communication Technologies (ICT), the financial sector, law and other business services, along with higher education and research and development activities. They not just have strong relations with the core group of creative industries, but also overlap them very often, such as in the case of software entertainment products (Musterd, S; Bontje, M. *et al,* 2007).

This "cult of urban creativity" (Peck, 2006) may be summarized in a few paragraphs. According with Florida (2003), people who work in the creative industries, such as artists, writers, scientists, entertainers, actors, designers, architects and all those whose occupation contributes to the creation of "meaningful new forms" (p.8) make the core of what he calls the "creative class". Being highly talented and educated, these people are also very mobile. This does not mean, however, that they are spatially scattered, or that they are the precursors of some sort of "end of geography". Quite on the contrary, they tend to cluster in some places, not only for economic reasons but also for lifestyle. They seem to feel attracted for locations that offer diversity, authenticity, tolerance and inclusiveness, the so-called "soft location factors".

Florida argues that the creative class forms a specific type of human capital, called creative capital, which is by far the most powerful driving force for local/regional economic growth. Creative capital endowment is funded on what Florida calls the 3T's, Technology, Talent and Tolerance. He supports that places that combine these three attributes are in a good position to succeed economically, mainly because creative people want to live there.

Using empirical evidence from other research studies, along with correlations between his indexes and economic growth factors across US regions, Florida found strong support for his "creative capital" theory. Places that perform better economically seem to show higher levels of "3T" endowment. This is especially true in the cases of large urban centres, and not so large ones, such as several University cities. These places seem to perform better economically than celebrated, but also polluted, fast-growing sprawled regions. Nevertheless, more recent literature identified several flaws on Florida reflections on the creative class.

Florida pays little attention to historical factors, such as the role of path-dependency. The notion that "history matters", that each place has a historically grown identity that evolved to a specific atmosphere, and that these contextual factors are hard to replicate elsewhere, is almost absent in most Florida writings, as if conditions for creativity could be produced anywhere, almost overnight (Bontje & Musterd, 2006; Hall, 2004).

Another critique directed to "creative class" theory has to do with over importance attributed to "soft" location factors of development such as cultural amenities, talent, tolerance and diversity, at the detriment of the more traditional "hard" factors such as the availability of office space and adequate infrastructure, rent and tax levels, and regulation. Although these last loosed prominence in the last decades, since they can be met almost everywhere in the developed world, they still remain important classic factors (Musterd & Ostendorf, 2004).

Florida's views about the "creative class" assume that providing the right conditions for attracting skilled and talented people is the vital condition to develop a knowledge-intensive economy based on high-tech, cultural and business services. These conditions may include the so-called "urban amenities" that affluent and highly-skilled creative and knowledge workers use to value, such

a lively cultural scene, tolerance, social diversity, a “unique” historical heritage, attractive public space or some other kind of aesthetic advantage.

“Urban ambience” may not be the main drive for attracting creative people, however. Stressing the remarkable lack of “urban ambience” of many innovative places when they started to thrive (most notably the Sillicon Valley, Hollywood or even New York and London when the financial industry arose there), Storper & Manville (2005:18) conclude that very often explanations centred on amenities “put the cart before the horse”. Alternatively, they emphasize the fact that creative people use to prefer places where they can maximize job opportunities. Large metropolitan areas and their diversified job markets offer lower adjustment costs, in the case of employment change or loss, making them particularly attractive for creative and knowledge workers, who often need to deal with volatile job markets.

On the other hand, employee’s choices may not be the most determinant location factors. As Musterd (2006: 1326) states, “we might also adopt a "firms perspective’”. Storper & Manville (2005:9) argue that “cities grow where firms congregate together, and firms congregate in places where they can benefit from proximity to other firms, to their markets, or to their labour force”. Agglomeration effects are hardly new on economic geography studies (Leborgne & Lipietz, 1996). What seem to be new are the reasons that lie behind these effects. While firms in the manufacturing-base economy seek proximity related with the presence of “hard” infrastructure (harbour facilities, for instance) as a necessarily condition for lower average production costs, knowledge-intensive firms do not agglomerate for this reason, at least not predominantly. They search for diversity, innovation and a constant upgrading of their goods and services. This is better achieved by having access to the right kind of information, which is not widespread and standardized, then needing to be mediated through face-to-face contacts based on trust relationships (Storper & Manville, 2005).

Debates about employees and firms location preferences give rise to questions about whether firms follow more talented employees in their seek for an adequate “ambience” and better job opportunities, or if the other way round is more common. Evidence seems to suggest that although not always for the same reasons, both creative and knowledge-intensive firms and workers tend to privilege large urban areas. These may provide a wider range of skills and “urban amenities”, as well as more opportunities for thriving innovative ideas.

Nonetheless, as Musterd (2006) and Musterd, S; Gritsai,O. *et al.* (2007) argues, there are sharp differences within cities and urban regions, mostly related with the kind of activity concerned. Analysing firms and workers location patterns in Amsterdam agglomeration, this author found that while firms of what he calls “culturally-creative” activities such as performing arts, the media, advertising, architecture and design tend to cluster in older parts of the city, the same is not true to “knowledge-intensive” activities such as software, finance, marketing and Information and Communication technologies, which tend to locate in more peripheral areas, notably around nodes and corridors.

From an employee’s perspective, Musterd findings also showed remarkable differences between different groups of skilled professionals. While “culturally-creative” workers tend to live in the city-centre or in the immediately adjacent periphery (which means, close to their workplaces), there is a lack of empirical evidence of a generalized preference for this pattern. “Knowledge-intensive”

workers, those who do not work in cultural industries but in Information and Communication Technologies (ICT), the financial sector or the business services, clearly prefer suburban locations, showing far more disseminated residential pattern. Levine (2004) finds an even greater evidence of this trend in the US and Storper & Manville (2006) even question long-established dichotomies between compact and sprawled cities, when the analysed territory absorbs the whole city-region rather than its core. All these aspects have obvious implications on urban policies, particularly in the relationships between their design and the social and spatial consequences of their implementation. These findings converge with Markusen (2006) views against the notion of creative people as a homogeneous "class". People who exert inventiveness as a way of earning their lives typically do not share the same preferences, aspirations or political orientations.

2.2 Implications for urban policy

Relationships between the resurgent city and creative economy debates have been raising a renewed interest for new strategies and urban agendas focused on city centres. In the European context and, in particular, in debates about urban regeneration policies, several authors have been emphasizing the growing appeal of strategies and practices supported on specific "urban qualities" such as the historical and symbolic value of cities, their social and cultural diversity. Literature has been distinguishing two different kinds of fundamental aims of these strategies:

1. "City marketing" and "city branding" objectives, mainly supported on emblematic urban projects (Moulaert *et al*, 2003) and, more recently, in operations designed to transform and manage urban image and identities through a deliberate association of symbolic values and functional attributes (Karavaratzis & Ashworth, 2005). These projects are often linked to diversification strategies based on new spaces of cultural creation and production (Evans, 2003; Gonzalez, 2006).

2. Objectives focused on the reinforcement of a distinctive and vibrant "atmosphere", throughout the valorisation of new spaces as places of consumption and urban experience. New strategies centred on the revival cultural and "spaces" and activities in the central and historical parts of cities are inserted in this framework (Montgomery, 2003). The same happens with urban strategies based on social diversification through the attraction of the so-called "creative class" to parts of the city predominantly inhabited by less favoured segments of society (Lees, 2008; Atkinson & Easthorpe, 2009).

These ambitions situate urban regeneration policies – as well as urban policy variants associated with terms such as urban renaissance, urban revitalization and urban sustainability – at the heart of the so-called "creative economy" (Pratt, 2009). Social mix, in particular, is considered an important aspect of creative city success, being related not just with a "growth first logic" (Cochrane, 2007), but also with a normative discourse based on the celebration of diversity and on the creation of sustainable social communities. Underlying this view is a concept of "positive gentrification" (Shaw, 2008) used to legitimate the "re-colonization" by the creative class (and the middle classes in general) of places usually inhabited by low-resources populations, such as city-centres.

Nonetheless, the increased debate on gentrification and social mix illuminates the wide range of problems posed by this kind of strategies (see, among others, Atkinson, 2002, 2004; Colomb, 2007; Lees, 2003a, 2003b, 2008; Pratt, 2009; Uitermark, Duyvendack & Kleinhans, 2007). By

analysing extensively the positive and negative impacts of these strategies, Atkinson (2004) and Lees (2008), for instance, emphasize the risk factors that constitute a menace to social cohesion. The potential effects of gentrification and social mix strategies in the creation of socially diversifying communities deserve, then, a significant analysis. Among the most critical factors in this respect are difficulties of interaction between new and old residents and their distinctive social values and behaviours, a fact that may compromise some assumptions about the relationship between social mix and the creation of social capital (and, as a consequence, the generation of new opportunities for actual residents).

Inflationary effects in the property market are among the most prominent aspects focused in this literature, given the influence of rent and property raises on the availability of more affordable housing, and the resulting gradual displacement of disadvantaged groups. Finally, the moral authority of these strategies is questioned, as the middle class is often seen as the "normal" and "desirable" standard, while previously established solidarity networks are jeopardized (Catungal *et al*, 2009).

The relevance of these problems, and their effects on increased exclusion and social polarization, is added to the inequalities provoked by the creative economy itself, derived to the formation of a new "underclass" raised by the exclusion of part of the population from the creative activities (Barnes & Hutton, 2009).

In sum, as enhanced by Atkinson & Easthope (2009), "it has become quite clear that there is a core question around social equity and creative cities policies that requires further attention" (p.70). Being one of Portugal's main urban areas, Porto Metropolitan Region has been facing several pressing challenges related with the gradual transformation of its economic basis, from a largely industrial region to a more service-oriented one, desirably based on creativity and innovation. However, its context is still characterized by the persistence of deep social problems, along with sharp spatial inequalities. For these reasons, there is a strong need for analysing the location patterns of its creative activities and workers, in order to assess the extent to which they may contribute to an adequate formulation of urban policies.

3 Case study: Porto Metropolitan Region

3.1 Methodological aspects

The studied territory comprises 26 municipalities, 9.905 Sq. Kms and 2,3 millions inhabitants, including the sub regional areas of Greater Porto (comprising the city of Porto and its involving municipalities) and the neighbouring areas of Entre-Douro-e-Vouga, the Sousa Valley and the Middle Ave Valley. Despite its lack of coincidence with present-day institutional or statistical units, which have been changing frequently over the last few decades, the whole region and the chosen sub-divisions seem to encompass a considerable functional relations and territorial coherence (CCRN, 1988; Quaternaire, 1993; Ferrão, 2002).

The study of creativity spatial patterns across Porto Metropolitan Region combines different methodological techniques, including statistical analysis of different data sources and questionnaires with actors involved in some of the most emblematic creativity activities. The studied activities include not just the "core group" of activities usually associated with the concept of "*creative industry*", such

as publishing, advertising, radio and TV productions, the arts sector, architecture or design, but also the so-called "*knowledge-intensive industries*", such as Information and Communication Technologies (ICT), the financial sector, law and other business services, along with higher education and research and development activities.

Although the first group of activities is at the core of the definition of a "creative industry", several authors stress the need for a broader definition, in order to include a wide range of knowledge-intensive occupations that are strongly interrelated with the creative ones. They not just have strong relations with the core group of creative industries, but also overlap them very often, such as in the case of software entertainment products (Musterd, S; Bontje, M. *et al*., 2007). The present study shares this last view. Despite some differences related with divergent Economic Activities Classifications in Portugal and the Netherlands, the 17 analysed sectors in the present study generally coincide with Musterd & Deurloo (2006) selected branches in their study on Amsterdam Metropolitan Region. (see Table 1, in annex).

Statistical data sources used to match the privileged location patterns of creative and knowledge-intensive companies and their workers are from Portugal's National Statistics Institute, notably the last population Census (2001) and from the Ministry of Labour and Social Security (MLSS) Department of Statistics.

Census data provides useful information about the employed population residing in the 26 municipalities of the studied area in 2001, focusing their residential spatial patterns and interactions with job locations. Analysed information is spatially disaggregated at the level of parish (*Freguesia*). More recent information data from MLSS provides employment location patterns in the creative and knowledge-intensive activities in 2006, also at parish scale. Nonetheless, available information from this last statistical source excludes both public servants and self-employed workers, who may represent a considerable proportion of the region "creative class".

Given the need for qualitative and updated sources of information, the present paper also includes information from 46 questionnaires with workers in key activities such as the arts sector, design, architecture and leisure. As these branches are among the most usually associated with the presence of a distinguished "urban atmosphere", the targeted area for questionnaires is the city-centre of Porto, where some of the features that are supposed to attract talented people, such as historical heritage and cultural and leisure facilities, are concentrated. On the other hand, available statistical data hardly captures some very recent phenomena, such as the increased clustering of several characteristically creative activities in the city-centre of Porto. Nonetheless, since the questionnaire process is still underway, results presented in this paper represent only part of the universe included in the research programme.

The case study presentation has the following sequence: first, creative and knowledge workers residential patterns and their spatial house-work relationships with the region largest local labour market – the city of Porto – will be analysed, both generally and on a sectoral-disaggregated basis, using data sources from 2001 Census. Research will then focus on employment location patterns using 2006 MLSS statistics, before presenting the available results on city-centre questionnaires. Some key findings related with the location decisions of creative activities and their employees will be presented in the final part of the case study.

3.2 Creative and knowledge-intensive employees spatial patterns

The residing population in Porto Metropolitan Region who in the year 2001 was working in the 17 selected *creative* and *knowledge-intensive sectors* was of 88.860 individuals, representing 7,9 % of the total employed population residing in the area. There are, however, sharp contrasts among the area sub-regions, since that figure ranges between 3,3 % in the Sousa Valley and 11,4 % in Greater Porto. In the city of Porto alone, 17,5 % of inhabitants was working in the creative and knowledge-intensive activities in 2001 (Table 1).

2001 census figures show that Greater Porto represents more than three-quarters of the total amount of resident population working in these activities, being the largest share (22,4 %) concentrated in the city of Porto. Table 1 also illustrates an important unbalance between the two groups of activities, as the "*knowledge-intensive*" group is far more representative (73,2 % of total resident population) than the core group of activities more directly linked with culture and leisure (26,8 %). This pattern of strong knowledge-intensive dominance is common to all considered sub-spaces, although it is even more pronounced outside Greater Porto.

Table 1. More relevant figures on the employees' spatial distribution, in Porto Metropolitan Region

	Employees in creative activities	Proportion of employees in creative activities (%)	Spatial distribution of the employees in creative activities (%)	Pr. of employees in creative activities that work in the creative industries (%)	Pr. of employees in creative activities that work in the knowledge-intensive industries (%)
Porto Metropolitan Region	88.860	7,9	100	26,8	73,2
Sub-Regions Greater Porto	67.832	11,4	76,3	27,6	72,4
Middle Ave Valley	10.006	4,3	11,3	24,7	75,3
Sousa Valley	5.097	3,3	6,1	22,0	78,0
Entre-Douro-e-Vouga	5.925	4,4	6,8	25,1	74,9
Extra Sub-Regions of Greater Porto	21.028	4,0	23,7	24,1	75,9
Porto	14.412	17,5	22,4	27,6	72,4

Source: INE, Census (2001)

Analysis within each group presents a noticeable distinction between different branches in terms of their contribution to the total amount of residents working in the *creative* and *knowledge-intensive sectors*. While certain sectors represent important shares, such as *Monetary and financial intermediation* (21,1 %), *Fiscal, law and management consulting* (16,7 %) and *Publishing* (10,7 %), in other cases that proportion falls down to 1 % or less.

Figures circumscribed to the most qualified among workers in the *creative and knowledge-intensive* activities residing in the region (managers, specialists in scientific and technical functions and intermediate technicians) show a similar pattern of spatial distribution. These three groups, which together represent about one half of the total resident population working on the *creative* and *knowledge-intensive activities*, but only 4 % of the total resident employed population in the region, live for the most part in Greater Porto.

Analysis of territorial patterns of specialization using the Location Quotients (LQ) methodology[44] show that these individuals are highly concentrated in most parishes of the city of Porto (LQ's above 2,5) and, in a lesser extent, (LQ's between 1,1 and 2,5) in a first "crone" involving that core group of municipalities. Outside this area, and with some very few exceptions, levels of spatial concentration of highly qualified residents in the *creative or knowledge-intensive activities* are near or below the regional average (LQ's equal or bellow 1,1). 2001 Census data does not show evidence of substantial differences between residential patterns of "*creative*" and "*knowledge-intensive*" workers, at this level, when the two groups of activities are aggregated (Figure 1).

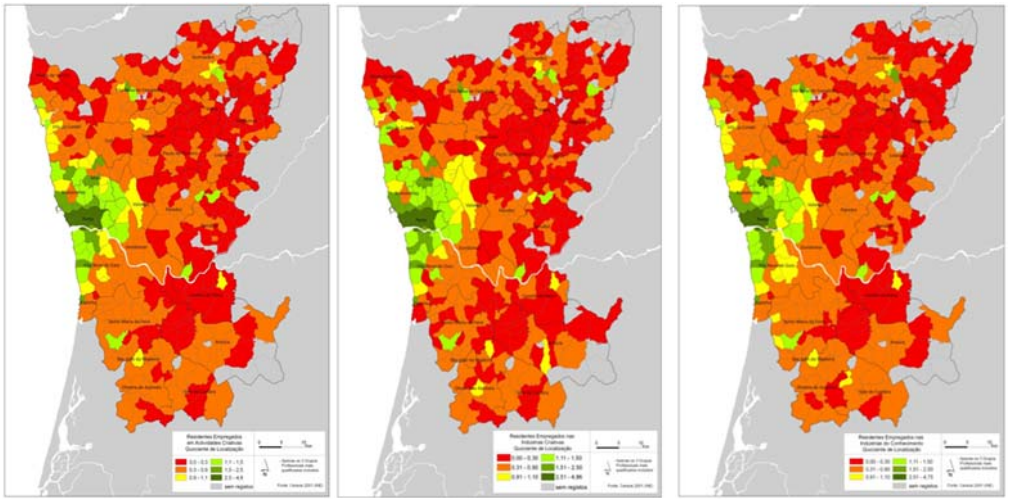

Figure 18. Employees spatial patterns for creative activities, *creative industries* and *knowledge-intensive industries*

Nonetheless, a more disaggregated analysis of the different branches shows remarkable different patterns of location. As evidenced in Figure 2, while highly qualified workers in *Research and development* reside in or around the city of Porto, those who work on *Fiscal and law consulting* show a far more dispersal residential pattern.

[44] LQ = (proportion of residents in the parished working in the targeted activity)/(proportion of residents in the whole region working in the targeted activity).

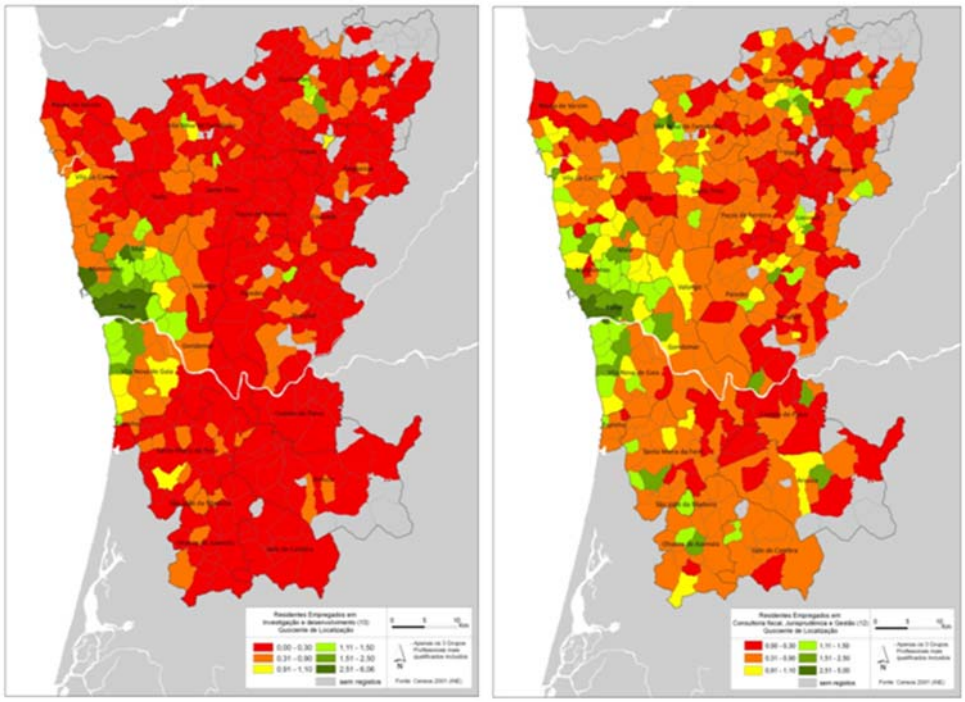

Figure 2. Employees spatial patterns in *Research and development* and *Fiscal and law consulting* activities

In relation to some less representative sectors, in terms of the number of employees residing in the area, the Porto-centred general pattern is even hard to discern, regardless their "knowledge-intensive" or "creative" profile. Such is the case of *Technical testing and analysis* and *Jewellery*, respectively (Figure 3).

Until now, census-based analysis has been concentrated exclusively on residential patterns. Yet available 2001 census data may also contribute to a better understanding of job-residence patterns of interaction. This is particularly relevant in the case of those residents working in the city of Porto, who in 2001 represented about 45 % of total employment in the *creative and knowledge-intensive activities*, in the region. Evidence from Figure 4 shows that a large proportion of the almost 40.000 individuals who were working in Porto were residing within the city's limits or in the adjacent "crone".

Relative numbers give us a rather different perspective, however. Figure 5, which presents the proportion of those who live in each parish and work in the *creative and knowledge-intensive activities* located in Porto in relation to the total residents who work in the same sector, evidences the spatially wide levels of polarization exerted by the city. A large proportion (more than 30 %, in many cases) of *creative and knowledge-intensive* workers who live in distant parishes have their jobs located in the central city. This figure contrasts sharply with the theoretical findings of much literature about the closeness between jobs and workers residences in these activities, and provides a starting point for analysis of job-location patterns.

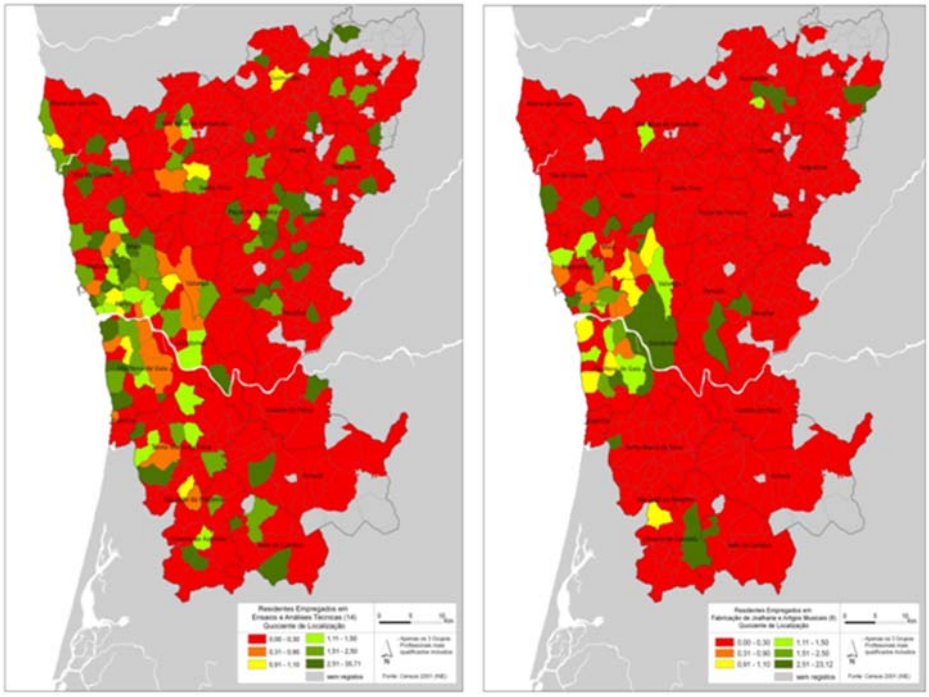

Figure 3. Employees spatial patterns in *Technical testing and analysis* and *Jewellery* activities

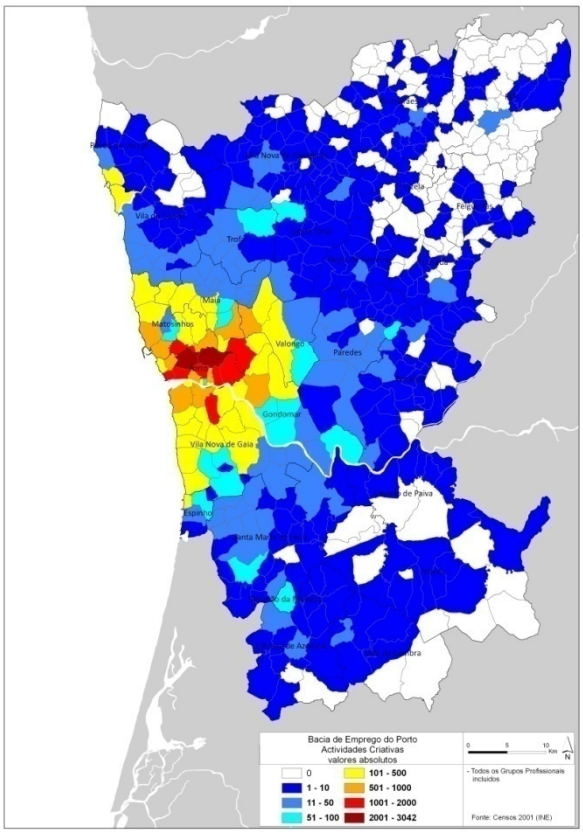

Figure 4. Residents working in the city of Porto

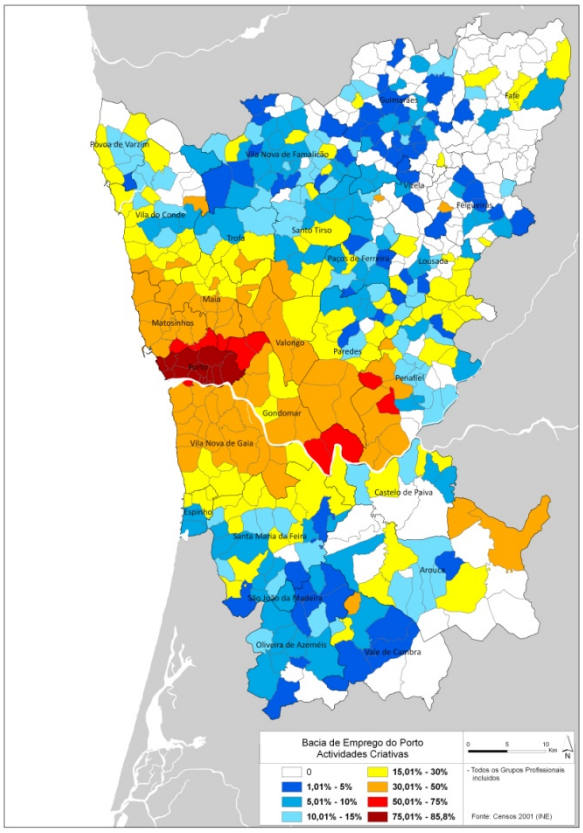

Figure 5. Residents working in the city of Porto, relative numbers.

3.3 Creative and knowledge-intensive employment spatial patterns

As referred in the methodological section, employment-location data disaggregated at parish level is provided by the Ministry of Labour and Social Security (MLSS) and excludes public-servants and the self-employed. The total number of employees identified in 2006 for the whole Porto Metropolitan Region is of 772.903 jobs, of which 11,1 % (or 85.891 jobs) are related with *creative and knowledge-intensive activities* (Table 2). As in relation to resident workers statistics, there is a considerable sub-regional variation in this proportion, which ranges from 3,7 % in the Sousa Valley to 16,3 % in Greater Porto and 26,6 % in the city of Porto.

The share of “creative” jobs on overall employment statistics (20,7 %) is even lower than the correspondent proportion of resident workers shown on Table 1, which is probably related to the use of different databases, rather than to differences in the years of reference. Self-employed workers, who are not included in Table 2, use to be over-represented in many creative sectors.

Figure 6 stresses similarities between employment spatial patterns of *creative and knowledge-intensive activities*, when all branches belonging to each group are aggregated. As in relation to workers residential patterns, jobs tend be concentrated in Greater Porto, where most parishes that concentrate a significant proportion of jobs are located.

Table 2. More relevant figures on the employment's spatial distribution, in Porto Metropolitan Region

	Employment in creative activities	Proportion of employment in creative activities * (%)	Spatial distribution of the employment in creative industries (%)	Pr. of employment in creative industries (%)	Pr.of employment in knowledge - intensive industries (%)
Porto Metropolitan Region	85.891	11,1	100	22,4	77,6
Sub-Regions Greater Porto	66.072	16,3	76,9	23,6	76,4
Middle Ave Valley	9.764	5,9	11,4	17,8	82,2
Sousa Valley	3.842	3,7	4,5	19,4	80,6
Entre-Douro-e-Vouga	6.213	6,4	7,2	19,1	80,9
Extra Sub-Regions of Greater Porto	19.819	5,4	23,1	18,5	81,5
Porto	32.985	26,6	38,4	20,7	79,3

*(overall employment) Source: MTSS (2006)

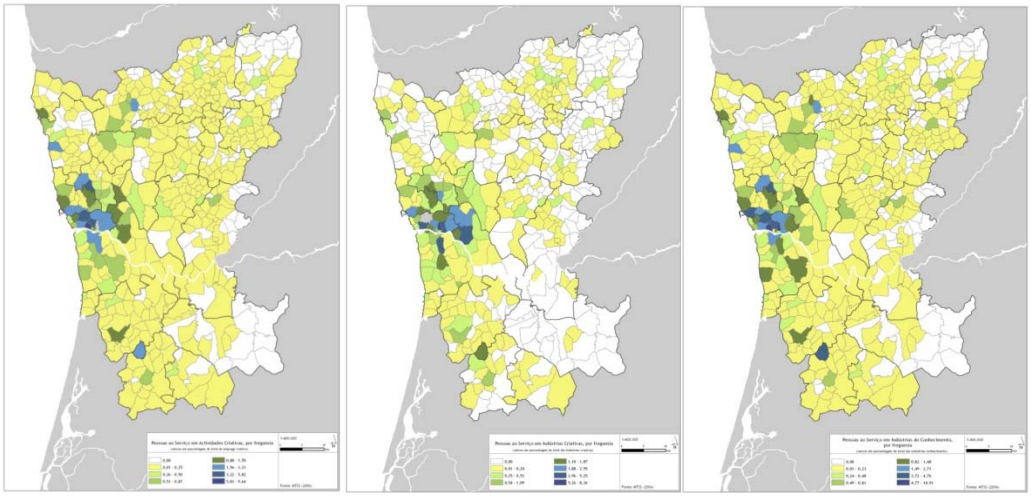

Figure 6. Employment spatial patterns of creative activities, creative industries and knowledge-intensive industries

Nevertheless, employment figures confirm the higher levels of spatial concentration of employment in the creative and knowledge-intensive activities, in comparison with the more dispersal pattern of workers residences. This fact helps to explain previous assumptions about frequently long commuter distances in these activities.

Given the specificities of the city of Porto, which concentrates a much higher volume of employment than of resident workers, its share of the total amount of jobs in the *creative and knowledge-intensive activities* raises to particularly high levels, of 38,4 % of total regional

employment, when all levels of qualification are considered (Table 2), and of 42,1 % among the three more qualified groups (Table 3)[45].

Table 3. More relevant figures on the employment's spatial distribution, in Porto Metropolitan Region (the 3 more qualified professional groups).

	Employment in creative activities	Proportion of employment in creative activities * (%)	Proportion of employment in Creative activities of Creative employment (%)	Spatial distribution of the employment in creative industries (%)	Pr. of employment in creative industries (%)	Pr. of employment in knowledge - intensive industries (%)
Porto Metropolitan Region	33.778	4,4	39,3	100	24,2	75,8
Sub-Regions Greater Porto	26.424	6,5	40,0	78,2	25,1	74,9
Middle Ave Valley	3.345	2,0	34,3	9,9	21,4	78,6
Sousa Valley	1.752	1,7	45,6	5,2	19,9	80,1
Entre-Douro-e-Vouga	2.257	2,4	36,3	6,7	21,7	78,3
Extra Sub-Regions of Greater Porto	7.354	2,0	37,1	15,8	21,1	78,9
Porto	14.214	11,4	43,1	42,1	22,3	77,7

*(overall employment) Source: MTSS (2006)

Data available for superior education jobs show an even higher level of concentration in the city of Porto, of 47,9 %, and an expressive predominance of the *knowledge intensive activities* in this group, never bellow 80 % (Table 4). We may then conclude that the already highly concentrated locative pattern of *creative and knowledge-intensive* employment concentration tend to rise with the levels of qualifications and formal education.

Is employment concentration in Porto a common location pattern for the whole 17 selected activities? MLSS figures show that, as with workers residential location patterns, such is not the case. Some activities, such as *Monetary and financial intermediation* or, in a smaller extend *Engineering and architecture*, exhibit considerable levels of dispersion (Figure 7).

[45] Qualifications classes used in the two databases – those of the Census 2001 and the MLSS - are not comparable. In the case of MLSS, the selected most qualified classes are superior managers, intermediate managers and highly qualified professionals.

Table 4. More relevant figures on the employment's spatial distribution, in Porto Metropolitan Region (the higher educated).

	Employment in creative activities	Proportion of employment in creative activities * (%)	Proportion of employment in Creative activities of Creative employment (%)	Spatial distribution of the employment in creative industries (%)	Pr. of employment in creative industries (%)	Pr. of employment in knowledge - intensive industries (%)
Porto Metropolitan Region	24.280	3,1	28,3	100	18,1	81,9
Sub-Regions Greater Porto	19.841	4,9	30,0	81,7	19,6	80,4
Middle Ave Valley	1.959	1,2	20,1	8,1	11,2	88,8
Sousa Valley	1.055	1,0	27,5	4,4	10,2	89,8
Entre-Douro-e-Vouga	1.425	1,5	22,9	5,8	12,6	87,4
Extra Sub-Regions of Greater Porto	4.439	1,2	22,4	18,3	11,4	88,6
Porto	11.633	9,4	35,3	47,9	19,9	80,1

*(overall employment) Source: MTSS (2006)

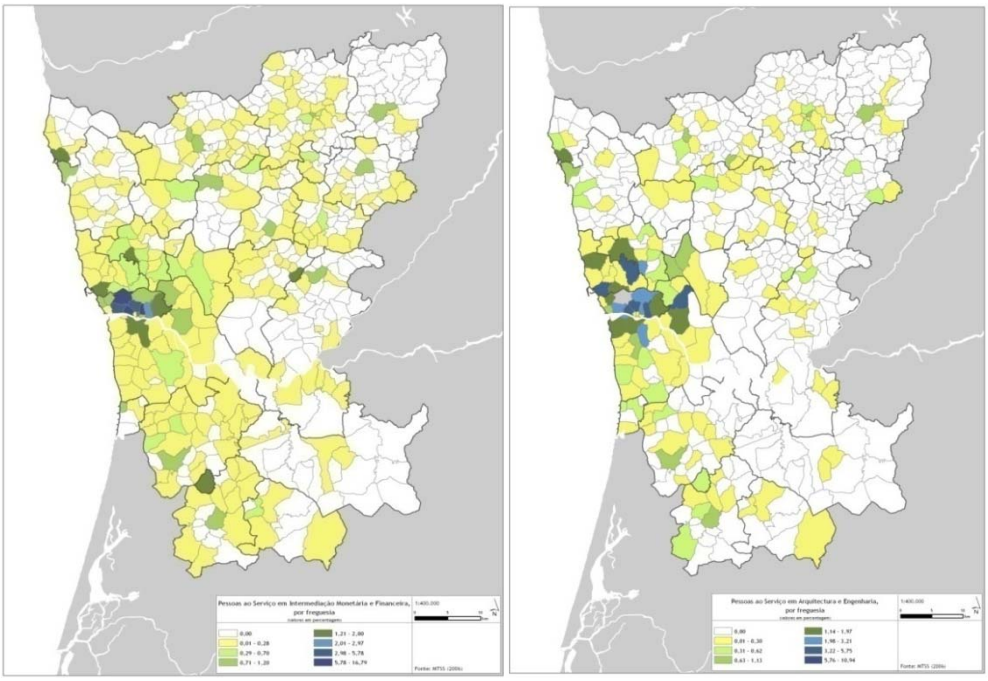

Figure 7. Employment spatial patterns in *Monetary and financial intermediation* and *Engineering and architecture* activities

Other activities, such as *Research and development*, are far more concentrated (Figure 8). We should notice, in this case, that levels of concentration in the city of Porto should be even higher if public servants, such as those working in state universities, were included in the MLSS database. Nonetheless, concentration does not necessarily occur in the central city, as *Jewellery* activity, which clusters in the neighbouring municipality of Gondomar, suggests.

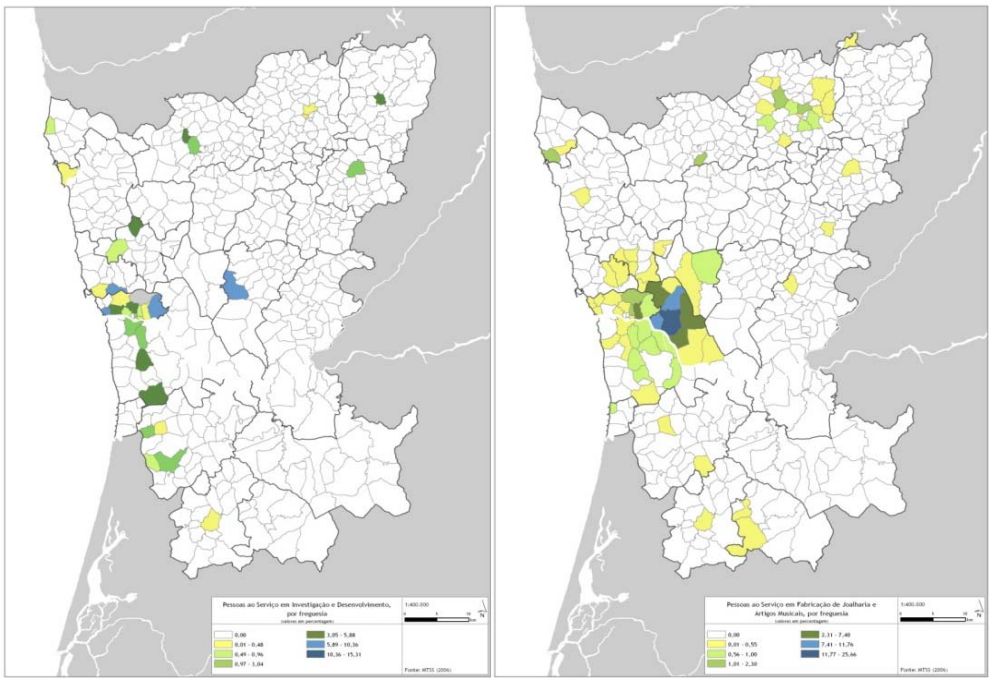

Figure 8. Employment spatial patterns in *Research and development* and *Jewellery* activities

As shown in previous studies (Musterd & Deurloo, 2006), evidence suggests that although large urban areas such as Greater Porto concentrate the most important shares of employment and residential workers in the *creative and knowledge-intensive activities* at regional level, there are considerable divergences among their many branches. Furthermore, most Greater Porto parishes that concentrate large shares of employment and workers do not encompass the “urban ambience” factors that, according with much literature on the subject, should be at the core of their attractiveness. They typically do not possess a strong historical identity, *avant-garde* theatre and architecture or stylish cafes and restaurants. Definitely, they are not “cool” places. For this reason, a more qualitative research is needed in Porto city-centre, one of the few areas in the metropolitan region that may offer at least some of these attributes.

3.4 The distinctive urban atmosphere of Porto city-centre

As referred above, since qualitative research is still underway, results presented in this paper focus only part of the universe of *cultural-creative activities* located in Porto city-centre. Questionnaires were divided in three parts. The first one has incidence in workers profile, particularly their area of residence and housing preferences. The second part is related with the characteristics of the creative

activity, including the reasons for its location choice. The third part relates with the degree of innovation of the concerned activity, and the characteristics of its public.

The 46 questionnaires elaborated until now are related with 37 innovative projects belonging to 8 areas of activity (Figure 9). However, many of these establishments are not concentrated in one single activity. They usually combine different cultural areas, such as exhibitions, concerts or other kinds of performing arts, for instance.

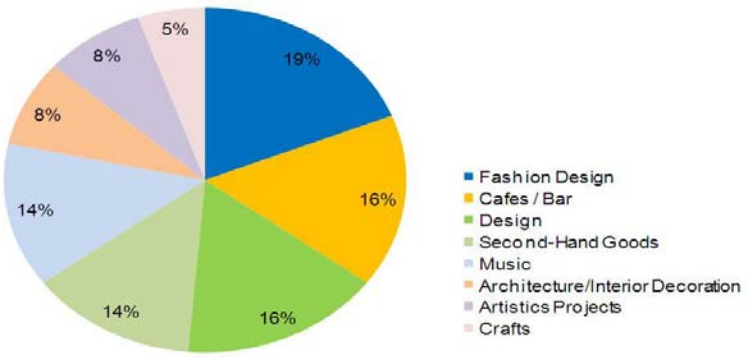

Figure 9. Cultural-creative activities

They are very recent activities – about 60% created no more than 2 years ago - and small units predominate (81% has no more than 3 workers). Many establishments have one single worker, the manager, who often is young (the average age of interviewees is 34 years old) and have a high degree of formal education, usually in the artistic areas.

Most interviewees (81%) related their preference for the city-centre with the existence of already well-established dynamics in their domains of activity, especially concerning the presence of related activities in the same area and the correspondent affluence of public. Clusterization in activities such art galleries, music or fashion design seems to be an increasing trend in several streets of Porto city centre. Nonetheless, as Figure 10 suggests, this is less evident in the employee's pattern of residence. Although a significant proportion (about 63 %) of interviewees live in Porto, in most cases their areas of residence do not seem to possess the kind of "urban amenities" usually associated with the preferences of cultural-creative workers. The characteristics of the housing market contribute in a large extend (32% of responses) to the lack of proximity between job and locations.

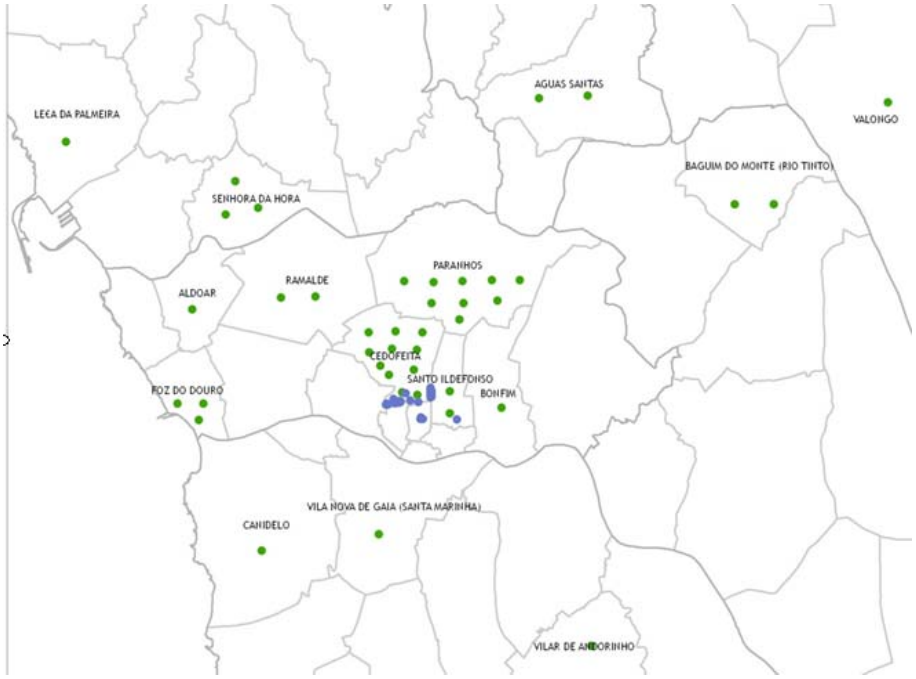

Figure 10. Cultural-creative activities location and employee's pattern of residence

3.5 Key findings

The presence of *creative and knowledge-intensive* workers is relatively low in Porto Metropolitan Region as well as in Greater Porto, as the proportion of resident population employed in these areas evidences (bellow 8 % and 12%, respectively). Note that it reaches much higher levels in Metropolitan Regions of Dublin (21 %), Barcelona (22 %) or Milan (31 %) (Musterd, S; Gritsai,O., *et al*., 2007). On the other hand, distribution of resident employees and jobs between *creative and knowledge-intensive activities* is clearly imbalance in the case of Porto, as the second group of activities reaches much higher volumes of employment and resident employees.

Creative and knowledge-intensive employment is highly concentrated in Greater Porto, particularly in the central city. This is even more evident among highly qualified segments of the *creative and knowledge-intensive* workforce and, especially, in the case of employees with high levels of formal education. As shown in figures for 2006, in this last case almost 48 % of jobs are located in the city of Porto (excluding public servants and self-employees).

Residential location patterns of employees in the *creative and knowledge-intensive industries* show a relatively more dispersed model, since the proportion of those living in the region central cities drops to about 22 % of total resident population. Although a considerable share of the remaining employees lives in surrounding parishes, the spatial mismatch between employment and housing location patterns reflects the high levels of regional polarization exerted by the *creative and knowledge-intensive activities* located in the city of Porto. In certain cases, this influence may imply significant commuter distances.

Nonetheless, a more disaggregated analysis evidences that this general picture do not fit with the reality of many *creative and knowledge-intensive* branches. We may find high concentration patterns in certain activities, on a pair with more dispersal models in relation to other sectors. Some

highly concentrated activities, such as *Jewellery*, are not centred on Porto. Furthermore, these divergences do not seem to fit very well with the *cultural-creative/knowledge-intensive* divide, although evidence shows that the first group of activities is slightly more spatially concentrated.

5 Conclusions

Empirical evidence for the case study shows that no clear association exists between the residential patterns of creative economy workers and centrality, that is, with specific "urban amenities". Although a large proportion of creative workers work and, in a lesser extent, lives in the central city, there are significant divergences between the several *creative and knowledge-intensive sectors*, both in terms of job location patterns as in relation to housing. Moreover, even among those who live in more central areas, the concerned parishes would hardly fit with the "creative class" hypothetical residential preferences. The same would be stated about firm's location preferences.

Findings about Porto Metropolitan Area seem to partially match those conducted in Amsterdam by Musterd & Deurloo (2006). In Porto as in Amsterdam, significant cross-sectoral divergence between the different creative branches challenges several assumptions on the intertwining between the creative economy and the resurgent city debates. Nevertheless, Amsterdam seems to evidence a clear preference for central locations among creative firms as in employees. This is far less evident in the case of Porto, which reflects the need for further research on the city historical parts, where some emerging trends are now observable. Questionnaires elaborated until now in the area suggest that the structure of the property market, notably in the housing segment, may play a central role in this issue.

Furthermore, evidence from Porto Metropolitan Area undermines the main arguments towards the promotion of "positive gentrification" strategies in city-centre, searching for socially mixed neighborhoods in order to attract skilled and talented people and maximize the conditions for 'urban resurgence'

With regard to Porto city-centre, these issues thereby exemplify the limits of actual gentrification-led regeneration strategies and illustrate the need for particular sensitivity to the negative repercussions of such policies (namely, inequality, social polarization and dislocation). Research agenda should focus on social implications of urban creative policies.

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Annex: Table 1

Creative and knowledge-intensive economy branches		CAE*	
		Code	Designation
Creative Industries			
1	Publishing	221	Publishing
		222	Printing activities
		924	News agency activities
2	Second-hand goods	525	Retail Second-hand goods
3	Advertising	744	Advertising
4	Film and video	921	Motion pictures and video activities
		223	Reproduction of recorded media
5	Radio and TV	922	Radio and television activities
6	Other artistic and show activities	923	Other artistic and show activities
7	Libraries, museums and archives	925	Libraries, museums and archives activities and other cultural activities
8	Manufacture of jewellery and musical instruments	362	Manufacture of jewellery and related articles
		363	Manufacture of musical instruments
9	Architecture and Design	742	Architecture and engineering activities and others related
Knowledge- intensive Industries			
10	Information and Communication Technology	721	Hardware consultancy
		722	Software consultancy
		725	Maintenance and repair of office accounting and computing machinery
		726	Other computer related activities
		300	Manufacture of office machinery and computers
		313	Manufacture of insulated wire and cable
		321	Manufacture of electronic components
		322	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
		323	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods
		332	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes
		333	Manufacture of industrial process equipment
11	Finances	651	Financial intermediation
		652	Other financial intermediation
		660	Insurance and pension funding
		671	Activities auxiliary to financial intermediation
		672	Activities auxiliary to insurance and pension funding
12	Tax, Legal and Management consultancy	741	Legal, accounting, book-keeping and auditing activities; tax consultancy, market research and public opinion polling; business and management consultancy
13	Research and Development	731	Research and development on natural sciences
		732	Research and development on social sciences and humanities
		803	Higher education
14	Technical testing and analysis	743	Technical testing and analysis activities
15	Telecommunications	642	Telecommunications
		724	Database activities
		723	Data processing
16	Other services activities	748	Other services activities
17	Labour recruitment and provision of personnel	745	Labour recruitment and provision of personnel

**CAE – Economic Activities Classification*

Time and urban design – Conclusions on a critical reading of Baixa-Chiado transformation process

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The paper presents some of the aspects of the relation between time and urban design. Discourses on space form and image are the essence of architectural and urban culture commonly reproduced today. But discourses produced around this territory, institutional or colloquial, are strongly conditioned by several ways of seeing time. Not only that includes temporal concepts like conservation, revitalization, changing, dynamic or process, what is determinant is how temporal concepts influence the action of urban design and its significance. This is our aim. The study case is the process of transformation in Baixa-Chiado since 1988s fire, back from Siza Vieira's project until the current ideas, combined with a process of substitution of the central function for a new metropolitan scale. We'll study the different discourses - institutional, professional, and political, opinion makers, public opinion - as well as their part in the process of reconstruction. In this case, we can find that relations (representations) between past, present and future are: deeply contradictory: when future construction is at the expense of sacrificing images and elements of the past; strongly linked: when future becomes a representation (a form of false continuity) of the past; when there is a compromise for a value creation, associated to recycling processes upon what a positive future image is built. With this study case we intend to study what are (or can be) the answers of urban planning and urban design, in the urge of a reconstruction and with a perspective of an uncertain future.

Keywords: time, urban design, transformation, identity, process

1 Introduction

The problem of time in Baixa-Chiado can be approached in many different ways. If there is the concern about the heritage's degradation (how to restore and for what uses?), there's also the need of an active city centre, as source of activity and producer of wealth. Incompatible or not, to these views (of past or future), we can still add the current needs of new transport, new levels of comfort, new habits of meeting that challenge an urban fabric designed with other purposes. The temporal issues gain importance especially with regard to the processes of transformation and how they shape the territory.

The last 20 years (since the Chiado's fire forced to review policies and strategies) are example of these changes, where we can explain the importance the temporal matrix in the urban processes, testing it in a case-study. Starting from these temporal matrices of Identity and Process, key-factors in the design and production of the city, will do a critical analysis of the paradigms of rehabilitation/conservation/regeneration proposed for the historic city, in the case study of Baixa-Chiado. This analysis is based in sources of the institutional and professional speeches and public opinion of the last 20 years, which allow us to read the transformation process.

I'll star the approach with a brief chronology where we identify the projects and the dynamics of transformation within the attempted rehabilitation of the last decades of Baixa and more specifically from the fire of 88 in Chiado. It is in this context that we'll identify the different opinions and forms of action in an attempt to look into the impact consequences of the present of the temporal matrix.

The chronology presented, highlights a variety of situations and discourses that marked the theoretical and practical intervention in the Baixa and Chiado, in the way they responded to the uncertainties on transformation process, in which we point out:

- The case of reconstruction of Chiado, marked by an emotional relationship between memory (and its representation) and the possibilities of a process of reconstruction. Prolonged in time, the intervention integrates economic and social factors, beyond the obvious physical reconstruction. Initially it shows the uncertainty in the absence of consensus models for the reconstruction that led the discussion of ideas about identity, then, it's in the programmatic issues, activities, accessibility, feasibility, that rely the bigger questions about the intervention "success".

- The production of two proposals - the nomination of Baixa Pombalina to UNESCO World Heritage and the Revitalization Plan of Baixa-Chiado - arising from the need to "react" to the current state of degradation of the area and on each case proposing a process. Although in the first case, the theme is related to heritage protection and the second with a possible strategic development, there's a common problem on the management of the territory. The uncertainties depend on the applicability of this proposals and their capacity to generate effects, able or not to reverse the scenario of desertification.

From the analysis of these episodes we intend to form an image (?) of the different temporal manifestations and their effect on the transformation of the last 20 years of Baixa Pombalina and Chiado. In an attempt to demonstrate ways of intervention in the face of uncertainty, we'll try to build relationships and identify provisions that were taken as models of intervention in the urban environment.

We pay special attention to some facts, but mainly to the speeches, more than a formal and spatial analysis of the places "built", because what concerns us is to understand how do we build a discourse on the evolution and transformation of the city - the representation of reality, its critical or uncritical legitimating, the relationship between theoretical bases and practical results, etc..

For this aim we used official "sources" - the documents that constitute the several proposals - but also some parallel readings to those documents: the institutional and political speeches that accompany the discourse theoretical-professional, literature on the topic, feedbacks, comments and news in the media and the common opinion, in order to make a complete picture (?) of both the context and the reactions and impacts associated with the objects of analysis.

2 The Time of the City - reflections on temporality

It is a commonplace to say that the today's time is too fast: time is running fast, "dromocratic ", the time lacks and flees. The technological developments started in the XIX century printed a galloping pace that since then commands the daily life. But the fast time in which we live is also a time of memories, a time that cultivates the magic of the past, the reinvention, the recycling ... Similarly the time of the present refer to the time of the past, projecting into the project as a vision of the future.

There are several authors who make us support the hypothesis of the role of time in today's society, highlighting time factors in the most recent understanding of the city. First Lynch (1976), which starting from the premise that the city is the framework that people use to locate in time, assesses the construction and representation of the image of the city, from time's point of view. In

Carmona et al (2003) we find an explanation of the nature and the processes that constitute the field of urban design where time is dominant, particularly relevant in the explanation of the themes of change and renewal.

In the problematic of urban in a wider context, we highlight François Ascher (1996, 2004): the city as an object polysemous, marked by technological development, and, is lead to a necessary change of spatial organization, raising more questions and areas of doubt, new needs, new frameworks for action, new job requirements. The contribution of Bernardo Secchi (2004, 2007) is the extensive discussion around the contemporary city and the emergence of problems that it causes the need to radically redefine the contours of thought and disciplinary action, where time and its uncertainty are part. Portas (2003, 2008) also recurrently addresses the theme of time in the city: reflecting about the definition and evolution of urban design - introducing concepts such as hypertext, or layers as more appropriate strategies to design for the demands of the complex context of urban design.

In the context of today's city - the network-city, multi-polar and polycentric - included in macro-regional urban systems, continental axes and global flows, it's not just the future that is hard to predict, but itself becomes difficult to understand, by its particularity, complexity and scale, beyond the limits of human readability. From the perspective of François Ascher (1996), we considered "a city as complex and not just as complicated," arguing "that it works with the basic logic and multiple rationalities possibly contradictory, that forms an open system, that their balances are unstable." The major issues are at the same time in the disproportionate urban suburbs and in the heart of the city in the declining historic centres.

The city as an only symbolic centrality seems to be a form of *identity* of the past. The former centres have become increasingly decentralized, keeping some cultural and tourist functions. The growth and dynamics of mobility within the city led to the adoption (spontaneous or desired) of other models with a multiplication and diversification of economic centres, commercial, technological ... The today´s' historic centre, is losing relevance and dynamics, desertified and degraded, it is a problem of the European city of today: between policies for conservation and revitalization we attempt to restore, rehabilitate or rebuild the "old glory".

The phenomenon of excessive importance of the past and the growing trend of museum cities, (Choay, 1999) seems to place a "malaise" caused by an overload of information combined with a process of cultural acceleration, which we don't seem to be prepared to handle. The "heritage" as a concept and as a property extends its field: it is invested by a human responsibility for future generations. If before it could be considered a mere legacy of the past, today it covers the entire culture and nature - is not limited to historical, or physical but it integrates the intangible, symbolic, ethical, ecological and genetic heritage.

We can assume that the sooner we are driven to the global future in which we don't trust, the more we return to the memories in search of some kind of comfort, the more we prefer the past. The context of Baixa Pombalina and Chiado in the last 20 years is characteristic of the phenomena of decay of the historic centres where the logic of preservation and rehabilitation are dominant. Temporal factors, used as critical tool, allow us to bring up the key questions:

- How to address the problem of process and change: how can we reduce the uncertainty, itself projectual, ensuring the dominance of the variables in the project or in a strategic logic?

- How to solve in a process of urban transformation, the role, the objectives and values of participants?

3 Policies, processes and discourses about transformation - a brief chronology

It could be said that until their "peak" in the 60s, the urban fabric of the Baixa-Chiado was a living tissue, in the way that it responded to the changes which were required.

In the XIX century, Chiado is reported as Lisbon's centre of social life as centre of culture and intellectual aristocracy. The cultural dynamics intensified with the First Republic: opening of new cafes, new bookshops, social clubs, new theatres, and finally the cinemas. The Chiado is Lisbon's centre of culture and a refine shopping centre.

The Baixa is since the reconstruction inhabited by a population of middle class, which justifies that the area had not achieved a great increased value, and still in the XIX century started a process of functional change and expansion of buildings. The economic development was accompanied by the need of space for the installation of businesses offices and similar activities. The Baixa will accommodate a significant amount of office space for companies, agencies of all kinds, lawyers, solicitors, etc., which occupy the 1st and 2nd floors of buildings, while the upper floors are still occupied with housing. The exit of inhabitants also released many spaces in the floor plan, then turned into commercial establishments. The commercial and administrative centrality is complemented with many small units of production (small workshops and factories of clothing or shoes, sewing workshops) in almost every building.

In the middle of the century the financial sector develops and the banks seek to improve the mains offices with full renovation of the blocks. The land value is the highest in the city. Between the Baixa and Chiado exists a functional continuity, without a significant difference in level of trade or the value of buildings.

The centrality and dynamism of Baixa and Chiado in the 1st half of the XX century, has been missing and successive downgraded over the next decades, competing with other areas of the city for attention. The first signs of desertification date back to the 50s. As an area essentially tertiary, in the evening the streets were deserted. The construction of the Avenidas Novas and the dynamic created around it lead to the transfer of many offices of lawyers and doctors to areas more attractive. Gradually, the Baixa was being reduced to trade, financial sector and public administration. As a result its image has suffered some changes. From the 50s until the beginning of the 70 some architects are asked to design stores for Baixa and Chiado with expressions of modernity and cosmopolitanism: Francisco Keil do Amaral, Francisco Silva Conceição and later the 'Trio Maravilhas" Carlos Tojal, Carlos Roxo and Manuel Moreira.

Lisbon had grown, both in its administrative boundaries as in its periphery. From 70s, the outsourcing (?), the shift of city's centre to the north, the growing dependence of motor transport, involve unplanned or not systematic transformations. With the doubling of the car park, it clears the inaccessibility of the private transport in Baixa: there's no place to park.

After the stagnation of 40 years of dictatorship and after the revolutionary period, in the management of Nuno Kruz Abecassis (1980 to 1989) there's a "modernization" in various areas of the city: in the Avenida da Républica and Avenida da Liberdade, without regard for its historic qualities, old buildings are replaced by new, creating a state of "alert" to a "threat" recognized in the opinion of architects. Examples of this way of intervention include the demolition of the cinema-theatre Monumental in 1982, the project of construction of the towers in the Jerónimos (1986) and the intervention on Carmo's street (1987).

It is necessary to project an image of future, progress, more cosmopolitan, but also more "mass consumed": in 1986 opened the Amoreiras shopping centre, from the architect Tomás Taveira. This would be the mark of a era, the fever of consumption was accompanied by a "proliferation of shopping centres with easy parking and an attractive image sent to the society of consumption" (Teotónio Pereira, 1997).

The new model of consumption in conjunction with the city's growth and development of new shopping centres and services, lead to the disqualification of the central zone, with a almost absence of housing. In 20 years the local population (residing in the city centre) decreased from 4 to 2 thousand people under the effects of degradation of the building.

On the eve of 1988'sfire, the Chiado and Baixa, disqualified and deprived of many of its traditional attributes, had lost its central role and affirmation in the city. However continued to gather itself, the symbolism of past of a luxury and glory, full of significance. The fire is just a culmination of a process of decline. Had the merit of bringing the issue to the Public Square and discussion of solutions. But the reconstruction of Chiado, didn't include the Baixa, nor did induce a new dynamic and so the process of degradation continued.

The mandate of Jorge Sampaio is marked by a return to the strategic development and to the planning of the (the first "PDM", the Strategic Plan). The acceleration of the transformations of urban and social change in large cities produced new challenges to the methods and procedures of planning. In the late 1990s (already in the office of João Soares) the reaction to the functional changes of the city begin to be visible in Baixa, through public and private investments in singular operations of equipment and infra structure: the improvement of public squares (Terreiro do Paço, Rossio, Praça da Figueira, Martim Moniz, Praça do Município) and sporadic measures for its animation; the opening of the metro's stations Baixa-Chiado and Cais Sodré reinforcing the conditions of accessibility to the centre; the redesign of public space, the planning of the parking area and construction of underground car parks (Praça da Figueira, Largo de Camões, Praça do Município, Martim Moniz).

After the EXPO in 1998, the support goes to major projects and events that pass through the city: the Euro 2004, the Rock in Rio. It is Lisbon as a multi-cultural capital, that is sought as a model. In this context, is made the launch of the nomination process of Baixa Pombalina for World Heritage by UNESCO, particularly with the seminar "Baixa Pombalina and its Importance to the World Heritage" in October 2003, in the mandate of Santana Lopes.

Table 1. - Chronology 1985- 2008 - Lisbon and Baixa-Chiado

	LISBON	BAIXA-CHIADO
1985	Kruz Abecassis is reelected as President of CML	
1986		Julho - Redesign project to Rua Augusta, later partially built
1986	Amoreiras Shopping Centre	
1988	August, 25th - a fire in Chiado destroys a total of 18 buildings in Rua do Carmo, Rua Nova do Almada, Rua do Ouro, Rua do Crucifixo, Rua Garrett, Rua da Assunção and Calçada do Sacramento	
		Pedonalização da Baixa
1989	Jorge Sampaio is elected President of the CML	
1990	June - The final VALIS report - Valorização Arquitectónica e Urbana de Lisbon (Lisbon's Urban and Architectural Recovery) is presented	April – Submission to the CML of Chiado's Reconstuction Plan and Regulation May – Approval of a 5 000 millions escudos Special Fund destined for Chiado's Reconstruction June – The Reconstruction plan is approved by local and national authorities
1991		May – Start of the Chiado's recovery works
1992		Competition for Terreiro do Paço. The Project (José Adrião e Pedro Pacheco), is partially built between 1992 and 1999.
1993	Jorge Sampaio is reelected President of the CML	
1994	Lisbon, European Capital of Culture	Lisbon's Plano Director Municipal (Master Plan) defines the Núcleo Histórico da Baixa (Baixa's Historic Centre)
1995	November - João Soares takes the chair of President of CML	
1996	The recovery of the Martim Moniz Square) is finished November - Fire in the CML building	August – CML and other authorities approve a project to create an hotel and shopping centre on the Armazéns do Chiado building
1997	December - João Soares is elected President of the CML	November Praça do Comércio "reopens" with a Botero exhibition
1998	May- September - Lisbon hosts the World Exhibition Expo 98	April – The first section of the Metropolitan line between Rossio and Cais do Sodré opens – Baixa-Chiado Station (Siza Vieira)
1999		The Armazéns do Chiado Shopping Centre is open
2001	December - Pedro Santana Lopes is elected President of the CML	The Praça da Figueira (Daciano Costa) and D Pedro IV (Rui Valada) recovery work is completed November – The Agency for Baixa Chiado's promotion is created
2002		November – The Baixa Chiado's Project Unit is created December – Establishment of Chiado's fund
2003		October – Seminar "Baixa Pombalina and its importance to the World Heritage"
2004	July - Carmona Rodrigues takes Pedro Santana Lopes' place as President of the CML	May – The Baixa Pombalina's Urban recovery society is created
2005	March - Pedro Santana Lopes takes the chair of President of the CML October - António Carmona Rodrigues is elected President of the CML	September – Baixa Pombalina is proposed as an UNESCO's Heritage City to the UNESCO's National Commission
2006		April - Starts the process to distinguish "Lisbon Pombalina" as National Monument September – The Baixa-Chiado's Revitalization Plan is delivered
2007	July - António Costa is elected President of the CML	December – The Baixa-Chiado – Santa Apolónia Metropolitan line section is oppened
2008		March - New measures are approved to create a master plan to Baixa Pombalina and to allow the development of four projects

Sources: Daily Press, Arquitects Association Arquive and CML website

As evidence that the process would not succeed and the measures were insufficient to change the situation of desertification and degradation of Baixa-Chiado is launched in 2006 a Commissioner for the Baixa-Chiado in order to establish a strategy for intervention at urban, economic, social and cultural levels. The sequence of events, the lack of a continuing policy in Baixa-Chiado, and political instability in Lisbon, leads to fluctuations in the speeches of the actors and shows the reflection of the political process, social, economic and cultural, in the transformation of conditions of space in time.

4 The case of Chiado - how to rebuild?

The Fire and the first reactions

The fire flared in the early hours of 25th August in the Grandella building. Quickly, and because of the difficulty in getting to the fire site, it spread to the nearby buildings. It only terminated at 18h, affecting a total of 18 buildings situated on the Streets of Carmo, Nova do Almada, Ouro, Crucifixo, Garrett, Assunção and Calçada do Sacramento (11 totally destroyed).

The firsts images of Chiado's fire, made all fear for disaster with the scale of the earthquake of 1755. Despite a more look reduced the size and impact of fire, however, the picture that conveys is that of a tragedy. Many articles do Chiado's evocation of which was consumed by fire - is the portrait of the "Chiado that can never be again". This way is introduced a relevant topic to all the process of reconstruction - the emotion - as decisive factor that determined and dictated the rules and forms of reconstruction. While watching the first discussions on Chiado's future, are made the first "constructions" on the past: "We have already created a mythical image of the Chiado disappeared that identifies what was there a month ago with what we think to have always been" (Vieira Caldas and Varela Gomes, 1988). In all the process (whether the discussion, the decision-making or the reconstruction) the background will be a defensive strategy, the "Memory".

The fire caused numerous reactions in several areas, where it stands out awareness and a discussion around the problems of the rehabilitation of historic centres. Therefore, the knowledge acquired in the emotional context involved in the Chiado, is not limited to it - is the aware that the fire was an "outcome" or a result of other processes of development in the city, which the disaster brought into the public sphere. The Chiado appears as an opportunity to reverse the previous scenario. This will is reflected specially in a professional discourse which expresses the desire of another paradigm.

The debate of ideas and the different discourses

Since the beginning the debate was expanded to other frontiers: the problem of a desertified centre in the city of Lisbon, the Baixa also degraded and vulnerable, and the needed revitalization of the area. Nuno Portas (1988) says that it can not "fail to take account for what and who we will rebuild now - which means political imagination (and negotiating with the authorities and the promoters involved." If in the process of reconstruction which began at the time with much of the debate focused on formal and style issues, with a highly emotional background, it could not be forgotten that the reconstruction was a political process.

In urgent need of construction, we see that an important part of the legitimacy of the different discourses in support of alternatives for action is made from an identity construction, far from procedural and methodological issues:

- based on a more or less rigid interpretation of the idea (and artifacts) of past, leading to proposals that "oscillate" between the mimetic reconstitution, reconstruction or more "free projections";

- other alternatives, taking advantage of the physical destruction of the area, propose the idea of the future introduction of the "novelty and diversity," non attracting favourable consensus;

- the continuous presence of an imaginary "mythical of a past", built from the historic and popular, of documented facts and experiences more or less daily mythicize.

We will see how the strong political constraints, dictated by a social and cultural context from the fire (its previous and next political frameworks), lead the decision-making in the reconstruction.
The initial reactions to the fire came from the institutions involved in various ways with Chiado: the Municipality of Lisbon, on which fell the responsibility of the fire and the following actions to be taken, the Association of Portuguese Architects, claiming a prominent role in the process, the Portuguese Institute of Cultural Heritage and the Secretary of State for Culture, both with institutional responsibilities in the areas of heritage and culture. From the meeting of these institutions reached the first conclusions on the procedure of reconstruction:

- the definition of "aesthetics" of the intervention, with the image of the Chiado to remain with their original outlines.
- the completion of a competition of ideas proposed by the AAP and accepted unanimously.

While there is a public debate on ways of rebuilding, Kruz Abecassis decides to ask Siza Vieira for a plan of reconstruction. The choice (solitary and unexpected) came to reassure those who feared intervention distorted the original matrix; Siza is the "quality assurance" of what will be in Chiado. Despite some occasional disputes, the choice of Siza Vieira for the preparation of the plan for reconstruction of the Chiado meet a broad consensus in the community of architects and had broad political support. With the invitation to Siza, the competition was abandoned and "partners" referred to the debate outside the action.

From that moment, and with all actors in their roles defined, the process stops to develop in the public sphere - the reconstruction process becomes gradually in the development of a plan by an architect with the character of "order". The lively discussion in the media is converted in the sporadic references to Siza, the progress of work or content of the plan of reconstruction. Thus, the presentation and adoption of the plan have not controversial or even discussion, since the guidelines were known to all.

The Plan and the Program of the reconstruction

The discourse of Siza's intervention, defined from the beginning of the process is centreed on an idea of "environmental restoration": the conservation of the environment of the area, based on the spatial and architectural characteristics "inherited" the matrix pombalina. Marked by the idea of permanence, Siza maintains a trend of continuity, restoration, given the absence of rupture of the urban fabric.

The plan presented to the public in June / July 1990 includes, in addition to the buildings affected by fire, other adjacent buildings that are part of the urban unit, justifying its inclusion. The fundamental objective is to preserve the environmental value, and architectural history of the area as part of the historic centre. The transform operations refer to the definition of aspects of the program (trade, equipment and housing) and accessibility. The "strategy" defined by Siza contemplated the definition of rules for the various projects and drawing the limits of public space with private space: walls, patios, crossings, core services, roofing, new streets and public spaces. The rules that it defines, however, incorporate in addition to specific aspects of construction (inside modulation, some materials to use...) as specifications to the uses and the program.

However, the need to respond to a considerable amount of agents, led to the concentration of contacts and procedures of operation in the Office of Reconstruction of the Chiado, dependent of the Municipality, which in addition to initially carry out comprehensive survey of area , coordinates all the stages of reconstruction and manages the organization of the "business" related to the owners, as well as those typical of public investment, coordinated and based on the programmatic and aesthetic guidelines of Siza Vieira.

On a more procedural perspective, the "concentration" on a idea of Chiado as an "object" instead of a "system" or part of a system, leads to the reduction of complexity in various "degrees" of intervention:

- the reconstruction is projected as it was a restoration of a historic artefact, giving predominance to the issues of design and construction, reducing a high degree of "uncertainty";
- in the process of rebuilding the scale of the targets is simplified, and the procedures for achieving strategic objectives are focused in the design and in the pursuit of a balance between desires of some players;
- in the social, cultural and even some commercial domain little was investment in developing a strategic and sustainable reconstruction.

A shift of paradigm, the change in the way to act and to think this country, could only be possible with consonant tools. Nuno Portas (1988) had identified the relationship of this theme, with the degradation that the centre of Lisbon was voted "What we lack now in Lisbon (and Porto) for too long is a sustained policy of revitalizing the area without which no urban regeneration is possible." The lack of resources and tools for action, the inertia and inefficiency of the audit institutions to reverse this scenario would in one way or another to cause the fire. In the reconstruction process, it will restrain the exploitation of other ways. According to the same author, "the city, the Baixa, the Chiado, suffered from lack 'project' (or plan, or comprehensive plan as it has now called), what I understand as a coherent set of policies designed to counter the trends of physical and functional decaying, by conducing any (even slightly) investment that can be attract to modernize the so-called economic fabric of the area."

The duration of the works and the effects of the reconstruction

The works began on 31st May of 1991: three years were spent in cleaning up debris, consolidation of facades but also real estate speculation, which made change several times the owners of the land and postpone the beginning of the work of reconstruction. The issue of delays, the chronic in the

nature of public works in Portugal and with frequent reference in the media, ought to be examined in more detail, because the circumstances of this case, the control or not of time, in its political relationship with political time and economic time, will be critical.

We also need to further clarify issues relating to entry on the scene of private (knowing that the possibility of expropriation had been removed) such as change of ownership and the "dismantling" of the previous corporate structure. The "gentlemen's agreement" in which was enshrined the right of traders to occupy their former places of commerce has never been long and not secured the return of workers.

In evaluating the results we have to take into account the objectives, but also the impact of time factor in the duration of the work and also that the reconstruction process was not limited in its objectives to the operation of the physical construction.

In the case of economic activities:

The Commerce: The reopening of shops was slow and difficult to attract buyers and investors. A number of prestigious establishments such as the Casa Batalha and the José Alexandre, adapted to other places decided not to return, others could not comport the increased value of the property. The four floors of Zara at the former building of Eduardo Martins proved that only the large multinationals could successfully occupy and maintain the spaces. The opening of the shopping centre and hotel in the building of Armazéns do Chiado in 1999, was stated as necessary to leverage the commercial success of Chiado. But in 2002 the high price and difficulty of parking affect the attractiveness of Chiado compared with other locations in the city, also delaying the recovery of the wider area.

However, the stagnation of the commercial area seems to have been slowly overtaken - in August 2008 on the anniversary, the talk is about new people, design cafes and luxury brands. The reporter Kátia Catulo (2008) says "the Chiado opened the drop-by-drop. First the subway, then the stores and later those of luxury brands like Cartier and Hermes. A Rua do Carmo, Rua Nova do Almada, Rua Garrett recovered their status and return to seduce."

In housing, the main aspect seems to be the success of Chiado's gentrification do. The desire make housing in the Chiado, attended the speech Siza from the beginning, with the regulation plan of reconstruction to ensure the requirement for housing, with occupancy rates of between 30 and 40%, in addition to ensure a safety and health in accordance with current parameters.

The initial resistance of the owners disappeared from the moment that the first reconstructed buildings were put up for sale: the high prices of real estate investors have not prevented sales of housing for "high quality". We can also ask is the commercial success of housing, is the result of a inhabited Chiado or of solutions and prospects for investment.

The memory strategy?

One issue in suspense is whether the "strategy of memory" will not be disclosed after all, a weak substitute for lack of a strategy for a new centrality. The initial picture of the process is highly participated: many are the voices that have ideas, options, ways and means to intervene in the vacuum left by the fire. The public demands the return of the city Chiado, while cries his

disappearance. However, the fear, uncertainty over the future, will influence the course of the proceedings.

If the fire provided a unique opportunity to less conventional intervention, it brings in itself, as political process many constraints and areas of uncertainty:

- The strategy of memory is used as an argument of defence (against nostalgia?) The memory of a piece of living city is stronger than the opportunity for change. The space that it was is stronger than the space that could be?

- A more radical intervention is feared as the absolute negation of the past; on the other hand, a more conservative, allows the maintenance of hope: that space can also return to what it was, regardless of the factors of pre-existing damage?

- Most of the speeches on the reconstruction of architects and engineers, have a material base: what to do with rocks, debris, pieces of burnt city. What forms and styles appropriate? The "spirit of place" is designed only through spatial characteristics?

The interaction of a professional discourse with a "common" discourse on the memory seems to have been lost: the colloquial speech of the Chiado is concerned mainly with the habits and experiences of everyday people. Yet the plan, and the process of reconstruction, was an operation strongly focused on a "skill" technique, the aesthetics, the design (and operation of a market "high-end") and less in the gestation of a new "identity project" (Castells, 2002).

In the intervention was not included the definition of broader objectives and measures to put it into practice (control soil, the program uses, the role of participants ...), here we can not be about a strategy, ie in the conditions to achieve these objectives through strategic actions, which lead to a strong relationship-Project Program, the effects of regeneration of tissues not affected by fire, in a broader process of regeneration - the Baixa.

5 From the nomination for "UNESCO WORLD HERITAGE" to the Revitalization Plan

Meaningful for this part of the study, is to understand what is a nomination to World Heritage Site: it is above all a process. A process because it involves a series of procedures previously defined (by the universality of the classification), according to a structured schedule, according to a hierarchical chain of responsibilities and authorities concerned with the objective of award a distinction - the World Heritage of UNESCO's. But also because in that case the procedure leads to a "strategy" with "tactical" steps to achieve the target, whose dynamics ultimately determine the outcome (more in the sphere of "preservation" or more in the sphere of "boosting").

5.1 The objectives and limitations of the nomination

From the structure of the nomination of the property for purposes of classification, in default format, we can highlight two essential parts. The first (where we find the description of the property and the justification for entry) is the historical framework, the relevance, the reasons and criteria for the valuation of the property to be classified.

For Lisbon the nomination is made on what is called "a monumental set" that includes "limited achievements in space but have exercised a great influence on the history of urbanism." Unlike other Portuguese cases as Porto, Évora or Guimarães in this case the classification is closely related to a

specific event, a historical period: the 1755 earthquake and subsequent reconstruction of the Baixa of Lisbon. The rebuilt city was based on principles of rationality, referring to a culture of enlightened in XVIII century and announcing the XIX century progressive urbanism. The reconstruction followed an urban and architectural plan, incorporating innovations in terms of infrastructure, construction techniques, security measures and standardized components. Important as the urban and architectural achievement is the rapid and effective disaster response and that gives it the exceptional values.

The second part, (where we find the state of conservation, protection and management of property and monitoring) is to ensure the maintenance of different forms of exceptional value. Because the classification is not only a process of distinguishing the goods monumental exception, it contains also its genesis, protection and conservation of such property. It is the finding that the historical and cultural heritage shows many weaknesses in the face of pressures and demands of contemporary society, which leads to the need to provide these parameters.

In the case of conservation status aren't discussed and analyzed in depth the problems and the reasons for its state of degradation. First, because it may pose difficulties in the process - the establishment of a deteriorated and adulterated site is not consonant with a rating - on the other hand, put evidence the pressures to which the property is currently subject and which is not entitled to deal.

Regarding the monitoring and management, the lack of a management plan, requires the submission of documents and other instruments that ensure the management of the property until the development of the management plan required. The statement of objectives of the management plan is very clear in defining the form of intervention in Baixa Pombalina, aspects of the maintain and the limits to the interventions (what can and can not be done): the conservation of cultural values of exceptional, maintaining the authenticity and integrity, through hard physical and cultural parameter and a technical and scientific evaluation. But this model does not includes nor strategies, or tools that can address the structural reasons for the degradation and devaluation.

In summary, the model presented focuses on a logic of conservation and protection, without covering, in a unique management system, social issues and economic development to sustain an economically dynamic process.

The feasibility and effects of application

Some of the basic questions of the classification appear erased, perhaps for fear that their details could adversely affect the central objective:

- An understanding of the structural reasons of the current situation: a "empty" centre, inappropriate to use that was used without a clear strategy to reverse this trend;
- The predicted consequences of the allocation of the "brand" World Heritage: excesses of tourism, transforming a heritage theme park, the management of a "city-heritage", a new mono-function.

Finally are gaps in the information about what the effect of classification:

- The consequences of this process in the heritage are unclear. The requirements of maintaining the integrity and authenticity in high levels, with many protection laws and regulations, setting strict rules

for intervention, can create a Baixa Pombalina fossilized and crystallized in a model that no longer serves the current requirements?

- To decipher the objectives of a "brand" of differentiation, and at the same time, rebuild the attractiveness of a centre "contemporary", it might be necessary to identify social conditions, economic and cultural allowing for a complete strategy. The policy of "conditions of action" is not an instrument of the project?

The nomination of Baixa Pombalina to World Heritage Site in 2005, produced no practical effect on the ground or not fostered the creation of new initiatives or strategies to promote the revitalization of the area. The link Baixa-Chiado, that the Plan of Reconstruction after the fire cautiously considered, and the specific measures developed (new car parks, redesigned squares, metro Baixa-Chiado), did not constitute a critical mass sufficient for a consistent process around the proposed classification.

5.2 The model of the strategic plan and "Revitalization"

The concept of revitalization, integrated in a management plan to ensure the control of degradation, is the origin of the revitalization plan to Baixa-Chiado, which will study next. Maria José Nogueira Pinto (2006) justified the importance of this plan to the UNESCO process: "The nomination space is not a scenario, but a living space, and therefore has to include the concept of revitalization".

The document has the objective to establish, on one hand a strategic plan to revitalize the area through sustainable dynamics that can reverse permanently the cycle of degradation current since some decades, and on another a type of centralized management unifying the various political entities with responsibilities and capacity to intervene on the area. We can enounce some of the characteristics of the model:

- The difference of the revitalization plan is concerned mainly with this logic: the definition of a vision and a strategy for implementing it in order to achieve the objectives, rather than a process of inventory or regulation. But if the model of the strategic plan (Borja and Castells, 2004) has contributions from economics and marketing, these urban policies have its framework in the context of "urban renaissance" inspired by the idea of "Compact City" of Rogers or the "Barcelona model" recycling uses and buildings, improve the urban environment, promoting the participation and management and encourage urban regeneration.

- The starting point of the report is the "acceptance" of the current conservation status of Baixa-Chiado, victim of its own constraints, delaying mandate after mandate making decisions which provide the output of this scenario, that is, to identify the process of decay of Baixa as centre.

- From this point on, and having a strategic vision for the future, it define projects and structuring ideas, the keys to open the virtuous circles: objectives, strategies and procedures in order to reactivate dynamics. In a procedural part of the cross disciplinary team that developed the plan, already shows an awareness of the variety of issues that it considers a transaction to revitalize an area of the city. Thus the proposal involves a variety of issues, develop some preliminary sectoral policies - culture, housing, tourism, security and urban management - is such an essential support to the intervention, which develops as a process of convergence of interests and activities of investment different actors.

- One of the most important characteristics of the document is the definition of an institutional model of exception, capable of providing stability and efficiency in managing the operation, the essential to special characteristics of the site and the specific needs to a macro-operation of this nature.

- Finally presents a possible model for financing public investment, important fact especially given the size and time limit for intervention, when it recalls the indebtedness of the Municipality and financial situation of the State at the time of launching of the proposal. The model is based on cooperation between public and private entities based on public investment, combined with a clear strategic logic and credible, with the aim of promoting private investment, the main engine operation.

Constraints and Uncertainties

In the Revitalization Plan to Baixa-Chiado, the preparation of an action plan for the Baixa Pombalina represents a change in the way of action so far, stressing the concern with the procedural and strategic area, in the search for synergies with partners and development of actions in several directions. The proposal must go through a "pragmatic pursuit of prospective planning of situations," a setting or projection of opportunities for the future and how it can be triggered. But the reversal of trends of desertification and degradation depend on the ability of the intervention to generate new synergies. Could be put to question whether the investment in the implementation of certain key projects will be strong enough to boost the private market or in conditions of very scarce public resources will be possible to regulate private action.

To assess alternative ways of proceeding, it is important to know:

- What are the tools and the necessary measures to have a reversal in patterns of use of Baixa? With which incentives can be attracted new users and new functions to a central area?

- How can the plan and the institutional structure created for it, manage the needs of adjustments driven by changes in the economic and governance, maintaining the consistency of the intervention?

The government instability will put some questions about the future, increasing the uncertainties and possibilities, which are increasingly the common trait of "liquid" modernity. In the course of the revitalization plan, many were the events in the political or economic that conditioned the options and applications of the same. Is perhaps the sentence a few developments that highlight the uncertainty in the current process.

The failure of economic and institutional model proposed in the original document, will determine the type of intervention proposed. The public interventions are now more specific and constrained projects: the installation of the Museum of Money in the building from Bank of Portugal, the installation of the Museum of Design and Fashion, a public space for leisure on the terrace of Carmo and public access by mechanical means between the Fanqueiros Street and Madalena Street.

Similarly the choice of development of municipal regulation, rather than a detailed plan, falls now, for legal and operational reasons in the second, whose preparation is underway.

The process of Baixa-Chiado is likely to prove difficult as the domain of instruments of prediction, is proof of the importance of factors of temporality, in the design of the city.

6 Conclusion

Understanding some of the models and discourse that justify the interventions, in a logic of recovery and revitalization what can say that today, on the experience of intervention in the Baixa and the Chiado over the last 20 years?

In a first analysis, we conclude that the existence of a vast literature (about the buildings, the historical, economic activities, social studies, characterization ...) on the territory and some of the causes of the current scenario of decline, didn't meant that this work remained in the essential knowledge. Perhaps it is necessary a reflection that can cross the theoretical contributions of the different disciplines in order to find alternatives for intervention that can produce "irreversible" effects.

We can also leave some issues for discussion and analysis:

a) The difficulties inherent to places of great symbolic and historical centrality, affect not only the intervention in the buildings, but also the institutions, the actors and the management. A "concerted action" for recovery of Baixa Pombalina requires the combination of heritage and cultural criteria, with social and economic criteria.

b) The "urgency" to reverse the decaying landscape of Baixa Pombalina, leads to the need to adopt new strategic thinking in terms of interactive processing. The driving of change - the process - needs to ensure the operating conditions necessary to "conclusion" on the field.

c) Similarly when we look at the city as the repository of our memories and dreams - the identity - we need that it can support and lead the changes that it time will print, towards a new identity, shared in some way, as desire or design - the Project Identity.

d) We can not ignore the interconnection and coordination in a comprehensive and strategic thinking on a scale larger spatial and temporal, a broad city (metropolitan), essential for defining a coherent and integrated role of Baixa, in the structure of the emerging urban centralities , where mobility is the protagonist.

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This work is based on the Dissertation of the Integrated Master in Architecture presented at Instituto Superior Técnico: "City, a Drama in Time - A discussion organized on temporal factors in the design of the city" and published at https://fenix.ist.utl.pt/cursos/ma/dissertacoes. The starting point of work is today's city, marked by centuries of history but having to respond to new demands for mobility, to the constant change of programs and the daily uncertainties. Time appears as a decisive factor in this city ranging from permanencies and emergencies, reflecting the new ways of using space and transformation processes.

The 1964 Venice Charter sets the guidelines for an international definition of heritage as "living testimony of secular traditions." Later, the 1972 UNESCO World Heritage Convention recovers this line of thought: assuming the principle that the cultural and natural heritage of each country is an asset of all - a world heritage - and considering it as a heritage to be preserved and retained to transmit to next generations. The recognition of the fragility of this heritage, led to the adoption of the Convention.

Evaluation of performance of European cities with the aim to promote quality of life improvements

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This paper explores the possibilities presented by DEA to assess the performance of cities in what concerns the urban quality of life. Using the data provided by the Urban Audit program, from the European Union, we defined the city profile regarding quality of life for 236 cities. The quality of life analysis was contextualised by the GDP per capita to measure the ability of local authorities to promote quality of life given the economic condition of the country. The results identify the cities with urban best practices and allow researchers to elaborate a model of intervention for the cities considered inefficient.

Keywords: Data Envelopment Analysis, quality of life, Urban Audit

1 Introduction

The evaluation of the quality of life is an issue with growing importance in the scientific literature. Several authors, from different academic backgrounds, have approached this theme. Contributions from these diverse disciplines illustrate the complexity of this phenomenon: sociology, geography, economy, public health, transport or environment engineering, are only some of the possible references that show the interest this issue rises in different areas of knowledge. The multidisciplinary approach shows, on one hand, the scientific wealth of this issue, but it raises, on the other hand, research constrains as it is difficult to reach a consensual concept of quality of life, as well as the underlying dimensions that should be used for its assessment. In the scientific literature that approaches this theme, the lack of agreement is well shown.

The concern raised by the growth of people living in urban contexts has been followed by the scientific literature. One of the reason is that “politicians, policy makers and planners are constantly faced with decisions on environmental, social and economic issues, directly linked with quality of life, at a national, regional, urban and neighbourhood level” (Lambiri et al., 2006, p. 2). This is why quality of life is a reality that has been demanding increased attention from the authorities of European institutions. A recent resolution of the European Parliament from 2005, considering the urban dimension within the process of the enlargement, explains that “towns and cities and urban agglomerations or areas, where 78% of the European Union population is concentrated, are the place where both the most complex and the most common problems are concentrated (social exclusion, spatial and ethnic segregation, housing shortages, insecurity, drugs, pollution, contaminated former industrial sites, traffic, unemployment, lack of competitiveness, poverty, demographic changes, and so on)”, but it is also “the place where the future is built: universities, research centres, and so on” (European Parliament, 2005, p.8).

Moreover, urban quality of life is also increasingly being seen as an essential element for the development of cities. Richard Florida (2002) argues that people are more important than firms in an urban economics context and that right urban policies should tend to attract “creative” people by improving the conditions in which they live. As Trip (2007, p.502) sums it, “crucial for this is quality of

place: an attractive, diverse and tolerant urban environment is being increasingly recognized as a key factor in urban competitiveness".

Despite the growing interest and work on the field of quality of life, this theme is far from being an operational and consistent tool for measuring and improving the wellbeing of citizens, still needing "to be addressed more deeply both theoretically and empirically in the economic and urban economic literature", namely with the "use of theoretically consistent statistical and econometric methods" (Lambiri et al., 2006, p. 20).

Our aim is to allow the operationalization of the quality of life concept, in a way that it becomes possible to measure the impact of local policies in the urban quality of life, as well as to compare cities between them and its evolution through time. We applied the Data Envelopment Analysis (DEA), technique to evaluate the performance of cities in what concerns the promotion of quality of life, given the economic condition of the country, thus elaborating a model of intervention that allows the definition of urban best practices.

2 Understanding quality of life

The first step to understand the large academic work on quality of life, mainly in its urban aspect, is to identify the key-concepts, the theories and the models with relevance to the research. According to Pacione (2003, p.1), it has been central to academic research the effort to examine the "multidimensional aspects of urban environmental quality and human wellbeing".

2.1 The concept

It is obvious from a first analysis of the scientific production in this field that it is difficult to define the concept of quality of life, since it is not yet stabilised in literature. "There is no agreement yet on quality of life, in terminology nor in construction methods or the criteria that comprise quality of life" (Mitchell et al., 2001). While quality of life is, in some approaches, a set of factors such as health, physical environment, natural resources, personal development and safety, others researchers present economics "as one of the three major pillars of quality" (Kamp et al., 2003, p. 9). Efforts to reach a consensual definition did not succeed and therefore "the absence of a generally accepted framework for quality of life research is acknowledged as an obstacle to progress" (Pacione, 2003, p. 2).

Although the previous references allow us to reach a quantitative concept, some authors defend quality of life as a mainly subjective concept. This is the case of the definition proposed by the WHO-QOL group in 1993, quality of life is "an individual's perception of his/her position in life in the context of the culture and value systems in which he/she lives in relation to his/her goals, expectations, standards and concerns" (Kamp et al., 2003, p. 7). Some authors have presented it as life satisfaction and others as the degree to which a person enjoys the possibilities of his/her life" (Kamp et al., 2003). However, both approaches have been fruitful to research and looking at the quality of life – as this paper intends – in the specific context of cities context presents "an opportunity to explore" the relationship between objective and subjective dimensions (Marans, 2003, p. 74).

For the purpose of this paper, we can assume as a good the definition of the Australian project Social Benchmarks and Indicators for Victoria (Salvaris et al., 2000, p. 39): "The overall level

of wellbeing and fulfilment that people enjoy from a combination of their social, economic and community environment and their physical and material conditions".

2.2 The dimensions of quality of life

When going from the concept to e real-world analysis, we realise that the complexity of quality of life is expressed in the diverse dimensions that are chosen by researchers. This is not only an academic problem, but also a political one. Policy-makers are also interested in defining the factors of satisfaction that their policies may alter, also driving researchers to study in what way satisfaction is influenced by various objective conditions. And it cannot be forgotten that "quality of life is increasingly considered a crucial element of urban competitiveness and growth" (Lambiri et al., 2006, p. 4), thus explaining the interest of urban planners and decisors.

Direct approaches to quality of life differed from place to place. Some proposals from New Zealand (Bigcities, 2007) have refined the work in terms of dimensions, including demography, knowledge and skills, health, safety, housing, social connectedness, civil and political rights, economic standard of living, economic development, the natural environment and the built environment. Also in Canada, in the city of Winnipeg, five dimensions were chosen to express the factors that influence quality of life: individual well-being, urban economy, urban environment, community assets, community leadership and pride (IISD, 1997, p. 1). In the Urban Audit programme – the study of quality of life promoted by the European Union – the effort of research, as we shall see later, has also been in the definition of the relevant dimensions to evaluate quality of life.

From the analysis of these references it is possible to realise that a sort of central core for research has been constructed: the studies undertaken have been focused in equivalent dimensions, then enlarging to a wider conception that reveals a different understanding of quality of life. For example, it can be more focused on individual or collective life of the population (such as the New Zealand study and the Urban Audit, in a certain way) or more directed to urban aspects of space enjoyment.

2.3 Measuring quality of life

For each of the dimensions considered, in the existing studies, researchers have selected different variables, gathered in proper indicators. There is a general consensus in literature that objective and subjective indicators are needed in the study of the person-environment relationship.

In the literature, the selection of indicators is normally the result of experts groups or of researchers. This is the case of the Urban Audit project, that regularly joins a think tank to evaluate the pertinence of the adopted indicators and the need do add or withdraw indicators.

One of the perspectives of work adopted in this field is the development of measuring methods such as "the construction of indices through of a system of indicators, with the aim to capture as precisely as possible the multidimensionality of the concept" (Lambiri et al., 2006, p. 20). Thus, some of the characteristics that measure quality of life or other factors influencing the wellbeing of the citizens, such as development, are presented through indices or meta-indices. Some of these indices are already used in a generalized way or correspond to concepts that are consolidated in literature.

This is the case for the Human Development Index (HDI), of the United Nations Programme for Development, which is a universal and stabilized concept. It embodies wealth, health and education as factors, allowing a comparison between countries and regions, thus constituting a evaluation tool of the policies of national and regional governments. The HDI is based in 3 indicators: longevity, measured by life expectancy at birth; educational level, measured by a combination of adult literacy (with two-third weighting) with the combined primary, secondary and tertiary gross enrolment ratio (with one-third weighting); and standard of living, measured by the Gross Domestic Product (GDP) per capita (PPP US dollars).

From these indicators it can be obtained a synthetic index. The HDI is the simple mean (arithmetic) of the life expectancy index, the educational level index and the real adjusted GDP per capita index (PPP US dollars). However, the equal weigh given to each of the 3 dimensions is contested by some academics. Despotis (2005), for instance, has proposed the assessment of the HDI reconsidered in the light of DEA. In his approach, Human Development is benchmarked, following Mahlberg et al. (2001) proposal of a non-lineary arranged set of best practice countries and considering that the weight of each indicator entering the HDI is endogenously determined, based on optimization calculus.

This approach reflects the difficulties that have been presented to researchers trying to construct indices, the main one precisely being “the inherent subjectivity in the choice firstly of indicators, and secondly of the final weights of every indicator used for the construction of the final composite quality of life index” (Lambiri et al, 2006, p. 20).

There are other indices in literature, such as the Environmental Sustainability Index of the World Economic Forum or the Prescott-Allen’s Wellbeing Index, that have also been used to allow comparison between countries or regions. As an example of an index of quality of life we can point out the Mercer’s study, based on detailed assessments and evaluations of 39 key quality of living determinants.

Other studies using only a set of indicators, but not effectively constructing an index, have measured quality of life in several cities of different regions of the world. Some universities have done research in this field and a variety of models have been developed in a non-coordinated and independent way. In what concerns this matter, we can point out the “Local Government Act 2000” project of New Zealand that evaluates the quality of life, firstly in the eight biggest cities and nowadays in the 12 biggest cities (Bigcities, 2007). We can also consider the Australian project Social Benchmarks and Indicators for Victoria (Salvaris et al., 2000).

In Europe, the effort to coordinate is still recent, notwithstanding some relevant experiences, namely at the European Commission level, with the Urban Audit project. This programme aims to give European politicians means to evaluate urban quality of life. These studies may also constitute a major tool in the definition of public European policies. Because resources are limited, “policymakers need to find the most efficient way of distributing them in line with the needs and priorities of people” (Ulengin et al., 2001, p. 361-362).

3 The Urban Audit Project and its city profile

The Urban Audit Project, that we have previously introduced in section 2, constitutes an answer to the growing need to determine and intervene in the quality of life of European cities. Being its outcomes the object of our work, the Urban Audit will now be explained in a more detailed reference. This is a programme that evaluates cities, where an increasing percentage of citizens lives, gathering data on several citizens and urban aspects.

Included in the core business of Eurostat in the end of 2004, Urban Audit allows a comparison between cities at the level of their position in Europe (central – peripheral – south), as well as in what concerns other characteristic (economic activity, public transportation, educational level). This study also stresses disparities between cities, which is useful, and even crucial, to the political decision-making. In 2006, this programme included information of 284 cities (189 belonging to the Europe of 15, 69 to the new 12 Member-States and 26 to Turkey).

Structured in nine dimensions (demography, social aspects, economic aspects, civic involvement, training and education, environment, transport and travel, culture and leisure, innovation and technology), this program present variables for each dimension, which correspond to statistic fields defined in the Urban Audit. But there is not any attempt to create synthetic indicators or studies to explore the relationships between different variables (European Commission, 2005). The 336 variables used are structured in nine distinct statistic fields: demography, social aspects, economic aspects, civic involvement, training and education, environment, travel and transport, information society and culture and recreation. The data presented consolidates information collected in each city and country, national statistic institutes constituting the main source used by the Urban Audit.

Besides this information, and to evaluate the subjective perceived quality of life by citizens, as a complement to the objective data, Urban Audit has a set of indicators, which result from surveys applied to large random samples of inhabitants of the studied cities. Due to the cost of these methods, only 31 cities were surveyed in 2003 and 71 in 2006. For each city, the Urban Audit Program establishes a city profile that includes a subset of aspects of quality of life organized in seven of the dimensions (demography, social aspects, economic aspects, civic involvement, training and education, environment, transport and travel).

The concept of city profile used by this European project does not include the components of culture and leisure and innovation and technology. However, in our study we have also adopted these two dimensions, so to have a city profile in which all the dimensions of quality of life used in the Urban Audit are considered. Following this inclusion, we looked at the indicators chosen by the Project for each dimension. For the purpose of our work, we chose only the ones we considered to be indicative of quality of life (ex. percentage of households living in owned dwellings). Indicators which were negatively related to quality of life (ex. percentage of households receiving less than half of the national average household income) were transformed into positive aspects of quality of life (ex. percentage of households receiving more than half of the national average household income), by using the related/opposite/complementary indicator. Thus we have built a new concept of city profile, based on a different selection of indicators that, clearly and objectively, reveals quality of life.

The Urban Audit project is a major program that gathers information about cities, in a systematic and exhaustive way, being the most important initiative in the area in Europe. It comprises

significant and comprehensive data that characterize Europeans cities and that can be worked out in models aiming at the evaluation of quality of life. Thus we have chosen to start from the data of Urban Audit to reach a new model of evaluation of the performance of cities.

4 The methodology

Our work intends to evaluate to what extent policy-makers of cities transform the wealth of their country, measured by the GDP per capita, in quality of life. Data Envelopment Analysis (DEA) was the technique selected to establish a model of evaluation of local policies, starting from the data provided by our enlarged city profile. We considered as outputs of local policies the values for each variable in the dimensions considered and GDP as the input.

DEA is a management tool has been increasingly used to evaluate the performance of different entities (or decision making units – DMUs), such as business firms, governments, schools, hospitals, etc. Gorman and Ruggiero (2008) applied this methodology to evaluate state police performance. Despotis (2005), as referred previously, applied DEA to the HDI, redesigning countries development. Zhu (1998) illustrated the potential of this method in an urban context, presenting a study on the economic performance of Chinese cities. To our knowledge, it has not been applied yet to the management of urban quality of life, but it presents several advantages, namely in terms of low information cost (Homburg, 2001), and thus can give fundamental contributions to help local policy-makers to achieve better performances in that matter.

DEA is used to assess the efficiency of entities that uses similar inputs to achieve similar outputs. Establishing scores for the degree of efficiency of each DMU, DEA also identifies the sources and amounts of inefficiency in each input and output, also pointing out to the efficient DMU, which can be presented as benchmarks to defining improvements in future performances of inefficient DMUs. (Cooper et al, 2000). It means that a central assumption in this approach is that if a given DMU (in our case study, city A) is capable of producing YA units of output, having XA inputs as a starting point, then other cities – with the same or less inputs - should also be able achieve at least the same output levels if they were to operate efficiently. So DEA defines the best practice frontier that serves as a benchmark for all inefficient DMU.

Consider an input vector of resources $\mathbf{x} = (x_1, \ldots, x_m) \in R_+^m$ used to produce an output vector of outcomes $\mathbf{y} = (y_1, \ldots, y_s) \in R_+^s$ in a technology involving *j=1,…,n* cities. Assuming Constant Returns to Scale (CRS), the efficiency assessment of a city o can be done using the DEA model (1) (Charnes et al, 1978).

$$\max\{\beta_o \mid \sum_{j=1}^{n} \lambda_j \; y_{rj} \geq \beta_o y_{ro}, r = 1, \ldots, s, \sum_{j=1}^{n} \lambda_j \; x_{ij} \leq x_{io}, i = 1, \ldots, m, \; \lambda_j \geq 0\} \qquad (1)$$

The optimal solution to model (1) provides the output efficiency score of unit o, given by $1/\beta_o^*$. This efficiency score represents the percentage of outputs unit o is achieving of the maximum it could possibly achieve. So when $1/\beta_o^*$ equals one the unit is deemed efficient and when

it is lower than one the unit is deemed inefficient, meaning that the outputs should improve pro-rata by a factor of β_o^*.

The targets for the inputs and outputs of the unit under assessment can be obtained using the expressions (2), where λ_j^* is the optimal value of λ_j from model (1) .

$$x_{io}^t = \sum_{j=1}^{n} \lambda_j^* \, x_{ij}, \ \forall i \qquad y_{ro}^t = \sum_{j=1}^{n} \lambda_j^* \, y_{rj}, \ \forall r \qquad (2)$$

Given our aim, we worked with an output-oriented DEA model, seeking to compute performance as a proportional augmentation of all indicators. Among the several extensions of the method and considering the characteristics of the variables in the city profiles, we chose to apply the Output Oriented Bounded Variable Model, as in Cooper (2000: 212), to account for the fact that the values of our indicators have upper bounds.

Before applying DEA to our sample and in order to avoid bias in the analysis that could be introduced by missing data, we decided to include in our study only the cities with a minimum of ten valid observations in the 30 outputs considered. A total of 48 cities were eliminated from the original database of the Urban Audit Program. Our sample is then constituted by 236 cities, belonging to 27 countries.

But it is clear that it is not possible to consider all cities in equal circumstances, as the country they belong to has a significant influence on local wealth. We need to put in perspective the fact that cities cannot be compared per si without consideration of national and regional conditions. By introducing GDP per capita, we can clearly assess the capacities of local decisors to induce quality of life given the country context and the regional area in which their cities are implanted. This is why we did not choose an input centred in urban dimensions such as the budget of local administrations for cities management. This option would have presented two kinds of problems: there is not a single model in the European cities for governance separation between local and central administrations, which has obvious implications on the revenues that each city can expect for its budgetary expenses; secondly, not all the outputs considered in city profile depend exclusively in cities characteristics. Therefore, a value that clearly can be compared at an European level and that can be expect to induce quality of life is GDP per capita.

We have then worked one input and 30 outputs, distributed by the nine dimensions, as displayed in the table 1.

5 Results and discussion

Applying DEA to our sample, we found 97 inefficient cities (41%) and have found a total of 139 efficient cities (59%). The mean efficiency of all inefficient cities is 95,9%. Though discrimination in results is not very high, due to the large number of outputs and considering the number of evaluated cities, conclusions can be obtained by analyzing the results.

The 97 non-efficient cities are displayed table 2.

Table 1. Input and outputs considered for DEA application

Input	
	GDP Per capita
Outputs	
Demography	Population change over two years
	Percentage of households with more than one person
	Percentage of households that are not lone-parent household
Social Aspects	Average price for an apartment per m2
	Average price for a house per m2
	Percentage of households living in owned dwellings
	Percentage of households not living in social housing
	Average area of living accommodation (m2 per person)
	Life expectancy at birth
	Population per recorded crime
Economic Aspects:	Employment rate
	Female Employment Rate
	Activity rate
	Median disposable annual household income
	Percentage of households receiving more than half the national average household income
Civic involvem.	Percentage of registered electorate voting in city elections
Training and Education	No. of children aged 0-4 in day care per 1000 children 0-4
	% of resident population with secondary education
	% of resident population with tertiary education
Environment	No. days with ozone O3 concentrations below 120 microgram/m3
	No. days with particulate matter PM10 concentrations below 50 microgram/m3
	Percentage of solid waste processed by landfill
	Green space to which the public has access (m2 per 100 inhabitants)
Transport and travel	Percentage of journeys to work not done by car
	Average time saved in journeys to work in relation to the time reference of 75 min
Information soc.	Percentage of households with a PC
Culture and recreation	Concert attendance per year per capita
	Cinema attendance (per year per capita)
	Number of museum visitors (1000 per year)
	Number of theatre seats per 1000 inhabitants

Table 2. Inefficient cities considering Urban Audit data

Cities	Efficiency	Cities	Efficiency	Cities	Efficiency
Cardiff	99%	Napoli	98%	Palermo	96%
Orléans	99%	Milano	98%	Linz	95%
Clermont-Ferrand	99%	Leicester	98%	Umea	95%
Dijon	99%	Hannover	98%	Suwalki	96%
Amiens	99%	Malmo	98%	Venezia	95%
Derry	99%	Aarhus	98%	Newcastle upon Tyne	95%
Lille	99%	Aalborg	98%	Verona	95%
Leipzig	99%	Strasbourg	98%	Odense	95%
Exeter	99%	Bologna	98%	Lincoln	95%
Liverpool	99%	Bielefeld	97%	Nantes	95%
Grenoble	99%	Roma	97%	Dublin	95%
Rotterdam	99%	Patra	97%	Bradford	95%
Braga	99%	Wuppertal	97%	Goteborg	95%
Katowice	99%	Koln	97%	Marseille	95%
Charleroi	99%	Irakleio	97%	Le havre	94%
Oviedo	99%	Larisa	97%	Nice	94%
Porto	99%	Jonkoping	97%	Graz	93%
Nancy	99%	Worcester	97%	Trieste	93%
Rouen	99%	Volos	97%	Ajaccio	93%
Bari	99%	Ponta Delgada	97%	Genova	93%
Aveiro	99%	Athina	97%	Glasgow	93%
Bydgoszcz	99%	Moers	97%	Múrcia	92%
Lyon	99%	Essen	97%	Zaragoza	92%
Birmingham	99%	Torino	96%	Badajoz	89%
Saint-Étienne	99%	Poitiers	96%	Las Palmas	88%
Bochum	99%	Aberdeen	96%	Sevilla	87%
Manchester	99%	Portsmouth	96%	Málaga	84%
Edinburgh	99%	Limoges	96%	Taranto	82%
Lodz	99%	Wrexham	96%	Regio di Calabria	81%
Toledo	99%	Setubal	96%	Cagliari	80%
Bremen	99%	Gravesham	96%	Catania	77%
Thessaloniki	99%	Stevenage	96%		
Trento	98%	Leeds	96%		

We can then identify a relevant group of cities with relatively low efficiency scores, thus presenting an opportunity for the development of operational tools aimed at improving quality of life. Using this methodology, for each city each variable can be targeted to higher standards presented by other cities, constituting its benchmarks.

On the other side, this methodology allows us to identify efficient cities with a possibly reproducible performance, whose best practices could be spread to other European cities. In table 3 we present the cities that are mostly selected as the benchmarks for other urban centres:

Table 3. Cities used more often as benchmarks (or peers) for the others.

Cities	Times in peer set	Cities	Times in peer set
Tallinn	43	Enschede	11
Gozo	41	Cambridge	11
Kosice	40	Kaunas	11
Liepaja	37	Utrecht	10
Banska Bystrica	36	Frankfurt (Oder)	10
Freiburg im Breisgau	35	Vidin	10
Panevezys	33	Gdansk	9
Tartu	30	Caen	8
Pecs	28	Tampere	8
Ljubljana	21	Pamplona/Iruña	8
Liège	21	Warszawa	8
Riga	20	Groningen	8
Bremen	20	Derry	8
München	19	Giurgiu	8
Praha	18	Belfast	7
Ruse	16	Bratislava	7
Aarhus	15	Valletta	7
Usti nad Labem	15	Wiesbaden	6
Göttingen	14	Eindhoven	6
Ancona	14	Regensburg	6
Zory	14	Vilnius	6
Halle an der Saale	12	Karlsruhe	5
Nitra	12	Portsmouth	5
Mainz	11	Szczecin	5

As we can observe, there are 30 cities that appear more than 10 times as possible examples for others, presenting best practices that can be followed by others in terms of promoting quality of life. Topping the most quoted cities is Tallinn (43), in Estonia, followed by Gozo (Malta) e Kosice (Slovakia), appearing 40 times each. It is also significant to note that in the 15 first places of the list we find cities mostly from Eastern of Europe.

Finally, this methodology can have a secondary outcome presenting a global evaluation for countries, as shown in table X. For instances, some countries show poor performance in terms of urban quality of life, given the countries wealth, such as Italy, Spain and Austria, with an average score below 97%. We an average score of 97%, we can also find Denmark, Greece, Sweden and United Kingdom. In particular, Italy has the lower value of efficiency in the group of cities considered, with a mean of 93% of efficiency and a standard deviation of 7,5%, showing large disparities between cities within the same country. Typically, countries with a lower global performance have a higher standard deviation, which demonstrates that good and bad practices co-exist in the management of cities. Another significant result is the lowest efficiency of Sweden and Denmark cities, when compared, for instance, to Slovenia or Slovakia. This does not mean that the cities of the Nordic

countries are worse in terms of quality of life than the ex-communist countries, but that, considering the level of the GDP per capita, Swedish and Danish urban centres have a lower performance in the management of the dimensions considered.

To understand the challenges presented by this methodology of evaluation of cities efficiency, we can use Catania (Italy, capital of Sicily) as an illustrative example and point out where to look to improve the city performance. Table 4 presents the original values of the input and output indicators of Catania, compared with the indicators of the peers.

Table 4. Illustrative example using Catania

			Peers									
	Catania		Riga	Kaunas	Firenze	Katowice	Ljubljana	Malmö	Liège	Tartu	Liepaja	Zory
	O.	T.	λ = 0,018	λ = 0,154	λ = 0,081	λ = 0,273	λ = 0,194	λ = 0,051	λ = 0,354	λ = 0,079	λ = 0,249	λ = 0,116
I1	27119		10270	10270	27119	11379	19150	26750	28335	13539	10270	11379
O1	0	10	2	0	2	2	3	**11**	10	0	2	0
O2	77	100	75	67	65	68	72	44	47	60	70	**82**
O6	50	65	50	**87**	63	6	71	n/d	44	67	36	3
O8	31	40	13	20	40	22	26	**42**	37	22	14	19
O11	71	92	89	82	**94**	82	n/d	91	76	**95**	n/d	77
O12	64	83	90	87	**93**	81	n/d	92	72	n/d	n/d	71
O13	36	48	49	**50**	43	42	n/d	39	39	42	n/d	44
O16	69	90	**99**	51	69	n/d	68	73	84	43	**98**	n/d
O17	47	61	45	31	56	26	**106**	58	13	51	41	13
O23	6	17	n/d	n/d	14	**38**	8	n/d	n/d	n/d	n/d	33
O28	4,4	5,7	1,1	0,7	7,4	1,1	2,5	n/d	**11,3**	1,6	0,2	0,2

The analysis of the data allows us to identify where are the best practices in terms of each of the output considered in our work. In this illustrative case, we can conclude that catanian policy makers have lessons to be learned from Liège (France) in what concerns cinema attendance (O27), improving quality of life in its culture and recreation dimension. Considering the environment and looking specifically to green space (O23), Catania can also better its performance applying the policy of Katowice (Poland). In the training and education dimension, policy-makers have to study Ljubljana (Slovenia) strategy to include a bigger number of children between ages 0 and 4 in day care institutions (O17). In what concerns the activity rate (O13), Kaunas (Latvia) shows an inspiring performance for Catania. This city that can also use Firenze (Italy) as an example for bettering its female employment rate (O12) and employment rate (O11), output in which the capital of Sicily can also learn from Tartu (Estonia). Malmö (Sweden) is an example for catanian local decisors considering the average area of living accommodation (O08), Kaunas being inspiring in what concerns percentage of households living in owned dwellings (O06). Political participation is a dimension that can be improved, by following Riga (Latvia) and Liepaja (Latvia) ‘s practices in the matter of having registered electorate voting in city elections (O16). Finally, in the demography dimension, Malmö / Liège and Zory (Poland) are, respectively, examples for Catania in what concerns population change over two years (O01) and percentage of household with more than one person (O02).

As we can observe, there can be more than one city to look at when it comes to establish the best practices. One of the decisions to be taken by local policy-makers, in order to optimize their performance, is to construct a ranking of benchmarks so to determine which city should be visited first as an example. The methodology is given by observing the lambda/quoficient: this value show which benchmark is the most relevant and has a higher contribution in order to obtain the established target for the city in study. Considering our example (Catania), Liège is the benchmark with the higher lambda (0,354) and with the higher values in the output 28 (cinema attendance). This means that in order to increase the number of people that use cinema as a recreation pratices, Catania should study, in the first place, Liège's performance. When we look at the change in population over two years, Malmö and Liège present similar positions. However, as Liège has a higher lambda, it should be the city to study in the first place. The second city with highest lambda is Katowice (0,273), which has the higher values in the output 23 (Green space to which the public has access). For instance, Riga and Liepaja share similar values in what concerns output 16 (percentage of electorate voting in city elections), but since Liepaja has a higher lambda (0,249 against 0,018 for Riga), Liepaja is the city to visit first in order to better political participation.

6 Conclusion

Urban quality of life is an issue of undeniable importance for local policy-makers. Improvements in this field can lead to a growing competitiveness of cities but, defining the right decisions is not an easy task. Thus, benchmarking is an opportunity for cities to learn with one another experiences, establishing targets of performance that can be reproducible in order to improve quality of life for citizens.

The importance of urban quality of life for the European Union is shown by the inclusion of the Urban Audit project in the core of the Eurostat. Not designed to be an operational tool in what concerns improvements of quality of life, this database can, however, be used as a fundamental information for local policy-making. This is the aim of this work, which applied DEA to the data provided by the Urban Audit in order to assess efficiency in city management.

With this new methodology we identified the most efficient cities in terms of quality of life, pointing out which are most frequently an example for others. Our study also allows us to develop a systematic approach to the establishment of benchmarks for the less efficient cities, whose policy-makers also have the opportunity to identify which urban policies can be used as an example in the dimensions that need improvements. We presented some examples of the potentiality of this new method, analysing cities and identifying its benchmarks in order to improve the performance of their urban local policies.

Some limitations of this study can be pointed out. First of all, the discrimination power of the model was low. On the other hand, possibly due to the fact that it is still a recent project, Urban Audit is still faced with a significant amount of missing data. The more this project can fulfil the blankets the more operative will become this new tool we developed for assessing the improvements in urban quality of life.

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Annex

Table. Mean efficiency of countries

Country	Mean of efficiency	Standard deviation
Austria	0,96206	0,035379
Belgium	0,998677	0,00324
Bulgary	1	0
Checz Republic	1	0
Cyprus	-	-
Germany	0,993973	0,010759
Denmark	0,975581	0,019037
Estonia	1	0
Spain	0,960721	0,05692
Finland	1	0
France	0,981232	0,022858
Greece	0,973161	0,006512
Hungary	1	0
Ireland	-	-
Italy	0,931593	0,075564
Latvia	1	0
Lithuania	1	0
Luxembourg	-	-
Malta	1	0
Netherlands	0,999384	0,001949
Poland	0,99645	0,010317
Portugal	0,987912	0,014793
Roumania	1	0
Sweden	0,970511	0,020211
Slovenia	1	0
Slovakia	1	0
United Kingdom	0,976272	0,021178

Part 4. Transport planning and logistics

Assessment of urban goods distribution initiatives towards mobility and sustainability – an empirical overview

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Goods transport and distribution within urban and metropolitan areas, especially in the core areas of cities with old and established centers, impacts the local community in what concerns to the economic development, quality of life, accessibility and attractiveness of cities. To minimize these impacts, an increasing seek for alternative solutions to supply cities has been carried out. Following that tendency, authors define and evaluate alternative urban goods distribution initiatives under the criteria of (operational) mobility and sustainability, considering both public and private interests. The evaluation of initiatives was carried out in Porto (Portugal) through the use of microscopic traffic simulation (AIMSUN), using a set of indicators previously defined. Based on a compilation of good practices and scientific literature review as well as on specific data collection on problematic areas in the city, the performance of cooperative systems, collaborative systems and enforcement was simulated. Results of the analysis revealed that enforcement would be the best specific solution adapted to the intrinsic characteristics of the area, as well as to the respective technical and political context.

Keywords: city logistics, freight transport, mobility, sustainability

1 Introduction

The topic of urban goods distribution (UGD), as well as the closely related subject of freight traffic, has been underestimated by researchers and planners. It has been treated as a marginal issue of passenger's traffic and usually studied in an inappropriate geographical scale, not taking into account the specificities of freight.

Along the last decade, the increasing concern with key concepts like mobility and sustainability had however, contributed for a recent increase on research on the UGD topic. Research is now making the first steps on the issue and as it has been happening in the past with other themes, the first tendency has been to look at solutions on other well known perspectives (like the passenger one) and apply them to a new specific context (freight). The second step is to seek for alternatives that could then be categorized as 'good practices'. Lastly, the third step has been to implement them and actually check whether they justify such designation.

This paper, which results from a wider research on the topic of urban goods distribution, tries to improve the usual methodology on the study of the topic. It adapts the third step, optimizing the process. It evaluates 'good practices', through the use of modelling tools, both from passengers and freight perspectives, considering the specificities of the topic and of the local intrinsic characteristics of implementation. To support the theoretical microsimulation analysis, a case study is carried out, highlighting the main stakeholders' impacts and the respective geographical impact of the initiatives. This analysis allows checking in advance whether the initiative can be considered a good practice in terms of mobility and sustainability to supply the study area and consequently, if it could or should be implemented.

2 ‘Sustainability’ and ‘Mobility’ criteria

Each city is individual and its development is impacted by numerous decisions taken by people and enterprises within it. Thus, there is no single model or reference of cities and each has a unique culture, shape and organization, which defy generalization (Melo, 2009). Despite the intrinsic discrepancies, cities also exhibit a certain number of common problems and worries and share a great number of common expectations (Mega, 1996). One of these expectations is that cities want to attract more people and capital and at the same time, achieve a sustainable development. To achieve this expectation, some targets are established to maintain an internal equilibrium balance between economic activity, population growth, infrastructure and services, pollution, waste, noise, etc. in such a way that the urban system and its dynamics evolve in harmony, internally limiting (as much as it is possible) impacts on the natural environment (Barredo and Demicheli, 2003). In this sense, ‘sustainability’ and ‘mobility’ has become the guiding vision for many cities and consequently, for its users.

Literature review on ‘sustainability’ and ‘mobility’ reveals a recent common use of the concepts on freight topic as a policy target. To overcome the usual vagueness of the implementation of both concepts and to make them operational and measurable, a set of indicators was defined.

The set of indicators may serve as a framework for the assessment of goods distribution initiatives performance and for the analysis and comparisons of policy scenarios/strategies to mitigate negative impacts originated from delivery activities. Indicators reflect society's values and goals and are key tools to measure the performance of a system, the evolution of a process or to evaluate the results of a particular action on a complex system. Thus, indicators provide a useful tool for policy making and for assessing policy implementation (Mega and Pedersen, 1998).

In an attempt to identify quantitative indicators criteria, it were previously defined what consequences or impacts need to be measured and how those effects were related with a set of causes. On the transport area and to the mobility and sustainability criterions, this approach typically leads to the measurement of the following impacts: congestion, fuel consumption and environment. Such impacts are not a direct measure of the sustainability and mobility of the initiatives by themselves, although they can point on that direction. For instance, an initiative which reduces the indicator ‘fuel consumption’ can lead to a reduction on costs of road users (both for freight and passenger vehicles) and on air pollutant emissions and consequently, to an improvement on the efficiency of suppliers (more reliability on service) and on urban environment quality, which contributes to achieve a more sustainable development.

Based on a review of literature and on results from participation in meetings, discussions devoted to this topic and empirical evidence and once proposed indicators have gone through an initial round of scrutiny, it was considered that the following set of selected indicators was valid to be used on the case study on the evaluation of initiatives on UGD:

Delivery times

Supplier operational costs

Deliveries/day

Use of load capacity

Proportion of goods vehicles in total traffic
Distance Travelled by HGV, LGV , taxi, bus and car (Veickm)
Energy Intensity (Fuel Consumption in liters by vehicle type)
CO2 emissions (g per area or km)
Emissions g per area or km by vehicle type (NOx, CO, HC)
Average Speed (excluding stops to make deliveries – km/hour)
Travel time (sec/km)
Delay time (sec/km)
Density (veh/km).

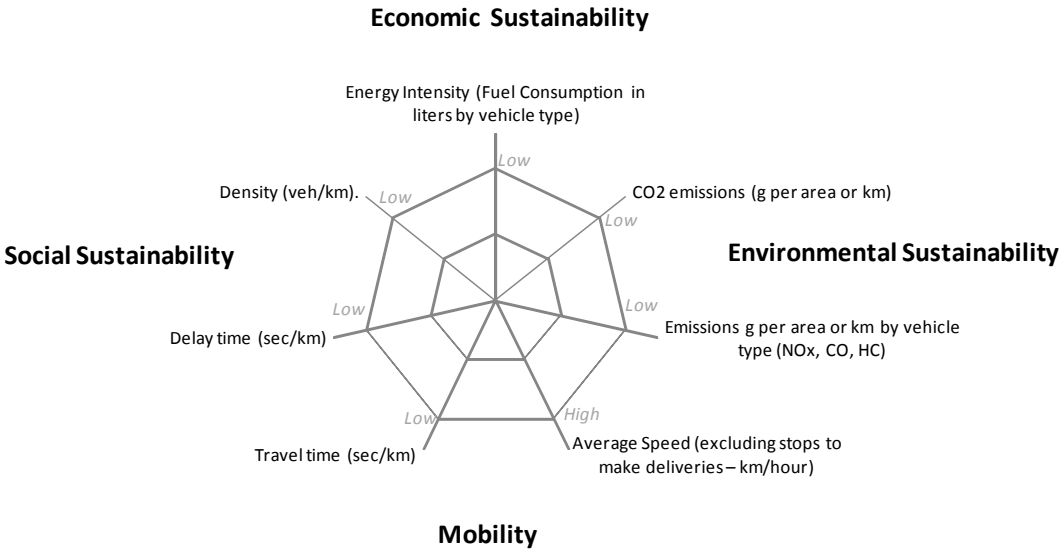

Figure 1. Representation of the indicators (illustrative example) Source: Melo, 2009

The more towards the outside the values of the individual indicators lie, the higher mobility and sustainability are on the transport system and respective case study area.

On the basis of the current discussion, more indicators could also enrich the set of suggested indicators illustrated in Figure 1 and clearly there is room for discussion and debate on this choice. Virtually other different set of variables could have been developed to be indicators of sustainability and mobility performance. However, once the final definition of a set of indicators always depends on personal choices, there always can be a judgment error, not in the information represented by every single indicator, but in the overall view provided by the set. In an attempt to overcome the subjectivity inherent of personal choices, an inquiry was carried out to validate the set of indicators.

The validation of the set of indicators was carried out with the assistance of scientific/technical experts. The support was obtained through a survey sent to 124 sampled people and 14,5% evaluated and validate the set of indicators according with the following description. All respondents revealed to know the concepts of mobility and sustainability and 44% state their experience in projects and studies closely related to these concepts. A share of 19% even considered themselves experts on these topics. In what concerns to the knowledge of respondents on the selection of

indicators to evaluate initiatives in terms of mobility and sustainability, results are encouraging: 87% of the respondents affirm to have experience on such task. Altogether, these figures provide a high degree of confidence on the technical knowledge of the respondents to validate the proposed set of indicators. The proposed indicators were validated by respondents. 34% considered the indicators to be 'good' measuring the respective domain and 27% even considered them 'very good'. 24% did not considered them 'good' or 'bad'.

3 Stakeholders interests and criteria

Regarding the organization of goods distribution system, *sustainability* and *mobility* may have a different meaning and content for each group of stakeholders, which may depend on their short- and long-term objectives and preferences. The main group of stakeholders to be considered in urban goods distribution includes suppliers, residents/users (community), receivers/shopkeepers and (local) administrators, all of them with different and complex transportation and consumption needs.

A usual distinction made on the analysis of stakeholders positions is based on their public or private objectives. Public objectives are often related to the well-being of all stakeholders in a specific area, such as quality of life (accidents, noise, emissions, nuisance, etc.), economic vitality and mobility. Public interests reflect administrators, companies, residents and users (visitors, tourists, employees) concerns about promoting the public good. Private objectives are often related to turnover levels like sales levels, customer levels, costs levels, service levels, and competition. Private interests reflect suppliers and transport industry worries about improving the efficiency and profits of their service.

The best way to get their support is to a) understand and care for their needs and concerns, and b) get them involved throughout the whole process: problem analysis, objectives definition, and selection of solution, implementation and evaluation (STRATEC, 2005). To achieve this, it is fundamental to make their different positions and expectations transparent. If all the interested parties can predict the (public and private) effects of a specific initiative, the negotiation process is more transparent and can lead to an integrate strategy, which will in principle lead to better results. On this sense, microscopic traffic simulation exercises like the one described in the following section are useful tools to support negotiation between public and private stakeholders.

4 Case study

4.1 Overview of the area

The chosen area for the study was *Marquês* located in Porto (Portugal). Figure 2 shows the unit *Marquês* and its respective streets and landscape. At its core it is illustrated the important square Marquês, surrounded by streets with high pressure from freight vehicles (dark grey stretches).

Marquês is mostly a residential area with traditional commercial stores, which have faced in the beginning of the decade the phenomena of population's aging. In the last years, a new dynamism was provided from an increase of youth population (mainly from Brazilian and Eastern-European immigrant communities), which has been followed by a new vitality and diversity on the commercial

activities located on the area. Currently, it is one of the areas with higher density of commercial activities in the city, although with a small diversity of commercial branches.

Figure 2. Illustration of the case study area Source: Melo, 2009

4.2 Goods distribution pattern

To better characterize goods distribution and freight traffic in the area, a survey was carried out. The data collection of the survey included the following indicators: traffic counting by direction and type of vehicle (bicycle, motorbike, car, van, coach, bus and truck), parking time/delivery, frequency of deliveries according to the branch of activity, type of freight vehicle (truck, lorries, vans, car), traffic freight flows, use of capacity of the vehicle (full, 50%, less than 50%) and the share of cars and vans in the freight traffic.

121 commercial stores with an average of 14 deliveries/day, mainly belonging to the food and fashion branches, were included on the survey. 44% of the stores located there are related to the fashion branch (shoes, clothes and other accessories) and 16% are restaurants and coffee shops.

The survey revealed that the average parking time in the area is of 10 minutes per delivery, with the fashion branch having the lowest average parking time (4 minutes per delivery) and the largest one being registered by the food branch (27 minutes per delivery). The food branch is also the one which registers the highest share of deliveries to the area (64%). Goods vehicles accounted for 12% of all movements between 7:30 and 19:30 in the area, split by 3% of HGV and 9% of LGV.

The split between the three categories of freight vehicle is approximately light vans (71%), trucks (23%) and cars have a share of less than 1% in freight traffic. About 75% of these freight vehicles that supply the area have a load factor < 50%.

It was also collected other additional data, like the identification of the store that received the goods, the exact location where the supplier stopped the vehicle, the parking solution adopted (bus lane, ramps, double lane, pavement). This information was used to characterize in detail the delivery patterns of the area.

The small width of the streets of the case study, together with poor traffic regulations and lack of enforcement cause widespread transgression of the rules. Furthermore, the existence of buildings of high architectural quality prevents physical changes in the infrastructure layout, which could allow reducing the impacts of urban goods distribution activities.

Considering the strong restrictions to change the infrastructure layout, alternatively it were evaluated urban goods distribution initiatives belonging to the domain of traffic management in the specific context of the study area.

5 Simulation of Scenarios

In the last years several initiatives have been proposed to achieve sustainable targets and some have even been pointed out as 'good practices', according with its theoretical or practical results at economic, environmental or social levels (sustainability dimensions). From those good practices, three initiatives were selected to be evaluated on the study area: cooperative systems, collaborative systems and enforcement. The evaluation was made through the simulation of the impacts of each of the initiatives being implemented separately, because the characteristics of the area and respective supply pattern do not require a complex solution evolving the harmonization of two or more initiatives. The impacts of the three initiatives were compared in order to choose the one which would bring more benefits to the study area.

Additionally to a better knowledge of the Portuguese reality on urban goods distribution, authors intended to give a contribution to the use of microscopic traffic simulation to support urban goods distribution management decisions.

It was considered that the objective of the microsimulation exercise was to evaluate a micro-behaviour of stakeholders but also the behaviour of the all spatial system. Thus, the impact was analysed at three geographical layers: the overall system (inside VCI, Porto first ring), the unit of the study illustrated in Figure 2 (Marquês area) and at the street level (where the initiative is implemented). Such analysis reflects the behaviour of the all spatial system and allows having a broader view on the geographical coverage of each initiative. To complement this perspective, effects are also analysed at a disaggregated level by stakeholder interest group. A major categorization is made at the micro-behaviour analysis distinguishing public and private objectives. Public objectives are often related to well-being of all stakeholders in a specific area, such as quality of life (accidents, noise, emissions, nuisance, etc.), economic vitality and mobility. Private objectives are often related to turnover levels like sales levels, customer levels, costs levels, service levels, and competition. To incorporate both categories in the microsimulation exercise, stakeholders are assigned to their main objective. Stakeholders whose main objective is public include (motorized) citizens and users of the city, public transport (city buses, intercity buses and taxis and the total of the motorized society. Suppliers on LGV's and on HGV's reflect stakeholders whose main objective is private. Along the simulation process, it is given in a first stage priority to the evaluation of the initiative under the main criterion of public objective. If the initiative reveals to be a good practice to that set of indicators, a more detailed analysis is followed to confirm it also fulfils the private objective criterion (vd 5.3.1). Such approach tries to make the different stakeholders interests more transparent and thus, optimize the process of decision making.

5.1 Scenario 1: Cooperative distribution systems

Physical limitations of the street to receive delivery operations added to the fact that 75% of the freight vehicles supplying the area have a load factor <50%, lead to the consideration of cooperative

delivery systems. Cooperative Delivery Systems (CDS) are systems in which loads are consolidated and a reduced number of trucks is used for collecting or delivering the same amount of goods (Taniguchi and Heijden, 2000).

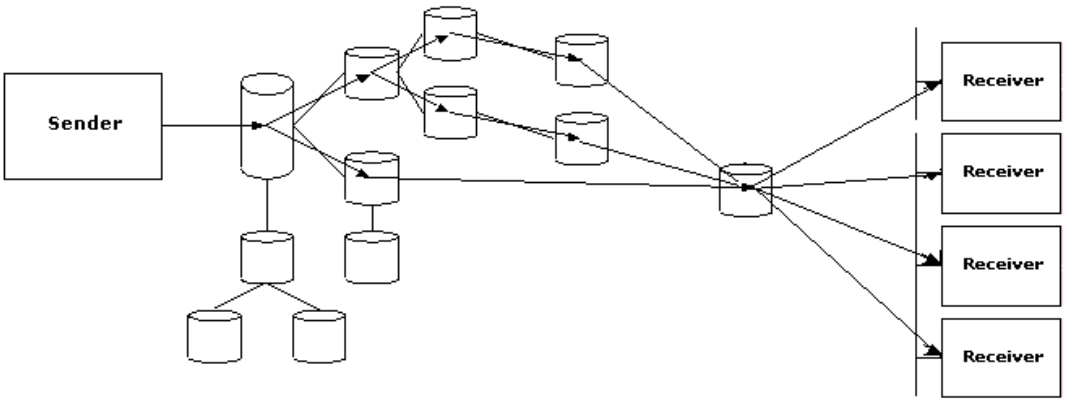

Figure 3. Cooperative delivery system

Scenario 1 represents a prediction of the effects of cooperative distribution systems. It assumes that freight vehicles that supply the area, aggregate the deliveries with an arrival time difference not superior to 30 minutes. Such condition implies that about 30% of the direct supply trips would be reduced, but each delivery and respective parking times at the street would take longer.

The simulation exercise assumed the initiative is in force 7 hours per day, 7 days per week covering the daily peak of deliveries in the area (7:00 – 14:00). The delivery patterns adopted on the exercise are the ones obtained during the survey. The parking time of delivery trips aggregating loads is the sum of parking times of those loads if they would be delivered separately. And lastly, the consolidation of loads is carried out in a micro-platform located outside the case study area.

Results reveal that on the overall system (city coverage) the effects of the implementation of cooperative systems in the area are negative. Such impacts seem to derive from the additional flows generated by the need to consolidate, but there is not a clear evidence of it.

Results by stakeholder group on the overall system reveal that the initiative is negative both to private and public stakeholders. The range of total effects is low [-7; 7]%, with total delays being increased by 7%.The general increase on delays and travel times (5%) together with a decrease on the average speed (<-1%) indicates a worst mobility in the overall system. Vehicles on the system travel a lower distance (-6%) due to congestion and therefore, consume less fuel (-4%). CO2 emissions vary with the amount of fossil-fuel use and its mix, which leads to lower values (-4%). CO, which results from incomplete congestion in traffic engines, increases due to congestion (+4%). NOx also presents a general slight increase of 3%. On the overall system, cooperative distribution systems are a negative measure towards mobility and sustainability.

At a lower geographical level, Marquês area, results are also negative in general (Figure 5), although with a higher range of effects on the total [-3; 14]%.

The decrease of the number of delivery trips with the implementation of cooperative distribution systems leads to an increase on delays (5%) and on travel times (2%). Such increase on congestion, also followed by a slight decrease on the average speed (-2%) lead to a very slight increase on fuel consumption (-3%) and CO2 emissions (-3%). Such reductions due to congestion are also visible on the increase of CO by 14% and NOx by 13%, respectively.

The negative effects felt at the unit level mainly affect public stakeholders. Private stakeholders have a positive, although low, impact. Suppliers on HGV's and LGV's would have a decrease on travel times by -6% and -7%, respectively, and delays would be reduced by -13% and -14%. Such improvement on mobility would lead to an increase on speed. Faster suppliers and a lower distance travelled due to CDS contribute for a reduction on energy consumption and on pollutants emitted. Despite at the unit spatial level results already show some positive potential, the low range of effects to a particular group of stakeholders is not enough to consider the measure as a 'good practice' at Marquês.

Finally, at the micro (street) level, the initiative has a negative impact for most of the stakeholders as illustrated in Figure 3. The reduction of the number of delivery trips with the implementation of CDS does not lead to an improvement on the mobility and sustainability of the street. Once the supplier has to make more than one delivery at the street, it takes more time to supply, implying a higher parking time and consequent stronger obstacle to the circulation. Such behavior affects in a significant and negative way all stakeholders with exception of the suppliers on LGV's. On the total, delays increase by 56%, travel times by 36% and the average speed is reduced by 10%. Such signs of increasing congestion are confirmed by a lower distance travelled and consequent reduction on fuel consumption levels and CO2 emissions. Suppliers on LGV's achieve a reduction on delays of 37% and travel times by 25%. To all the others, increasing travel times and delays, together with decreasing distance travelled due to congestion and consequent reduction on fuel consumption vehicles and CO2 emissions, are the general tendency.

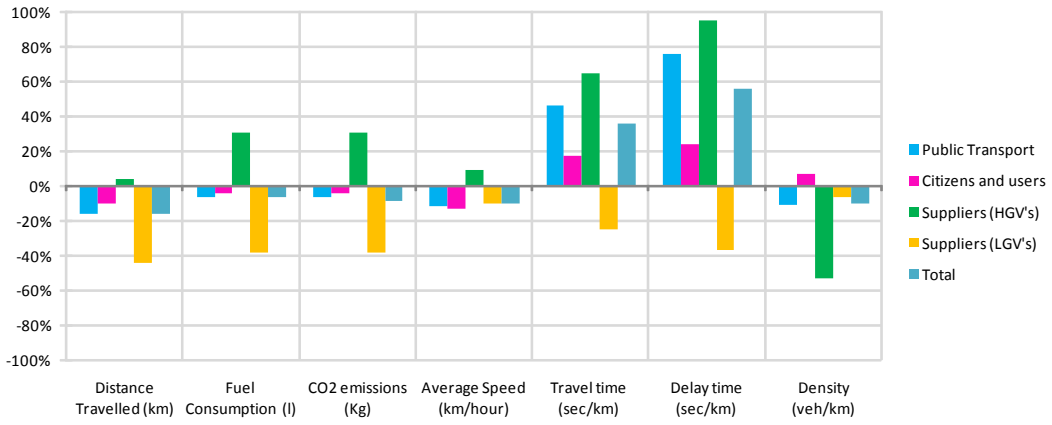

Figure 4. Cooperative systems at street level

Results illustrated on Figure 3 in terms of traffic analysis are counterintuitive. It would be expected that a measure forcing suppliers to consolidate to privilege the other road users of the city,

would benefit more the society in general. Results from modeling show it affects negatively public transport (STCP plus intercity buses) and citizens and users due to longer parking times to deliver. It also affects negatively suppliers on HGV's due to the additional distance they have to travel and it benefits suppliers on LGV's. Suppliers on LGV's have a share of 75% of the freight traffic and thus, the reduction of delivery trips is mainly done with their loads.

The analysis of cooperative distribution systems revealed the initiative can be positive to suppliers on LGV's, but with clear negative effects to the other stakeholders. The estimated impacts of cooperative distribution systems also revealed it is not a good practice at none of the spatial levels considered on this study. Moreover, the implementation of this initiative would not minimize the problems of circulation on the area, despite the reduction on the number of delivery trips. On the contrary, it would aggravate the existing problems due to longer illegal parking times.

The previous facts, together with the insignificant number of carriers that are willing to join such system, leads to low benefits on the overall system. With such effects, scenario 1 cannot be considered a better initiative to supply the area, under mobility and sustainability criteria, and considering public and private objectives.

5.2 Scenario 2: Collaborative delivery systems

The strong dominance of the fashion branch representing 44% of the stores located in the area lead to the suggestion of collaborative delivery systems.

Collaborative systems are promoted by shops belonging to the same business segment and by shops that sell products with similar physical and marketing characteristics, located within close proximity of each other's (Melo and Costa, 2007). Figure 4 illustrates suppliers included on collaborative delivery systems (grey tubes) along a typical supply chain network.

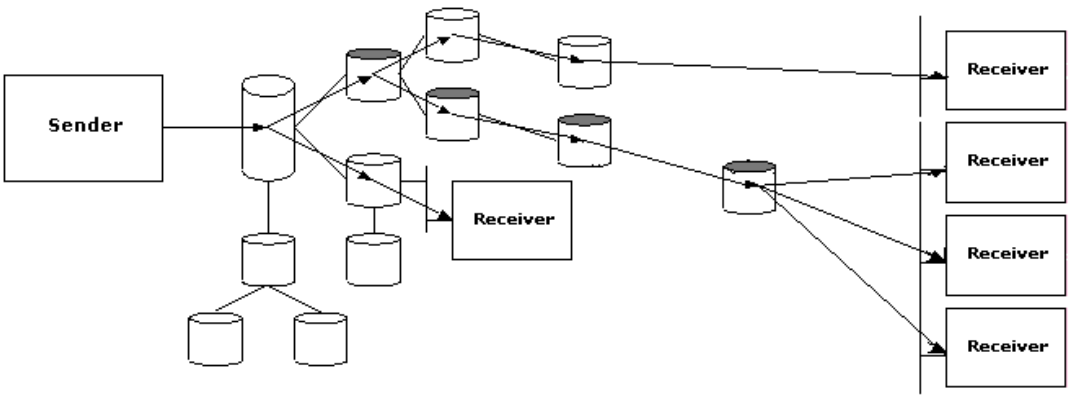

Figure 5. Collaborative delivery systems

Scenario 2 represents a prediction of the effects of collaborative systems. It assumes that freight vehicles that supply the fashion branch would aggregate their deliveries with an arrival time not superior to 60 minutes. Such condition implies about 40% of the supply trips would be reduced.

Results from simulation reveal the impact of collaborative systems in the overall system is negative. Although the overall relative differences, compared with the base case, are very low [-7%: + 4%] they are consistent enough to confirm a negative tendency. Increasing travel times (3%), delays (3%) and density (2%) show a decrease on mobility patterns caused by congestion. Such unease of movement leads to a decrease on distance travelled (-3%) by cars inside the study area and because of that time they are idling, lower fuel consumption (-2%) is registered as well as lower CO2 emissions (-2%). Co and NOx also increase by 4% and 3%, respectively due to a decreasing mobility.

These low but negative effects are not homogeneous to all stakeholders. Public stakeholders would feel a negative effect as well as one of the private stakeholders (suppliers on LGV's). Suppliers on HGV's would have small positive indicators, achieving a reduction by 1% on delays and by 1% on travel times.

On the overall system, collaborative systems are a negative measure towards mobility and sustainability. At Marquês area, results are already positive, contradicting the yielding tendency observed at the overall system. The effects are still low in relative terms but indicating a positive direction towards increasing mobility and sustainability. The general effects varies between [-5; 11]%, which is quite similar to the range of effects of scenario 1 to this level of analysis. Public stakeholders like public transport, citizens and users benefit from it, but private stakeholders, particularly suppliers on HGV's are the ones who get more advantages.

The decrease of the number of delivery trips with the implementation of collaborative distribution systems leads to a decrease on delays (-5%) and on travel times (-4%). Such decrease on congestion, also followed by a slight increase on the average speed (2%) lead to a very slight decrease on fuel consumption (-5%) and CO2 emissions (-5%). Such improvements on the quality of the urban environment are also visible on the decrease of CO by 3% and NOx by 4%, respectively.

The effects on suppliers on HGV's are more significant in most of the indicators: delays (-16%), travel times (-8%), average speed (3%), fuel consumption (-5%), CO2 emissions (-5%), CO (-2%) and NOx (-6%). Despite the low (but positive) dimension of the effects, the homogeneity of the effects to all group of stakeholders indicates collaborative systems as a potential deliver practice to the area.

At the street level, results confirm the previous analyses, but even with a higher range of impacts, from -37% to 10%.

Total general delays are reduced by 18% and travel times by 11%. These two indicators together with a higher speed (10%) indicate a better mobility, explained by the reduction of delivery trips and consequent reduction of obstacles to road crculation. The improvement on mobility leads also to an improvement on sustainability through the decrease on the energy consumed (-37%) and on the CO2 emissions (-38%). The ones who most benefit from such initiative are suppliers on HGV's and on LGV's (private stakeholders).

The analysis of collaborative delivery systems revealed the initiative is a good practice at the street and unit levels, but not at the city coverage. It would benefit more, expectably, private stakeholders, although its implementation would also require more from them than from the other actors. Determinants requirements like the existence of an informatics specific program to make the

deliveries, a particular depot to consolidate or the acceptance of shopkeepers to be included on such scheme make the estimated positive effects to be insignificant to convince public and private stakeholders to implement collaborative systems.

Very few comparable studies of urban goods distribution have been conducted and therefore, this study makes a valuable contribution to the field. Results of the survey and indicative estimations seem to confirm the benefits that might be derived from collaborative systems. However, this study should only be considered the first step of a more accurate study about the practical feasibility of collaborative systems. Besides the focus on the effects, like CO2 emissions and traffic congestion, a special attention should be given to the basis conditions, like costs and actors evolved. In what concerns to costs, a particular focus on the platform feasibility is required. In the present study it was assumed that once the platform already existed, no additional operational costs would occur, which is not true in most of the cases. In what concerns to stakeholders evolved, a more exhaustive analyze is required. Collaborative systems require a extraordinary goal alignment that can only be achieved by finding critical goals that stakeholders can agree on. Such initiative has more potential benefits for some branches than for others, thus it is needed a special effort to satisfy expectations of the main partners.

The previous facts, together with the insignificant number of actors that can join such system, leads to low benefits on the overall system. With such effects, scenario 2 cannot be considered a better initiative to supply the area, under mobility and sustainability criteria, and considering public and private objectives.

5.2 Scenario 3: Enforcement

The (ineffective) predicted effects of the previous scenarios lead to the suggestion of a strict enforcement. Parking enforcement significantly improves traffic flows, reduces congestion and contributes to the quality of life in the community. In London, for instance, the implementation of this measure reduced the number of illegally parking by 35% from 2638 vehicles in February 2006 to 1708 in February 2007 (TfL, 2007).

Scenario 3 establishes that freight vehicles are not allowed to park illegally to deliver on the area. All vehicles would be forced to park legally in the closest available and legal parking place in relation to the store to be supplied. According with the delivery pattern of the unit, such scenario would affect 100% of the freight vehicles supplying the area.

The simulation exercise assumed that the initiative is in force 7 hours per day, 7 days per week, covering the morning peak period of the bus lane and the daily peak of deliveries in the area (7:00 – 14:00). Suppliers do not park illegally and have a civic behavior, which implies not to park in a place creating an obstacle to the normal road circulation. The enforcement is put into practice only with human resources, without the use of additional automated technology. Outputs of the simulation exercise refer to the morning average hour.

The analysis of results by area of impacts reveals that a strict enforcement applied in the area would not have a significant impact in the overall system.

The range of effects at the overall system would be low [-11; 3] % as it was also observed with the previous scenarios. The effects of the enforcement in the overall system would be negative,

leading to a decrease in mobility and sustainability. The general effects in terms of density, travel times, delay times and average speed would be lower than 3%. The remaining indicators would be slightly higher in absolute terms, but still not significant.

An analysis of results by stakeholders group reveals that at city level, enforcement would be slightly negative for public stakeholders (public transport, citizens and users) but positive for private stakeholders, which is quite a surprising result. Such fact can be explained by the beneficial effects that suppliers of the all system feel from a system with less congestion, although the variation is too low to be easily explained by a direct cause-effect clarification.

At the unit level, in Marquês area, the results are (already) more positive towards an improvement of mobility. The range of effects are higher than at city level, varying between [-3; 8]% (not considering the CO and NOx variation). The decrease of the delays (-2%) and travel times (-1%) seem to indicate a lower congestion in the unit. The lower congestion added to a higher average speed (1%) reveal an easiness of movement, a measure of mobility. The distance travelled in the area increases 2% (due to the search for legal parking places). Fuel consumption and the CO2 emissions decrease -3%, suggesting an improvement of the sustainability of the unit.

At the street level, results are even more obvious and the range of effects clearly higher [-24; 19]% than at the previous spatial analysis. Delay times on the total decrease 44%, correspondent to 29 seconds along the street and travel times by 28%, correspondent to 31 sec/km. Such impressive results, together with an increase of the average speed of 5 km/h to 36 km/h, confirm a higher mobility along the street. Also in terms of sustainability, results are quite positive with average reductions on fuel consumption levels by 24% and on CO2 emissions by 19%. Only the indicator ‘distance travelled’ does not follow this remarkable positive tendency. The indicator shows a slight increase of 5%, mainly due to the need to search for an available legal place to park.

As it was expected, results are significantly positive to all stakeholders. Public transport is the one with lower effects, which is explained by the fact that in one of the directions there is an exclusive bus lane, where the effects are negligible. Intercity buses circulating on the other direction feel a low effect. Citizens and users experience the effects of the enforcement in a significant way, because incidents occur on the road direction in which they circulate. Suppliers are the ones that have more benefits in terms of mobility but also the ones which have to make a higher travel (distance travelled) due to enforcement.

In terms of mobility, the positive results observed along the street come mainly from the opposite direction to the bus lane, where the incidents occurred before the implementation of the measure.

The reduction on delays on the opposite direction to the bus lane of about 80% corresponds to 30 seconds along the street, which is considerably high. Also the increase on 11km/h to 43km/h and the decrease on travel times by 30 seconds confirm the impressive results on this direction.

Along the bus lane, the effects are more legible in terms of sustainability with a reduction of the distance travelled, the energy consumed and the CO2 emitted. The effects along this direction are clearly minor due to the fact the bus lane is not so significantly affected by the disappearance of illegal parking as the other direction.

5.3.1 Private Objective

Towards the positive results of enforcement at a first analysis (stakeholders and geographical coverage), on the criteria of mobility and sustainability – public objective - a more detailed analysis is followed to confirm it also fulfills the private objective criterion.

Considering the indicators used on the previous analysis and the translation of those values to a economic reference, the financial/operational impacts of enforcement are encouraging.

It were quantified by stakeholders group the fixed costs and the variable ones. The fixed costs included the taxes on the vehicle and park. The variable ones included the operation and maintenance, the amortization, travel time, delays and environmental externalities. The values (euro/km) to each of these costs were obtained from scientific literature (Small *et al.*, 2007).

Such calculations lead to the following conclusions: at the street level the sum of the costs would lead to a benefit along the street by 14.50 euros/day. To public transport the implementation of enforcement would be significant with a reduction by 12.40 euros/day. Citizens and users would experience a reduction of 4% on financial impacts. Taxis would have a benefit of 13% and suppliers on HGV's an impressive reduction on operational costs by 26% (corresponding to a benefit of 1.5 euros/day along the street). Suppliers on LGV's are the only group of stakeholders negatively affected by enforcement in terms of costs. The higher distance travelled due to the search for a legal parking place implies higher fuel consumption costs and higher vehicle maintenance costs. Consequently, operational costs would increase 22% to 2.1 euros/day along the street due to the increase on vehicle/costs.

If additionally to the operational, driving and vehicle costs, the environmental externalities are also considered on this analysis, these values slightly decrease (+0.80 euros/day along the street). Such effect is due to the increase on this distance travelled experienced by road users in a search for a legal parking place. The higher distance travelled by some stakeholders leads to higher environmental externalities.

Thus, in the total a benefit of 13.30 euros/day would be achieved and could subsidize the human resources expenses for assure the implementation of a strict enforcement.

The effects of the enforcement are significant at micro and meso level within the city, both in geographical coverage and in terms of consistent effects to stakeholders. To the unit and street levels, it is positive and clearly more easy and cheap to implement than other measures. These effects raise some doubts whether goods distribution in Porto really needs to implement innovative good practices or just to implement more strict enforcement.

6 Comparison of results of all policy measures

Table 1 summarizes the effects of the 3 initiatives towards increasing mobility and sustainability. Cooperative delivery systems is the less beneficial measure to supply the area, whereas the best one is the enforcement.

Measures considered 'good practices' by the scientific community and simulated in this paper to the specific context of Porto revealed that the benefits of each measure are rather visible at street level and decrease at a meso and macro level. Results at the overall system are rather low and the

relation cause-effect is not obvious to explain. Results at the street level are quite significant and easily readable and understandable.

Table 1. Summary of effects of initiatives towards increasing mobility and sustainability

	Public Transport	Citizens and city users	Suppliers HGV's	Suppliers LGV's	Society (Total)
Cooperative Systems					
System	Not conclusive	Negative	Negative	Not conclusive	Not conclusive
Unit	Not conclusive	Negative	Negative	Positive	Not conclusive
Street	Negative	Negative	Negative	Positive	Not conclusive
Collaborative Systems					
System	Not conclusive	Negative	Positive	Negative	Negative
Unit	Positive	Positive	Positive	Positive	Positive
Street	Positive	Positive	Positive	Positive	Positive
Enforcement					
System	Negative	Negative	Positive	Positive	Not conclusive
Unit	Positive	Positive	Positive	Positive	Positive
Street	Positive	Positive	Positive	Positive	Positive

Negative
Not conclusive
Positive

Two of them are in fact 'good practices' at a micro geographical level (street) and unit level, although none of them can have the same classification at the city coverage. With such effects, it raises the question of which stakeholders and priorities should be considered. Would it make sense to benefit stakeholders and street level affecting in a slight negative way the remaining actors of the system?

Stakeholders having more benefits towards mobility and sustainability are the suppliers, (followed in general) by citizens and users. Public transport (buses and taxis) usually are affected in a less positive way according with the chosen indicators.

7 Results

The paper evaluated and identified the potential of three initiatives to be considered as 'good practices' to supply the area, under the criterions of (operational) mobility and sustainability considering the local public and private interests.

The impacts of urban goods distribution initiatives strongly depend on local conditions of the experiments, so results obtained on this evaluation cannot be widespread.

All the initiatives were expected to lead to social and environmental benefits and thus, increase the welfare of the society, but the output of the simulation showed that the implementation of

enforcement would be the best solution (of the three) to improve the mobility and sustainability of the street and of the case study area. The significant benefits that are probable to happen with a strict enforcement seems to be strongly influenced by the fact that currently the one of the two lanes of circulation is often occupied by suppliers illegally parked. The practical implementation of such initiative should be done in a gradual way, after more detailed studies about the respective local and overall effects. It would also be prudent to implement a previous experimental period to validate the estimated benefits of the enforcement.

Additionally, this quantitative analysis should still be complemented with an empirical analysis, which tries to consider also the impacts of the non-motorized society. The overall results will predictably confirm what the microsimulation results already showed: the strict enforcement would be a 'good practice' to lead urban goods distribution on the direction of mobility and sustainability.

Regarding the organization of goods distribution system, sustainability and mobility may have a different meaning and content for each group of stakeholders. If all the interested parties can predict the effects of a specific initiative, the negotiation process is more transparent and can lead to an integrate strategy. On this sense, microsimulation revealed to have a determinant role to explicitly highlight those different interests.

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Annex

Cooperative distribution systems – Overall system

	Distance Trav.	Fuel Cons.	CO	NOx	CO2 emissions	Average Speed	Travel time	Delay time	Density
Total Motorized Society	-6%	-4%	4%	3%	-4%	0%	5%	7%	4%
Public transport	-10%	-10%	-10%	-15%	-10%	-4%	1%	2%	-9%
Citizens and users	-6%	-3%	6%	4%	-3%	-2%	6%	8%	4%
Suppliers (HGV's)	-2%	-10%	-3%	-17%	-10%	-4%	3%	3%	32%
Suppliers (LGV's)	-3%	0%	2%	2%	0%	-1%	0%	0%	40%

Cooperative distribution systems – Unit level

	Distance Trav.	Fuel Cons.	CO	NOx	CO2 emissions	Average Speed	Travel time	Delay time	Density
Total Motorized Society	0%	-3%	14%	13%	-3%	-2%	2%	5%	10%
Public transport	-5%	0%	-8%	-10%	0%	-2%	10%	17%	32%
Citizens and users	1%	-4%	15%	13%	-4%	-2%	2%	6%	8%
Suppliers (HGV's)	-4%	0%	-13%	-19%	0%	0%	-6%	-13%	67%
Suppliers (LGV's)	-3%	-1%	-9%	-14%	-1%	4%	-7%	-14%	-4%

Cooperative distribution systems – Street level

	Distance Trav.	Fuel Cons.	CO	NOx	CO2 emissions	Average Speed	Travel time	Delay time	Density
Total Motorized Society	-16%	-7%			-8%	-10%	36%	56%	-10%
Public transport	-16%	-6%			-6%	-11%	46%	76%	-11%
Citizens and users	-10%	-4%			-4%	-13%	17%	24%	7%
Suppliers (HGV's)	4%	31%			31%	9%	65%	94%	-53%
Suppliers (LGV's)	-44%	-38%			-38%	-10%	-25%	-37%	-6%

Collaborative delivery systems – Overall system

	Distance Trav.	Fuel Cons.	CO	NOx	CO2 emissions	Average Speed	Travel time	Delay time	Density
Total Motorized Society	-3%	-2%	4%	3%	-2%	2%	3%	3%	2%
Public transport	-5%	-6%	-10%	-15%	-6%	-2%	0%	0%	-10%
Citizens and users	-2%	-1%	6%	4%	-1%	0%	3%	5%	2%
Suppliers (HGV's)	-3%	-9%	-3%	-17%	-9%	-2%	-1%	-1%	36%
Suppliers (LGV's)	1%	5%	2%	2%	5%	0%	1%	1%	41%

Collaborative delivery systems – Unit level

	Distance Trav.	Fuel Cons.	CO	NOx	CO2 emissions	Average Speed	Travel time	Delay time	Density
Total Motorized Society	-5%	-5%	-3%	-4%	-5%	2%	-4%	-5%	11%
Public transport	-7%	-7%	-2%	-4%	-7%	1%	-2%	-4%	26%
Citizens and users	-5%	-5%	-3%	-3%	-5%	2%	-2%	-5%	11%
Suppliers (HGV's)	-6%	-5%	-2%	-6%	-5%	3%	-8%	-16%	20%
Suppliers (LGV's)	-9%	-9%	-16%	-29%	-9%	5%	-5%	-11%	-14%

Collaborative delivery systems – Street level

	Distance Trav.	Fuel Cons.	CO	NOx	CO2 emissions	Average Speed	Travel time	Delay time	Density
Total Motorized Society	-22%	-37%			-38%	10%	-11%	-18%	3%
Public transport	-23%	-35%			-35%	6%	-6%	-9%	3%
Citizens and users	-32%	-42%			-42%	4%	-27%	-36%	3%
Suppliers (HGV's)	-8%	-55%			-55%	49%	-49%	-74%	11%
Suppliers (LGV's)	-6%	-34%			-34%	21%	-29%	-44%	13%

Enforcement – Overall System

	Distance Trav.	Fuel Cons.	CO	NOx	CO2 emissions	Average Speed	Travel time	Delay time	Density
Total Motorized Society	-11%	-8%	-6%	-7%	-8%	0%	2%	2%	3%
Public transport	-13%	-13%	-5%	-7%	-13%	-3%	4%	5%	-4%
Citizens and users	-10%	-7%	-6%	-6%	-7%	-2%	2%	2%	3%
Suppliers (HGV's)	-10%	-11%	-5%	-9%	-11%	-6%	0%	-1%	34%
Suppliers (LGV's)	-10%	-7%	-16%	-29%	-7%	0%	-3%	-3%	28%

Enforcement – Unit level

	Distance Trav.	Fuel Cons.	CO	NOx	CO2 emissions	Average Speed	Travel time	Delay time	Density
Total Motorized Society	2%	-3%	17%	21%	-3%	1%	-1%	-2%	8%
Public transport	-3%	-4%	34%	25%	-4%	2%	-3%	-4%	19%
Citizens and users	2%	-3%	16%	17%	-3%	1%	-1%	-2%	7%
Suppliers (HGV's)	-2%	-2%	42%	31%	-2%	-1%	-6%	-13%	63%
Suppliers (LGV's)	-3%	-3%	22%	29%	-3%	2%	-3%	-7%	-7%

	Enforcement – Street level								
	Distance Trav.	Fuel Cons.	CO	NOx	CO2 emissions	Average Speed	Travel time	Delay time	Density
Total Motorized Society	5%	-24%			-19%	19%	-28%	-44%	0%
Public transport	7%	-18%			-18%	12%	-25%	-40%	0%
Citizens and users	8%	-11%			-11%	17%	-34%	-47%	0%
Suppliers (HGV's)	-4%	-65%			-65%	84%	-59%	-87%	0%
Suppliers (LGV's)	38%	-14%			-14%	45%	-55%	-82%	-1%

Interface of Entrecampos, Lisbon: New Functions, New Usage Dynamics

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As buildings of large dimension and importance in contemporary cities, rail interfaces play important roles in passenger transport and as transitory spaces, related to waiting. As equipments associated with movement or short periods of stay, the purposes of these facilities focus on tasks of limited size and scope, such as shopping or catering. Transport hubs have asymmetrical daily occupation rates: sometimes saturated within their periods of maximum use, other times empty, creating imbalances in their use throughout the day. Allied to the absence of complementary functions, the increasing use of private transport over public transport is reflected in these underused facilities, which can become unsafe and uncomfortable for the user. Regarding concepts such as urban regeneration and sustainability, this study suggests the reconfiguration of the interface's program so that it may function as something more beneficial for users and their city. Adding programmes such as exhibition areas and spaces oriented for informal learning and reading like libraries and cyber-cafes can revitalize these public equipments, while boosting their urban and social surroundings. By exploring these guidelines, this study aims to combine relations and interactions between situations of stay and fluidity in the new proposed uses, without compromising each other. Global strategies applicable to interface networks in metropolitan areas are suggested on the study based on the analysis of the Interface of Entrecampos, in Lisbon. The applicability of culture, learning and leisure oriented uses and their programmatic contamination resulted in both new architectural and programmatic proposals for this equipment.

Keywords: Interface, culture, learning, idea store, public building

1 Introduction

Usually represented by structures of large dimension and importance in modern cities, rail interfaces play a significant role both in passenger transportation and also as major waiting places. Most of them are not fully used. Normally associated with a brief passage or a short stay, they contain services that focus mainly on commerce like small shops, restaurants, coffee shops or kiosks.

Another feature of these spaces is their cycle of daily life - sometimes saturated of people (especially during the work period), sometimes associated with emptiness, often causing discomfort and insecurity in their users. The poor use of these public facilities may be explained by the lack of complementary uses. This situation reaches its highest expression during the weekend, usually related to the use of private transport at the expense of public transport as a means of travelling within and outside the cities, also compromising the frequency of public transport.

These inhibitions to the use of public transport by users could be resolved by restructuring the interface's programme, so it can function both as a transport station and something more, encompassing short waiting periods and other complementary roles. Thus, combined with cultural spaces such as art galleries, museums and exhibition areas, and functions oriented to informal learning such as workshop places, libraries and reading rooms, the interface can be revitalized while boosting the surrounding areas. By using the swinging motion paths home/school/work, interfaces can accommodate spaces for loan/rental of books and multimedia material, supporting the idea of self-learning and lifelong learning.

Equipments such as museums, libraries, cafes and train stations are contextualized historically in their evolution, from the national to international cases (whenever possible and justifiable), with particular emphasis on a more recent past (since 1960).

1.1 Methods and Goals

This study addresses the issue of integration and adaptability of cultural and learning practices in transport hubs. The key objectives are:

- Awareness of development of the equipments mentioned and their current situation, with particular focus on programmes of social use (rail stations, museums, libraries, cafeterias and *idea stores*);
- Assessment of needs and / or space requirements, as well as functional and environmental constraints of the urban interface, towards the inclusion of new uses;
- Exploration of forms of usage of the physical space if the interface through the combination of several functions;
- Formulation of principles to be considered in programmes of remodelling / rehabilitation of existing railway interfaces – within the case-study of the Interface of Entrecampos, in Lisbon;
- Exploration of the applicability of these concepts, associated not only for consumption but also to the loan of goods.

Documentary research was done on these infrastructures related to culture and learning, as well as on the concepts of interface and leisure.

2 Theoretical Framework

The act of travelling inside and outside of cities is one of the features that characterize the contemporary way of life in major cities. As well as museums, the interfaces have provided large urban regeneration in places where they operate, becoming the brand images of the place that hosts them. Given the growing developments in areas adjacent to the location of the interfaces, they are dynamic places that can accommodate people of almost all social strata. Stations and railway lines should be seen not as obstacles but as means of facilitating the life in the city, therefore constituting excellent public spaces.

The proposed functions to qualify the interface can be categorized in three types: culture, learning and leisure. The proposed framework is expected to set out the uses that are considered to be more appropriate given the demands and habits of the contemporary society. Thus, for each institution studied, it is drawn its role in the future as additional value to the interface. This study focuses then on the following concepts:

The interface / transit space;
The museum / exhibition space;
The library / reading room;
The coffee shop / space for leisure;
The idea store / multifaceted space.

In the present metropolitan areas, the interface constitutes the “first impression” when arriving to a city by train. These equipments tend to aggregate different systems of transport like trains, buses and taxis. Consequently, around them or sometimes already an integral part of its programme (in the most recent cases of new construction), these facilities contain hotels, housing, services and shopping areas, in addition to other uses. When compared to the other institutions mentioned, the interface represents a competitor as public space. The combination of these different functions should be seen as an asset, and the junction of these programmes should represent a new step in the evolution of them all.

The interface is also addressed within its concept, development and national and international scenarios. The main goal is to understand it as a main area of transit, and to diagnose its needs and constraints (programmatic, functional, environmental, ergonomic, etc.), regarding the capacity to receive the proposed new uses.

As public equipments, the interfaces must meet certain functions and provide their users with experiences and references. In the particular case of public space and the various forms it can assume, the ability to adapt and change in order to develop and improve, is the key element in the extension of its existence, and offer meaning to the community served by it. Interfaces, museums, libraries and cafeterias are considered public spaces that serve people, and should therefore be provided free access to them. Equipments with such strong social missions as those examined, often reflect the image of the city, its culture and its people.

The usage associated with particular equipment is likely to change, according to constructive, technical, functional or symbolic principles. The tradition of an equipment or institution reflects and is reflected in the community that surrounds it. In an independent and simultaneously related way to these changes, the creation of a sense of identity and community is one of the most important factors in an increasingly globalized and uprooted society.

In several situation, as exemplified throughout this study, Portugal has been introducing new uses on programmes and institutions once crystallized in time or in obsolescence, bringing them into a contemporary setting that is ruled by the so-called “information society”.

2.1 The Interface / Transit Space

Trains had a rapid development in the transport of goods, however, its creation has seen its services extended to passengers only after a certain time.

In the second half of the nineteenth century there was a progress on issues of safety, comfort and speed, especially in passenger transportation. The architecture of iron and glass had a significant and distinctive role in the construction of train stations, given the huge apparent lightness and grandeur while allowing the creation of large spans, allowing generous internal spaces. It is common to find buildings with metallic structures in equipments such as markets, greenhouses or exhibition spaces, particularly at the beginning of the nineteenth century. It was a versatile type of architecture associated with great construction requirements, quality and beauty. Some of these buildings have undergone changes in the program over their lifetime[1].

At the end of the 2nd World War, rail service has fallen due to the development of commercial aviation industry regarding long distance travelling. Also, the increasing use of private car at the

beginning of the twentieth century to travel short and medium distances, allowed the "door to door" trip with greater convenience and privacy[2]. However, the 1970s bring back the idea of mass transit by public transport and economic means of travel. The return to the use of public transport, in the particular case of the train, has its origin related to the peripheral expansion of cities, a process that introduced new objectives of the program of the train station, meeting new needs. The route is no longer limited to the travel route itself, but also related to the pathways preceding and leading to it. Therefore, the origin of transport interfaces arises naturally.

The proximity of railway stations to certain land and housing, offices and commerce, tends to increase their property value[3]. Like many other public buildings, rail interfaces attended the arrival of modernization at the expense of insertion of new uses. These new functions complemented the internal management services of the station and its direct operation and maintenance.

In large cities today, the interface works as “business card” to people who arrive by train. These facilities tend to operate aggregating different transport systems like metro, buses and taxis. Therefore, around them or sometimes already part of their program (in the most recent cases of new constructions), these facilities include hotels, shopping centres and offices, along with other uses. Besides rail interfaces, also airports contain extensive areas entirely devoted to shopping and other complementary uses. We can find such examples in Madrid-Barajas Airport (Richard Rogers, 1997-2005) or Schiphol Airport (spaces like Lounge 1 and the Plaza, by Bentham Crouwel Architects, 1999-2005).

Figure 1. Masterplan Euralille, France and Atocha Station, Madrid, Spain

The European case has some of the best representations to these mergers. Take the example of Lille (France), which has seen great evolution since 1989 until 1994. The Euralille Masterplan included the complete regeneration of 80 ha of urban area. The project contains commercial areas, offices, hotels, housing and an urban train station linking to high-speed lines (TGV). Another example is the railway station of Atocha (Madrid, Spain), designed by architect Rafael Moneo and completed in 1992. It contains catering, service and garden spaces that complement the architectural design of the station. Outside, the large square that serves the main entrance provides a generous public space that serves both the station as the city, acting as a point of arrival and meeting.

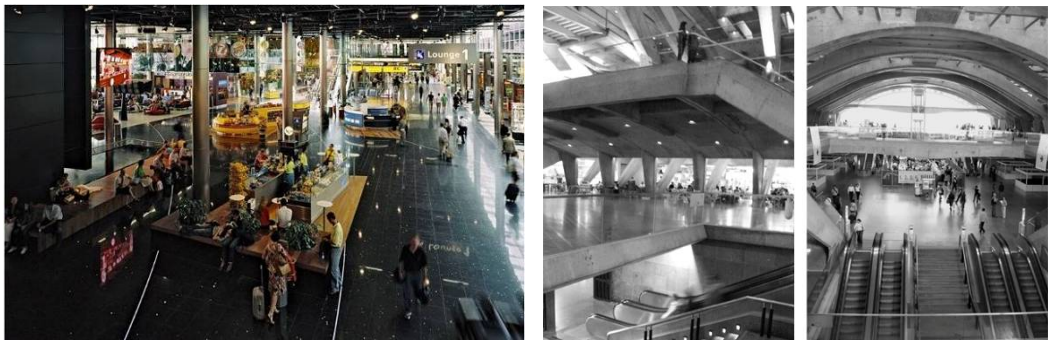

Figure 2. Lounge 1, Schiphol Airport, Amsterdam; Gare do Oriente, Lisbon.

2.2 The Museum / Exhibition Space

"No seu interior, o museu transformou-se num lugar destinado à afluência maciça de um público activo, aos estímulos, à interacção e também ao consumo no seu sentido mais amplo [...] Na sua relação com o exterior, o museu reforçou a sua dimensão colectiva e tornou-se num dos lugares públicos mais característicos da cidade contemporânea." [4] (Josep Maria Montaner)

The museum has been suffering both physical and conceptual changes since its creation, regarding its program and its architectural layout. They are considered interesting manifestations of the major social and cultural changes occurring in the twentieth century. Museums are also characterized by a pronouncedly urban expression and by the social mission they represent. Due to their metamorphic nature, museums are some of the institutions that "more evolved over time" as suggested by Maria Luisa Bellido Gant[5].

The model of society is guided by a strong notion of consumption and "massification" and is also driven by a strong sense of recovery and return to the origins of an historical past[6], since the second half of the twentieth century. Still, the great commitment is made to the future. The rapid development and exponential growth of cities and of their consumer societies have determined the increase (in quantity) of these institutions. Society also responded to the museum by the mass influx of visitors. The museum was thus part of the development of a city, often being included in its strategic plan. The awareness of a *collective identity*[7] came along with the museum programme, and large cities like Paris and London found in it important means of seduction and cultural dissemination. Since the first world exhibitions, architecture and architects have important roles in the materialization of ideas in vanguard spaces. Even today, the program of the museum is inseparable from its architectural language, which often served as a pretext for the design and mediatization of these spaces.

2.3. The Library / Reading Room

"We are drowning in information but starved for knowledge." [8] (John Naisbitt)

Libraries are known to offer a unique public service. Therefore, their programme has been adjusted to complement other spaces over the years. Institutions such as museums, bookshops and even cafeterias have been incorporating informal reading rooms and cyber-cafes, sometimes even providing loan and rental of books, documents and multimedia. In the UNESCO Manifest on Public Libraries (1994) the tasks of the public library have been defined, which sought to incorporate notions

of information, literacy, education and culture, aiming at personal development and self-learning. Often considered the “local information centres”, libraries should be the bearers of a social mission that provide services “on the basis of equal access”. It was also important that their collection reflected current trends in the evolution of society and preservation of their memories.

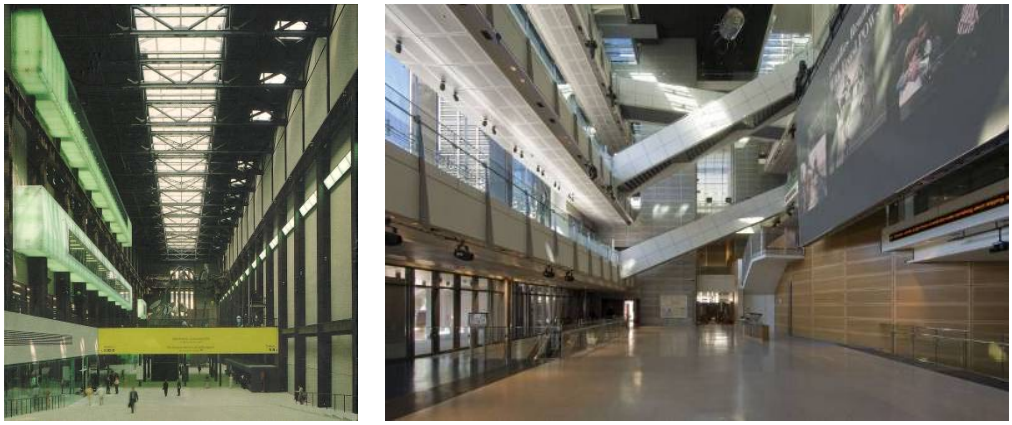

Figure 3. Tate Modern, London; Newseum, Washington.

The nineteenth century has brought largest developments such as the remodelling of internal space (by removing books from the shelves of reading rooms, separating and create hierarchy in the functions of demand and reading) and the creation of public libraries. First in the U.S. and then in England, the establishment of the first *free public libraries*[9] was a major step in bringing the reading closer to its public.

As an architectural concept, the library wasn’t always the same, having changed throughout its existence. Rudolf Anaya suggests that "the library should be the heart of the city"[10] and also be considered as centre of culture like museums and other cultural institutions. As equipments of large dimension in cities, their existence is often linked to an architectural domain. The extension made by Philip Johnson for the Boston Public Library (picture 8) and the Seattle Central Library of Rem Koolhaas (see picture 9) are good examples where the architectural programme met the functional programme. Also, the National Library of France in Paris (Dominique Perrault, 1989-1995) constitutes an example of urban restructuring and grandeur of scale, while the Peckham Library in London (Alsop and Stormer, 2000) reflects the usage of modern materials and constructive solutions that represent contemporary architecture language.

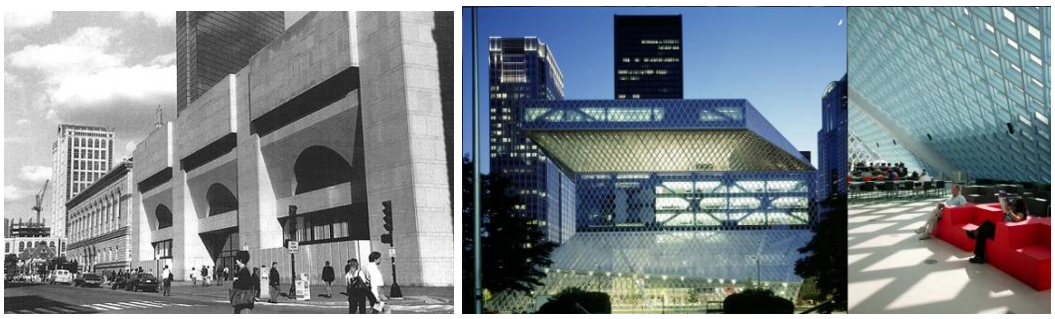

Figure 4. Extension to the Boston Public Library, Boston USA; Seattle Central Library, USA

At the same time, in the last two decades, it has been given particular attention to the entrance of the library in the digital and virtual worlds. Through the provision of library collections online, it is now easier to query and request their titles by the user. This will allow immediate access to the contents of libraries at any time and place. In a similar way, bookstores also adopted similar systems to disclosure their contents (a good example is the Amazon website).

The way forward is strongly related to the development and deepening of the strategies already undertaken by libraries and bookstores in order to increase and diversify their public. If the lending of books among friends and family has a great weight when compared to other forms of acquisition (buying), it is recommended the exploration of loan and lease strategies by rethinking the spaces that only allow the sale or consultation. Concepts such as book crossing (exchange and sharing of books between strangers creating a chain of information) can be successful and are already implemented in Portugal. The Magnolia Caffé, in Lisbon, exemplified in the following chapter dedicated to coffee shops, is a good example of these initiatives (Figure 5).

2.4. The Coffee Shop / Space for Leisure

"(...) é esse o principal objectivo de um café europeu: dar-nos a possibilidade de nos demorarmos mais tempo do que seria aceitável, mas desprovidos de qualquer sentimento de culpa. Não admira que a maioria dos grandes filósofos do mundo fosse originária da Europa: passavam muito tempo nos cafés, deixando o espírito vaguear até que lhes surgia, repentinamente, a ideia de uma corrente filosófica radicalmente inovadora (...)" [11] (Eric Weiner)

As previously mentioned, cafeterias and other catering places exert a high power of seduction among the public. Thus, institutions such as museums and libraries have adopted these services as a complement to other that already have, providing areas for relaxation and consumption. Being spaces of relaxation and conviviality, cafeterias and programmes alike can give some identity to the area where they are located, establishing close relations between the visitors and the institution that they complement. Such spaces are often catalysts for change, since sometimes work in different and more extensive hours than those of the institutions where they are, boosting them in a way that can lead to the extension of their opening hours.

A trip to the cafe / restaurant is one of the most recorded Portuguese practices of sociability[12]. Cafeterias and restaurants assume important roles in urban regeneration, captivating new public and introducing new dynamics in the equipment and area they integrate. Their urban relevance remains unchanged and even stronger, and cafeterias continue to be meeting points of relaxation and conviviality. Currently there is a strong search of architectural design in order to increase the quality of service, both in remodelling of existing spaces and creation of new ones.

Coffee shops and restaurants are places of leisure that were long taken up by equipments such as museums and libraries. The bookshops are no exception to this and in Portugal, the sale of books, CDs and DVDs of music and movies in spaces such as FNAC, have seen the incorporation of cafes, proving once again that reading and recreation are far from being separable.

Figure 5. Restaurant at Centre Pompidou, Paris; Magnolia Caffé, Lisbon.

2.5. The Idea Store / Multifaceted Space

"A public space is a 'human construct, an artifact, the result of the attempt by human beings to shape the place and thus the nature of their interactions'" [13] (Marcel Hénaff)

The beginning of the twenty-first century brought an interesting materialization of programmatic contamination within uses in one space. The project was born in London, under the name of "idea store". Generally, an "idea store" reflects the multidisciplinarity of the concept and space it displays. This space is a revolutionary idea when it comes to the integration of society and cultural offer in a space dedicated to cultural and learning activities in a participated environment[14]. This theme will be reinterpreted in this paper as a contemporary example of what this proposal intends to achieve. The main targets are the urban train interfaces existing in Portugal, and is also aimed the renewal of both interface programmes and the surrounding areas served by them. Therefore, it is necessary to understand the implications of the combination of exhibition spaces, reading, consultation, learning, information, relaxation and recreation areas for all ages and social strata in a single place.

These concepts are allied to the combat to social exclusion[15], which will be crucial in the strategic positioning of the idea stores in London, particularly in demographic and culturally diverse areas, in order to enhance and take advantage of their cultural wealth. Today, when we talk about globalization, in an urban approach, such expression can be interpreted as a city that does not belong somewhere beyond its own country, and it is defined not only by its size or number of habitants, but also for its richness and diversity in many different areas (social, cultural, economic, among others).

Underlying ideas of the continuity of space by the absence of physical barriers and obstacles, flexibility and adaptability of internal spaces are suggested by the contemporary architectural design, whether by the choice of materials and by the overall language that characterizes the project[16]. Principles of universal design[17] are key factors of the architectural layout of the building.

Other criteria of attractiveness of the idea stores and similar places are:

- The possibility of being seen as meeting places for colleagues / friends;
- Availability of space for meals and take-away;
- Proximity or inclusion of a supermarket;
- Proximity to public transport - preferably in the points that lie on routes between work, school and home

Figure 6. Interior of an Idea Store: children area, library self-service and cafeteria

The first idea store opened in 2002 in Bow (London), by the hand of the architect Bisset Adams. Since then, three more were also open in London following the same principles, by architects like David Adjaye (idea of stores Chrisp Street and Whitechapel) and Dearle & Henderson (Canary Wharf)[18].

The recent transformation of the concept of library through the inclusion of cafeterias, spaces for exhibitions and other events is an example of the increasing need for diversification of what an institution has to offer its visitors. Among the public spaces devoted to reading in Lisbon, in recent years the city has given the residents (especially students) free spaces equipped with multimedia rooms and internet access, providing spaces to individual and group study. There are now five of these “Espaços da Juventude” (youth spaces), situated throughout the city. As in the case of the idea stores, although offering much smaller areas, these spaces provide different information services in the areas of housing, education, employment, health, culture, sport and environment[19].

However, there is still a long way to go, both in the dissemination of these spaces within their target audience, as well as in their improvement and diversification. Idea stores are an excellent model to follow and adapt to the Portuguese scenario.

Figure 7. Interior of Espaço da Juventude as Aqua Roma Shopping Center, Lisbon

3 Case-Study: Interface of Entrecampos, Lisbon

3.1 Area of Entrecampos, Lisbon: Brief Contextualization

The current train-subway interface of Entrecampos was chosen to be the subject of this paper given its current misuse and undervaluation. The building is situated in the parish of Nossa Senhora de Fátima, in Lisbon. The parish is bounded by major road axis that cross important tertiary services areas in the city, like Av. of República.

Figure 8. Interface of Entrecampos, Lisbon: South Entrance (esterior and interior) and Level 1

One of the most important occurrences in the area of Entrecampos was the tertiarization suffered by many of the residential buildings that befringe important historical avenues of the city. In the interior of many buildings, housing was replaced by offices and services. At the same time, traditional commerce started losing ground to the emergence of large standardized commercial areas like shopping centres. However, as is the case with other equipments and programs, this trend is cyclical, and the there has been a return to residential programme in some cases. These actions are a result of policies made as an effort to bring back habitants from suburban and, generally, disqualified areas.

Entrecampos is a fragmented area in its urban layout and uses. The neighbourhoods of Santos and Rego are affected with empty houses and precarious build, and are corseted by road axes of great structure and importance in the city. The railroad constitutes another physical barrier, often befringed by expectant ground.

It is expected that the current initiatives in housing and urban development reverse the loss of population in the inner city to the adjacent counties included in the Lisbon Metropolitan Area. If, on one side, the expansion of the transport network aims to facilitate access from the periphery to the centre of the city, it is also partly responsible for the migration of the population, since it creates all the conditions for fast and convenient transport for neighbouring counties, where the cost of housing is significantly lower.

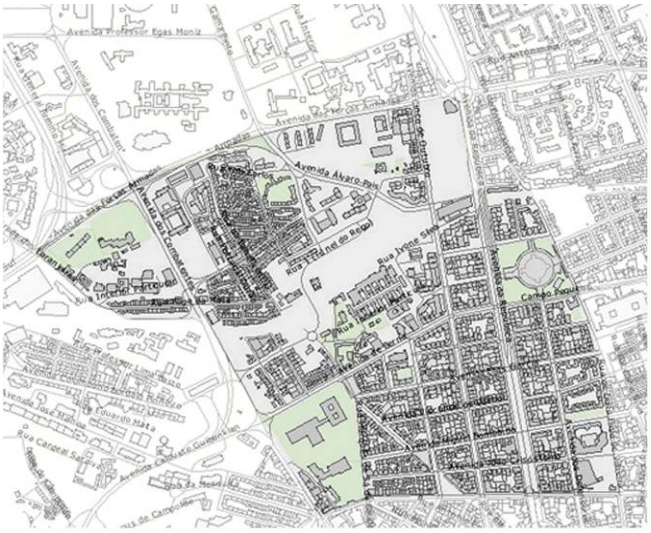

Figure 9. Parish of Nossa Senhora de Fátima, Entrecampos, Lisbon

These questions sometimes dubious and difficult to solve, have required considerable attention in recent years. Since 2002 there was a slight reversal of these negative trends[20], with the arrival of a large number of young people to the city, mostly university students[21].

3.2 The Building

Designed by architect Carlos Roxo, the train-subway interface of Entrecampos opened to the public in 1998. In terms of accessibility and transport, the new railway station is a viaduct built over Av. da República and Av. 5 de Outubro, two major tertiary arteries in the city. This equipment allows a direct connection to the subway network under Av. da República. The layout decision had negative impacts on uniformity, fluidity and closure in the urban district of Santos.

The current interface of Entrecampos is part of a set of strategies in the context of the modernization of rail transport that occurred in the past years in Lisbon. The building is organized into three levels: level 0 - main entrance and access to the subway on the levels below; level 1 - a mezzanine that distributes pedestrian flows to the four train platforms, and level 2 - containing the four platforms (section represented on figure 11).

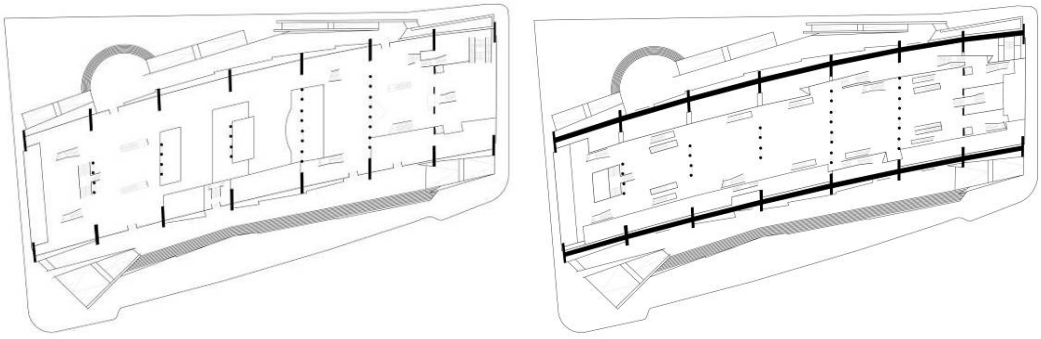

Figure 10. Interface of Entrecampos: floor plan of level 0 and 1

Figure 11. Interface of Entrecampos: transversal section

3.3 SWOT Analysis

The analysis of the current situation and capabilities of the interface as a public equipment is based on a SWOT analysis (Strong, Weak, Opportunities and Threats) of the various positive and negative aspects observed.

Strong

- Strong rotation and continuous presence of people throughout the day;
- Existence of periods of low rates of use and /or stay of users;
- Presence of underused or sub-profitable spatial resources underused.

Weak

- Overuse of people at "rush hours";
- Low safety and psychological comfort factors that coincide with periods of decreasing use of the interface;
- Effects of stress on the user that inhibit a comforting use of the interface;
- High values of noise and vibration that interfere in the comfort of the user;
- Problems of surveillance.

Opportunities

- Restructuring of the interface uses allowing extension of opening hours, services and transport;
- Learning and culture accessible to more people, quickly and easily;
- Provision of space for relaxation activities for research, study, reading, among others;
- Intergenerational contact.

Threats

- Shock between different uses of stay and transition associated with periods of increased pedestrian traffic;
- Issues of control and security against theft during periods of increased use of the interface.

Monthly, on a regular basis, the Interface Entrecampos receives over a million passengers. This number represents asymmetries of occupation according to the daily "rush hours" and the weekend (usually whit less occupation when in comparison to the working days of the week).

In addition to these inequalities of occupation in the diachronic plan, the spatial plan of the station is also bearer of imbalances regarding the use and occupation by its users. The West side of the building is least used, between the North and South entrances. On the East side, the República avenue has, in terms of uses, accessibility and connections to other means of transport. Therefore, it has a considerably large weight as opposed to what happens in the surroundings of the West side of the building. Such situation justifies the increased flow of people that occurs towards the East side of the building. This is exacerbated by the fact that the connection to the Metro is made also in that area

of the building, at the -1 level, under the ground. The underused West side of the station reveals problems of security and surveillance, at both levels 0 (entrance) and 1 (mezzanine).

The new uses of culture, learning and leisure proposed in order to qualify the interface of Entrecampos are expected to be a practical answer to these problems. In addition to the strategies that are already under development in the city regarding to accessibility and mobility (development and modernization of systems and equipment associated with public transport), the proposal made within this study also aims to increase the use of public transport by the city habitants. Supported by these premises, this proposal was elaborated in order to take advantage of the opportunities observed within the SWOT analysis. Making use of the possible "threats" to the interface, the proposal aims to achieve both building and urban restructuration.

4 Proposal

4.1 Introduction

The proposal is justified by the adequacy of the concepts of exhibition space, café and library to the interface, as catalysts for change. These concepts are materialized in the program and architectural layout of the space in which the proposed new uses are divided in into three general categories: culture, learning and leisure. These categories, as well as the physical spaces in which they can be architecturally materialized, must be seen in an integrated way, allowing programmatic contamination between them, which is one of the major goals of these premises.

Versatility monitors new trends of traditional spaces, and the three categories offer new appealing and dynamic spaces such as cyber cafes, exhibition spaces, libraries and study rooms. The adaptability of the new interface functions is operated under the terms of functional, environmental, ergonomic and programmatic requirements.

Regarding the institutions early presented in this study, it is suggested a strong intersection and interaction between them, one that can be embodied in various ways, always in order to widen the existing situation. The following proposal suggests the introduction of practices related to culture and learning in the building of the rail station, stimulating it and making it profitable. When looking at the referred categories - culture, learning and leisure - the latter is the only one already implemented in the interface in the form of shops and cafeterias.

After analyzing the concepts of museum, library and cafeteria, it is almost impossible to associate each one separately to a distinct use, since it was shown that it is possible to learn, “live” and acquire culture in all of them. However, the museum, when embodied in a space exhibition, is here considered a cultural use. Thus, the library, if materialized in a reading or multimedia room, is associated with learning. The cafeteria, for its high level of informality, is usually associated with a use of leisure. However, all these uses are complementary and intersect. This merger was successfully proven in London by the idea store concept. Therefore, this will be the base to the materialization of the ideas presented in this study.

There are several points where all uses intersect, which are primarily associated with the user, both as an individual or an element of a broader community. This is the major criterion to be taken into account, further enhancing these relations through the interconnection of different uses, or in

combination of activities, whether in sharing the same space - the interface. The idea stores established their implementation according to the proximity to public transport. This proposal goes one step beyond, bringing the concept “inside” of public transport (integrated in the interface building itself).

Given the high power of seduction exercised by cafeterias and restaurants near the public, these commercial uses are designed as a complement to programs like museums, libraries and bookstores. The existing commercial spaces in the interface of Entrecampos support the idea that these uses are profitable. The “Café com Livros” cafeteria and bookshop (mezzanine, level 1) has greatest potential among the existing stores. Consisting on a cafeteria with esplanade area linking to a bookstore, the ensemble gives direct access below to a stationery shop and an art gallery on the ground floor. Information gathered among the users and shopkeepers, there is the indication that the coffee shop has a lot more users than the library adjacent to it. This may be due to the fact that the existing esplanade provides an area with seating, filling one of the major gaps of the station.

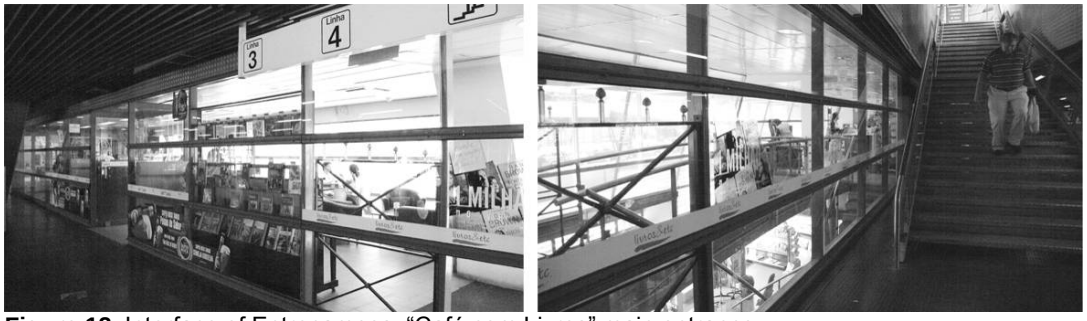

Figure 12. Interface of Entrecampos: “Café com Livros” main entrance

A smart example of incorporation of an exhibition space in a equipment for passenger transport is the extension of the Rijksmuseum at Schiphol airport in Amsterdam, which also includes a small museum shop (figure 13).

Considering the present case-study, with the average of over one million passengers per month, there should be an investment on other uses than strictly commercial, taking advantage of this situation to implement the new presented uses.

Figure 13. Extension of the Rijksmuseum at Schiphol Airport, Amsterdam; Metro dos Moinhos subway station, Lisbon

In the case of the reading areas, a simple observation *in situ* has shown that, wherever there is a seat, there is almost always a passenger with a book or a newspaper in hand, waiting for the train. The lack of qualified waiting areas incites in the free appropriation of the station by its users, not always resulting in secure or comforting conditions.

Figure 14. Users of the interface of Entrecampos: waiting and reading places.

Altogether, the interface and its complementary new uses have strong capabilities to provide intergenerational and intercultural relations with the surrounding areas, thereby complying with a pronouncedly social role capable of creating urban moments, memories and experiences, exploring the topic "opportunities" mentioned in the SWOT analysis.

Regarding pedestrian pathways, according to the observation made in site, on both floors, the largest movement of people can be found in the East side of the building, where connections to other means of transportation can be made.

Figure 15. Interface of Entrecampos: 1. Shop, Level 0; 2. “Café com Livros”, Level 1; 3. Cafeteria, Level 1; 4. Musical instruments store and fast-food restaurant, Level 0.

One of the goals of this proposal is the inclusion of uses that capitalize on the surrounding urban environment and community, thus creating the notion of "place". It is also attempted, through architectural design and recasting of the interface's program, to define and emphasize the concepts of community and identity that help materializing a sense of place.

4.2 Proposal Details: Internal Circulation, Functions, Assessment and Conflict Evaluation

Looking at the pedestrian flow of the internal interface, over several days of the year, allowed to conclude that the station functioning was being made "in reverse". It was observed that the concentration of public and private services at the top East of the building generated much underutilisation and insecurity at the West end of the station, which connects to avenue 5 Outubro.

Figure 16. Interface of Entrecampos, access to subway on level -1

The station is organized in three floors, which lead to questioning if the problem could be justified by the existing architectural solution. Floor 0 is slightly lowered in comparison to the exterior, and the North and South entrances are supported by outdoor ramps and stairs. All internal access and vertical distribution is made by mechanical means and stairs (escalators and elevators) – from floor -1 (access to Metro) to floor 0 (main entrances) to floors 1 (mezzanine) and 2 (rail platforms).

The first floor is apparently "detached" from the North façade, forming a generous mezzanine, whose function is to distribute passengers to the platforms above and also to the commercial uses and private services concentrated along the South and East façades. All the main entrances are situated under the mezzanine, at level 0, which raises issues on the usefulness and meaning to the mezzanine as it is today. Having no direct communication with the exterior, the mezzanine dependent on vertical communications (figure 17: red - elevators, orange - stairs), representing a breach to the fluidity of the pedestrian flow between levels.

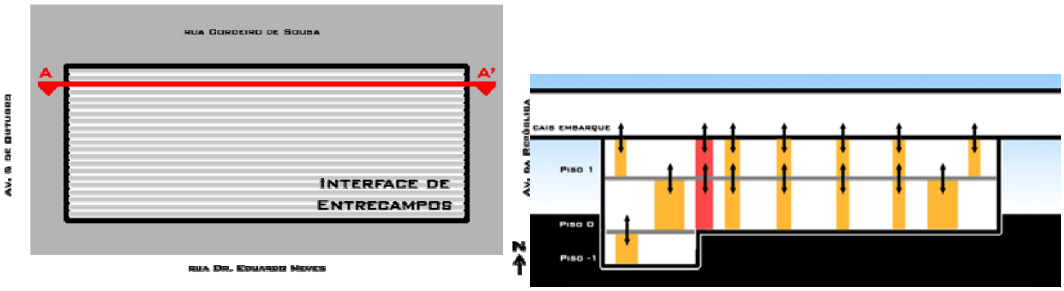

Figure 17. Interface implementation floor plan (sketch); Section AA': vertical access inside of the building

Answering the question about the need of the mezzanine as a distributor level, there can be other more integrated and faster ways to articulate all the levels of interface other than through the occupation of an entire floor by a complex web of staircases and escalators. All the existing uses and services are extended or may be extended to level 0. In addition to this, there are already, in some cases, internal private vertical communications (for services) or public (in the case of the coffee shop / bookshop ensemble). Therefore, the abolition of the mezzanine as it is today will allow direct communication between levels 0 and 2.

Architecturally, the release of the mezzanine would give the station a large ceiling height between 0 and 2 floors, allowing a great spatial and visual control over the shops and services distributed in the South façade. That action would allow another hierarchy to the building system, separating private areas and public services, adding new areas for new cultural, learning and leisure uses, complementing the pedestrian paths of the passengers. Also, monitoring the station would become more efficient, instead of monitorizing three separate floors, security would monitorize the internal space altogether and the platforms separately. Currently, the functional organization is as follows:

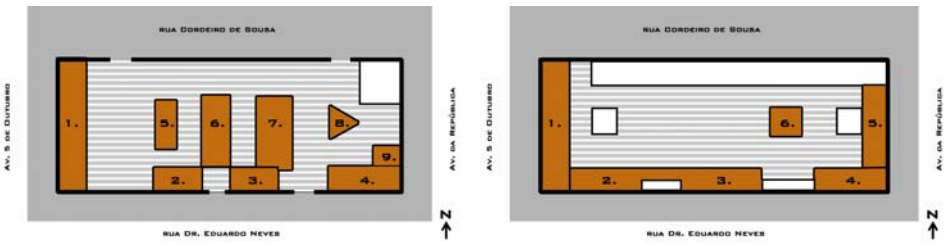

Figure 18. Level 0 (existing): 1. empty; 2. stationery store; 3. art gallery; 4. INVESFER (services); 5. Catering; 6. musical instruments store and sanitary installations; 7. box offices; 8. shop; 9. cafeteria. Level 1 (existing): 1. empty; 2. “Café com Livros” (bookshop); 3. “Café com Livros” (cafeteria); 4. INVESFER (services); 5. Surveillance and security; 6. Cafeteria

Depending on the type of use, it can be seen that the West part of the building, on both floors, is currently occupied with some kind of use. The internal pedestrian paths tend to be made towards that area of the station, leaving the West area underused and requiring a profound change.

The Southern façade is now occupied with commercial usage, and it is dedicated to the public on both floors 0 and 1. There are also small cafeterias and kiosks in the centre of the station. The services and monitoring areas are located in the top East of the building, following the pedestrian path of the users towards box offices and the subway. This particular spatial configuration aggravates the situation of the top West of the building. Therefore, the proposal seeks to address the distribution of uses as follows in figure 19.

The uses are hierarchically organized according to their public or private functions, and all vertical access between floors is reorganized, while maintaining access to all platforms on level 2. As seen in the proposed new mezzanine configuration (figure 20), its new design allows a great visual release to the floor below, still providing space for pedestrian traffic adjacent to the proposed new uses. It is also suggested incorporation of esplanade areas, adjacent to uses of commerce like cafeterias and the inclusion of a videowall in level 0, thus materializing the concept of dissemination of information through new technologies.

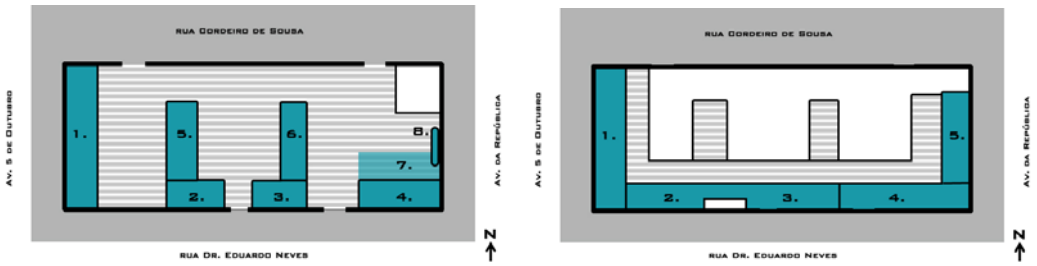

Figure 19. Level 0 (proposal): 1. Security and services; 2. stationery store; 3. art gallery; 4. cafeteria (kiosk); 5. box offices; 6. shop; 7. esplanade area; 8. videowall. Level 1 (proposal):1. Security and services; 2. “Café com Livros” (bookshop); 3. “Café com Livros” (cafeteria); 4. reading room; 5. exhibition room.

The division suggested between the reading room and the exhibition space is merely symbolic, and the ensemble should be seen as a whole. Thus the concept of programmatic contamination of uses of culture, learning and leisure, is explored making use of the knowledge acquired within the study of the idea stores.

One of the objectives of the study is the test of its feasibility. It was therefore decided create the least intrusion possible in handling the new situation. The proposal is still characterized by some affinity with the existing situation in the sense that the representation of the new usage remains at the West, South and East façades. The act of maintaining the uses located adjacent to the façades the detriment of other interior design relates to the autonomy given the new programme in this particular situation. Thus, the different types of spaces can exist almost independent of each other, operating in the different hours of public transport (subway and train), with their own main entrances and relations to the exterior.

In the particular case of Interface of Entrecampos, it is suggested the appropriation of space according to the following criteria:

- Restructuring the storeys and the internal space allowing the liberation of the visual field inside the building;

- Hierarchy of uses: Private (monitoring and security services), and Public (commerce, catering, culture and learning);

- Awareness of the notions of “passage” and “stay”, defining their pathways and areas following design criteria that respect the idea of continuity of space;

- Versatile architectonical configuration that allows change throughout the equipment’s lifetime;

- Focus on security and architectural quality of space as means of upgrading the equipment of the interface;

- The interface as a catalyst for boosting the surrounding urban areas, creating the notion of identity to the local community it serves.

These criteria were made in order to test the feasibility of the studied project of the Interface of Entrecampos (Lisbon, Portugal) and aims to provide a basis for implementing programmes in urban transport hubs.

The introduction of dynamic new uses may be the answer to the goal of increasing the use of public transportation in major cities. Besides being environmentally cleaner and safer, public transport such as subway and railway should drawn a single network, bringing people and places

physically and culturally together. The physical structure represented by transport hubs should also provide a sense of place, identity and urbanity.

Figure 20. Perspective of the proposal

To this end, extrapolating to the generality of interfaces, this study suggests:
- General awareness of the state of transport hubs – such places must be seen beyond their waiting and transit areas;
- Diagnosis and evaluation of functional, environmental and programmatic constraints and needs of the interfaces, regarding the inclusion of uses oriented to cultural, learning and leisure activities;
- Exploration of forms of ownership of the physical space by the user, through the creation of pathways and spaces that enable correct fruition of interfaces;
- Study of the applicability of uses of culture and learning, involving not only the consumption but the loan and rental of related goods;
- Formulation of principles to be considered in programs of rehabilitation and refurbishment of existing interfaces based on the concepts developed in this paper - the introduction of new uses and the study of its suitability on particular cases.

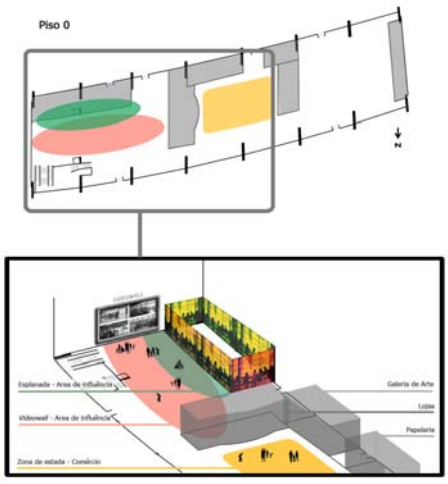

Figure 21. Proposal: level 0 – waiting areas, area of influence of the esplanade and the videowall

5 Conclusions

“Who will define what local means in a global, virtual world? Local means self-reliant. Local means our friends, neighbours, colleagues, a community. Local also means people with whom we might not always agree but with whom we share a common purpose and environment.” [22] (Charles McClure, William E. Moen, Joe Ryan)

Almost all uses are subject to change according to constructive, functional and symbolic principles, among other. According to this study, it can be concluded that the general trend of the analyzed spaces consists on the expansion of their programme and key functions. Understanding the types of institutions studied (idea stores, museums, libraries, cafeterias and interfaces) means studying their different materializations in architecture, along with their programs. These should represent stimulus to the user, within factors that include comfort, safety and enjoyment.

Independently and both intrinsic to these changes, the tradition of an equipment or institution reflects and is reflected in the community that surrounds it. The creation of a sense of identity and community is one of the most important factors of the approximation of individuals in a society increasingly globalized and uprooted.

In many situations, as illustrated throughout this study, Portugal has introduced new uses when redesigning old ones. Programs once crystallized or in obsolescence have being brought to a contemporary time ruled by the so called "information society". The target-public represents the youngest and active layers of the population. However, there is a huge need to spread these initiatives to the remaining strata of society, to explore and diversify them in order to enrich the entities that will be used by them. Diversification also has to be done among the public, supporting initiatives for social inclusion, as in the cases of children and the elderly, the disabled, the public with low rates of literacy and ethnic minorities, among others. An architectural proposal should always be able to follow these guidelines.

The particular proposal presented in this study is no exception, so the physical space and social and urban contexts of the case-study of the interface of Entrecampos were examined. As previously seen, the interface presents serious asymmetries in the distribution and occupation of its uses and users. The observation and analysis of internal pedestrian pathways and the influence of the built environment in the interface’s program, at various times throughout this study, have enabled to diagnose a general outline of the current state of the interface, leading later to the following conclusions. The proposal suggests the resolution of these problems through a new architectural approach of the functional area of the interface.

Therefore, it is taken in consideration, as an example of contemporary functions of learning and culture, the particular case of the idea stores in London. Being equipments with a very pronounced social character, idea stores meet the criteria for spatial organization that incorporate the architectural and programming languages in a continuous and multifaceted way. Having also been the subject of study and characterization in this work, they are adequate examples of actual implementation of these parameters (diversification of uses through incorporation of culture and learning as complements to the catering and commercial spaces, including points of hire / loan of goods related to culture and learning, hierarchy of spaces and pathways in public and private functions).

The proposal is therefore ruled by programmatic contamination that assists in the qualification of the interface area through the introduction of uses of culture, learning and leisure. The architectural expression of the proposal aims to combine functional and versatility aspects to the interface, suggesting a fluid appropriation, and continuous and flexible spaces. The absence of physical and visual barriers should allow the free perception and mobility of the user, responding to the versatility of architectural space in order to receive new uses and programs over time, following the needs / requirements of the population and the surrounding area.

The underlying supply of new programs related to culture, learning and leisure also aims at the transformation of the interfaces in "places", giving them an identity at architectural, social and cultural levels. In these new places the population must be able to find references, so the proposal would be the physical space where they can perform activities that bring together the surrounding communities.

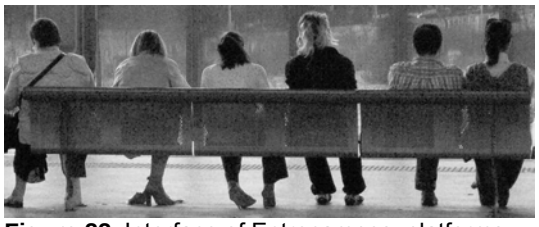

Figure 22. Interface of Entrecampos: platforms

The case of public transport and construction related to them need to see the program extended to uses other than strictly commercial, saving them from transforming in small shopping areas, empty of people and devoid of meaning for the city and its users. Transport hubs, rail stations, subway and buses have the physical capacity to provide more to the city than large places to wait, often unsafe and uncomfortable. The introduction of new uses that bring dynamic and greater permanence to these spaces may be the answer to the increasing use of public transport in major cities. In addition to environmentally friendly and safe, public transport as the metro and urban and suburban trains should be a single network, aiming at bringing people and places physically and culturally together, freeing the main roads of cities and their accesses. The scale of the building, the physical structure which is the station must allow the free fruition by the user, in an orderly fashion and at different levels, creating a sense of place and identity in the social, cultural and urban contexts.

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Pedestrian flows analysis in transport interfaces

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Multimodal transport stations are important poles of commuting and can influence pedestrian movements. The design and structure of stations, as well as the characteristics of the transport networks integrated on the station, can affect pedestrian flows efficiency along its movement segments. More efficient multi-modal stations lead to a reduction of the waiting and total travel times of commuters and thus, increase the importance of studying the causal relation station-pedestrian. The paper describes the development of a Monte Carlo model to simulate commuting times in multimodal stations. The simulation tool was calibrated with the support of empirical input data from two major Portuguese multimodal stations (Cais do Sodré – Lisbon and Campanhã - Porto). The experimental measurements were developed using two methodologies: commuters were analyzed in a daily basis by measuring the partial times in the station, and video recording of commuters in the station. The partial times were disaggregated in separate segments like stairs, walkways and fare gates and compared to values published by Fruin (1971), (Fujiyama and Tyler (2004) and TCQSM (2003) as a function of the Pedestrian Level of Service. Through a Monte Carlo modeling simulation process, those values were then used and tested with real input data. The validity of the model was later complemented with two additional segments, without scientific comparable measurements in scientific literature: fare gates and ticketing booths. To achieve reliable data, 3607 measurements over 6 Portuguese transport stations were carried out and the statistical analysis revealed that the model is a valid tool to simulate pedestrian movements in multi-modal stations, including new and innovative segments on the analysis of pedestrian flows.

Keywords: Pedestrian simulation, transport multimodal stations, commuting optimization

1 Introduction

In 2005, the Portuguese capital, Lisbon, registered about 1.3 million daily trips (Lisboa: O Desafio da Mobilidade, 2005). The majority of those trips (1.0 million) were motorized with almost 58% of them being registered in public transport. Currently, the amount of public transport trips is decreasing in Lisbon and a consequent increase of private cars trips is occurring. This can be verified by the increase of the number of vehicles per 1000 inhabitants from 232 in 1993 to 282 in 2003. In the second major Portuguese city, Porto, the scenario is quite similar. There were 0.55 million daily trips, of which 56% in public transport. Along the last decade, public transport share in Porto decreased from 42% to 28% while private transport increased by 31% to 52%.

Three main reasons can be pointed out to explain the choice of private transport instead of public transport: reliability of the public transport chain (Rietvield *et al*, 2001), speed and comfort. On this context, multimodal stations can play a determinant role to contradict the current tendency. Multimodal stations can promote the usage of public transport through the optimization of the commuting time and the improvement of the conditions of the infrastructure. Comfort, reliability and speed influence the partial times taken by commuter to overcome some elements like stairs, ticketing, queuing, etc. Along this paper, each of those segments is analysed, as well as its respective influence on the total commuting time.

2 Objective

The objective of the project (InTrSim), which based this paper, was to build a versatile, user-friendly and accurate Monte Carlo model to simulate commuting times in multimodal stations, considering the path chosen by the pedestrian as well as the queuing process at the fare gates and turnstiles.

The model was compared and calibrated with values obtained in two multimodal stations (Cais do Sodré – Lisbon and Campanhã – Porto), using as inputs pedestrians level of services and geometrical characteristics of the segments. The main outputs of the model are commuting and partial times associated to the following events: time to overcome the fare gate, queuing time, walkways and stairways.

3 The multimodal stations

The study was carried out in two multimodal stations (Cais do Sodré Station– Lisbon and Campanhã Station – Porto). Both stations serve as terminal hub for train, metro, bus and taxi; Cais do Sodre station has additionally trams and ships. The larger commuting intermodal flow in both stations is the train-to-metro and metro-to-train. Along these commuting paths, each of the stations has a specific fare gate system. Cais do Sodre has an automatic fare gate access, allowing the entrance/exit to commuters with a valid ticket or electronic card. Campanhã Station has no physical restriction access to the station – the system is comprised by validation poles. Such difference is determinant on the analysis of the queuing effect and will be again highlighted along the paper.

4 Experimental study

Fruin (1971), Fujiyama and Tyler (2004) and the Transit Capacity and Quality of Service Manual (2003) established correlations to estimate the speed of commuters in multimodal stations. These correlations are the result of empirical studies for segments like stairs, platforms, walkways and ticketing. Pedestrians' capacity, speeds and commuters flows were analysed considering the occupied area and the level of service of commuters. Such correlations are focused on speed and pedestrian flows to design stations and do not consider the influence of the path chosen by the commuter neither the respective commuting time. Fruin (1971) studied pedestrians' speeds on walkways and stairways and correlated the pedestrian available space (in units of area per pedestrian) with pedestrian flow for different level of services. Fujiyama and Tyler (2004) analyzed the pedestrians´ walking speed on stairways and compared the results with Fruin´s data. The Transit Capacity and Quality of Service Manual (TCQSM, 2003) use Fruin´s data for the standard design of stations especially for the pedestrians´ speed on stairways and walkways. The TCQSM also analyzed further other design factors influencing the pedestrians' movement in stations such as Doorways, Ticketing Machines, Fare Gates, Escalators, Elevators and Platforms.

These studies can be a source for numerical simulations of commuting times in multimodal stations as long as they are calibrated with specific characteristics of local people and stations. Using empirical studies and simplified numerical procedures, Silva *et al*. (2006) tried to calibrate such data, analysing the commuting time and commuters speed in a multimodal station located in Lisbon (Portugal). The output of this analysis was then compared with Fruin (1971), Fujiyama and Tyler (2004) and Transit Capacity and Quality of Service Manual (TCQSM, 2003) and an experimental study was carried out in two multimodal stations located at the major Portuguese cities (Lisbon and Porto) as described in detail by Nunes *et al.* (2007).

4.1 Cais do Sodré station

An experimental analysis was performed in the multimodal station Cais do Sodré for validation and comparison with numerical simulations (Silva et al., 2006). In situ measurements were performed along 22 days between 8:30a.m. and 9:30 a.m and between 8:30 p.m. and 9:30 p.m.

Pedestrian Levels of Service (LOS) were estimated and later checked with available data in the literature Fruin (1971), Fujiyama and Tyler (2004) and Transit Capacity and Quality of Service Manual (TCQSM, 2003). The experimental evaluation of pedestrian paths as well as the observation of the respective behaviour at the fare gate was carried out in Cais do Sodré and followed two different processes. The first one consisted in following and measuring two daily commuters and the second one in following random commuters at the station.

4.1.1 Two selected commuters

Two typical commuters previously selected (a man of 42 years and a woman of 27 years), were analyzed in a daily base with measurements of their partial commuting times on both directions: train to metro and metro to train.

Figure 1 shows the histogram of the commuting speed of the two typical commuters. The average value was of 1,25m/s ± 0,07m/s, with a confidence level of 95%. The average of the total commuting time of was 142,8s ± 5,3s (2,38mim ± 0,09min) (Silva et al., 2006).

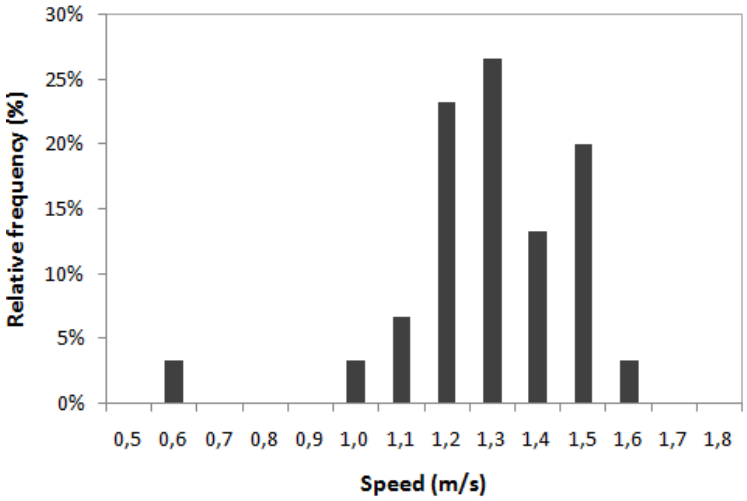

Figure 1. Histogram of the commuting speed of the two typical commuters

The influence of the Level of Service (LOS) in the commuting speed was also evaluated. LOS was obtained through the information provided by the two commuters. Figure 2 shows the measured values of the two commuters' speeds compared with the values (solid line) published by the TCQSM (2003). The hatched lines represent the maximum and minimum limits of speed for the respective Levels of Service (Highway Manual Capactity HCM, 1997).

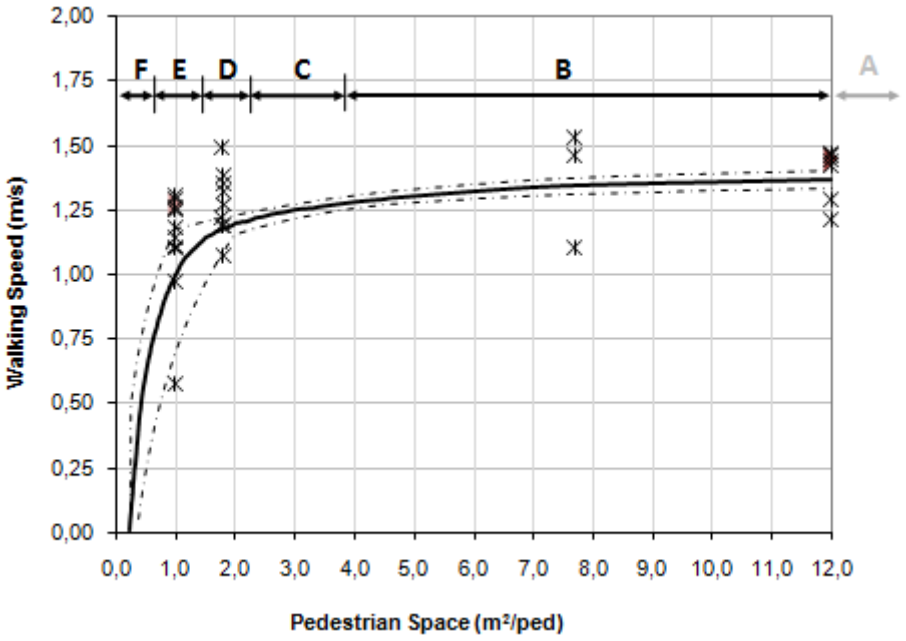

Figure 2. Walking speed at Cais do Sodré Station

The horizontal stairway speed of commuters was also evaluated for the levels of service shown above. Figure 3 illustrates the measured speed values of ascending and descending stairs in Cais do Sodré station. The measured values were compared with the ones published in Transit Capacity and Quality of Manual Service (TCQSM, 2003). The solid line represents the curve of descending speed and the hatched line the ascending speed.

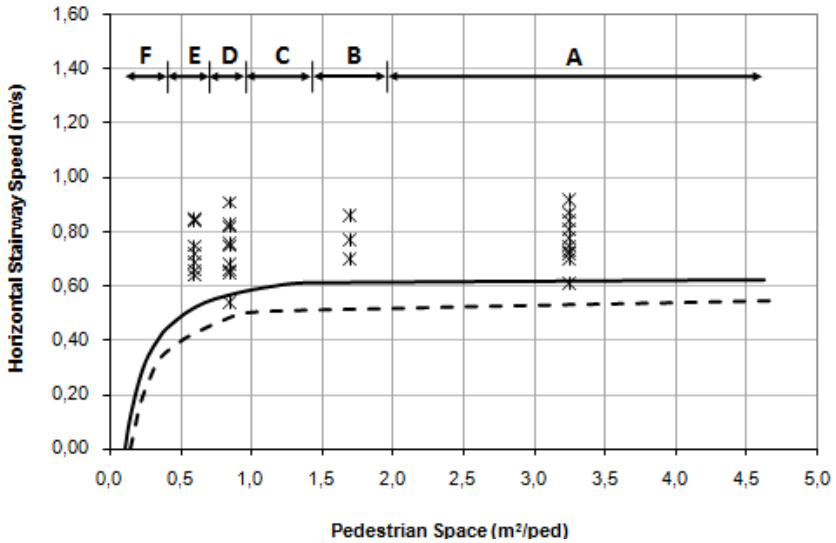

Figure 3. Horizontal speed on stairs at Cais do Sodré

Values from walking speeds (Figure 2) are in accordance with the trend of the ones published in TCQSM (2003) and Fruin (1971). The measured values of speeds in stairs (Figure 3) are above of

the curves of TCQSM (2003) and Fruin (1971). Lastly, the measured values of stairway speeds in Cais do Sodré station are close to the values published by Fujiyama and Tyler (2004) for stairs with inclination of 24,6° (Table 1).

Table 1. Average horizontal speed n stairs at Cais do Sodré station, compared to Fujiyama and Tyler (2004)

	Ascending speed (m/s)	Descending speed (m/s)
INTRSIM	0,71 ± 0,06	0,77 ± 0,04
Fujiyama e Tyler (2004)	0,76 ± 0,17	0,87 ± 0,19

The queuing length on the fare gate system at Cais do Sodré station was evaluated through the disaggregation of partial times that commuters take to overcome each segment. Figure 4 shows the histogram of the tickets validation times of the two commuters. The two commuters had the same type of validation: an electronic card. The average ticket validation time was of 3,06s ± 0,76s (Silva et al., 2006) using the methodology described in this section.

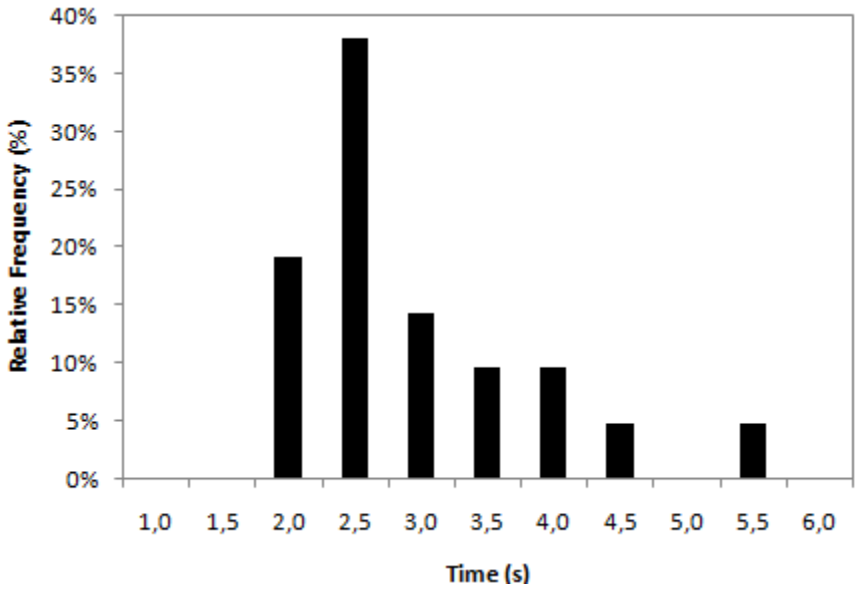

Figure 4. Histogram of the ticket validation time of two typical commuters at Cais do Sodré station

4.1.2 Random commuters

To confirm the ticket validation times at fare gate, a second methodology was used for a larger and more diverse sample of commuters and thus, reducing the standard deviation. Eighty five commuters randomly chosen were followed and their ticket validation time was measured. Random commuters had also the same type of validation: an electronic card.The average ticket validation time obtained with this methodology was 2,8s ± 0,2s, with a confidence level of 95% (Figure 5).

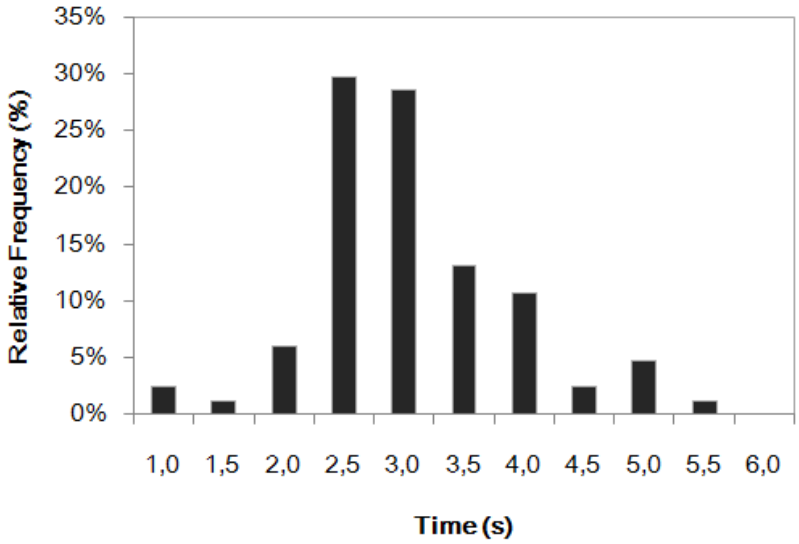

Figure 5. Histogram of the ticket validation time of random commuters at Cais do Sodré station

4.2 Campanhã station

In Campanhã station (Porto), a third methodology was used to analyze experimental data, using image recording. Partial times of 125 commuters were measured through the analysis of images obtained at one of the main entrances of the station. Data was recorded in a typical weekday for periods of 15 minutes starting at 7:00, 7:30, 8:00, 8:30, 9:00 and 10:30 a.m. The analyzed commuters had the same type of access: an electronic card.

Figure 6 shows the number of commuters that entered the station and validated the ticket at the observed entrance. Sets of one commuter at a time is dominant during all time measured, from 7:00 to 10:45, while sets of 5 or more commuters are dominant for the period between 8:00 and 9:00.

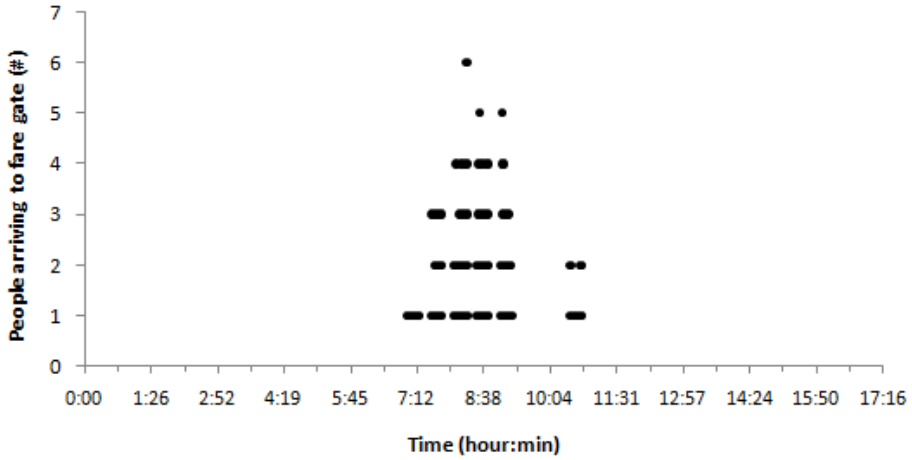

Figure 6. Commuters arriving through one of the entrances of Campanhã station

Between 7: 00 and 10:45 a.m., 1353 commuters passed through the analyzed entrance (Table 2). About 90% went directly to the validation system, a small percentage (7%) purchased the ticket just before passing the ticket validation system, while 2.4% did not pay. Figure 7 shows the more

crowded period (8:30 to 8:45) whereas figure 8 shows the more crowded minute (8: 34). The flow of commuters at the entrance of the station was used as reference to the input for the numerical model of simulation.

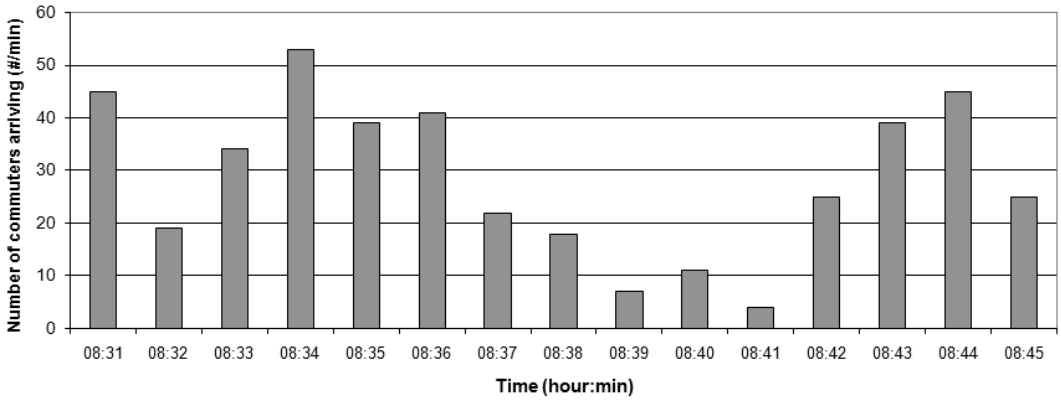

Figure 7. Number of commuters arriving at the validation system between 8:30 and 8:45

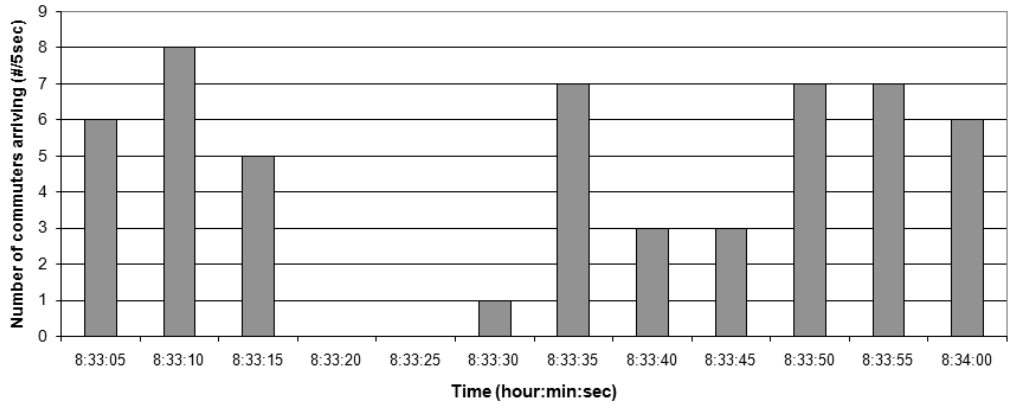

Figure 8. Number of commuters arriving at the fare gate between 8:33 and 8:34

Table 2. Commuters that entered at Campanhã station (one entrance)

Campanhã Station				
Hour	**Users**	**Fare Gate**	**Not paid**	**Buy Ticket**
7:15	39	37	2	0
		95%	5%	0%
7:45	204	181	6	17
		89%	3%	8%
8:15	316	291	6	19
		92%	2%	6%
8:45	462	427	6	29
		92,4%	1,3%	6,3%
9:15	277	248	5	24
		89,5%	1,8%	8,7%
10:45	55	38	8	9
		69%	15%	16%
Total	**1353**	**1222**	**33**	**98**
		90,4%	**2,4%**	**7,2%**

Figure 9 shows the probability of commuters, arriving at the fare gate system, to find other commuters at the queue. Values are represented from the higher to the lower probability, resulting in a decreasing curve of probability. The x axle represents the number of commuters arriving at the

station and facing the queuing event. *1Find0* represents one commuter arriving and finding zero commuters at the queue. The condition “without-queue” (*1Find0 and 2Find0*) represents 57.14% of the events, and the condition to find not more than one commuter in the queue *(1 Find 0, 2 Find 0, 1 Find 1, 2 Find 1)* represents 79.7% of the events. Commuters can face a queue with 5, 6 or 7 other commuters in peak periods, but this event has a low probability to occur.

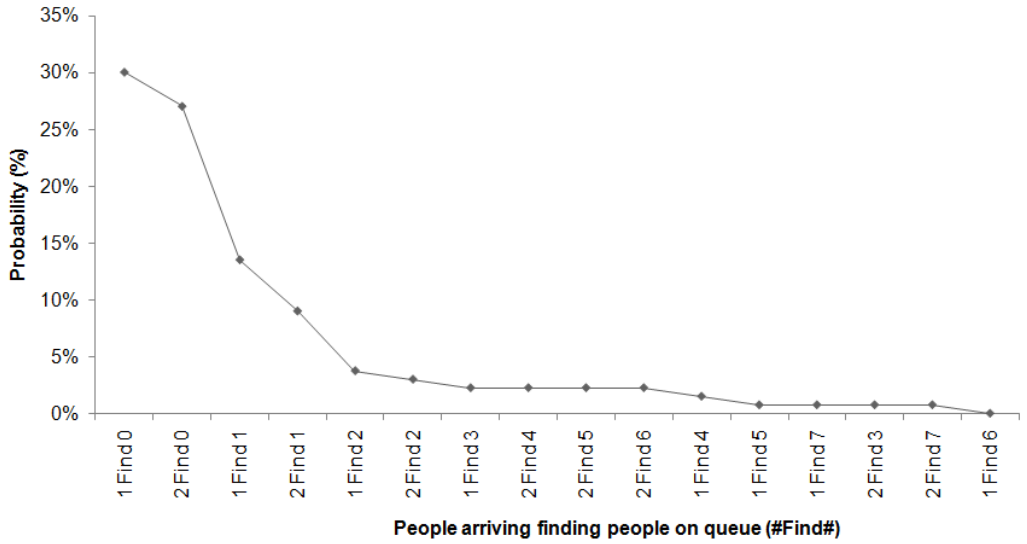

Figure 9. Probability of commuters to find other commuters in the queue

5 The Model

Empirical studies developed in the Cais do Sodré and Campanhã stations provided an important input to develop a model to simulate commuting times in multimodal stations. The model allows simulating queuing, fare gate and commuting times of one passenger, to a specific path and respective levels of service.

To calculate partial times taken in each segment during commuting, a data base was implemented with correlations of commuters speeds as a function of the gender, characteristics of the segments (stairways, walkways and fare gate) and Level of Service. The correlation values that constitute the data base were established based on the experimental studies described in section 4.

Figure 10 shows the flowchart of the computational code.

A numerical code was implemented in Visual Basic integrated with an Excel database. The first input of the program is the gender of the commuter. After that, the type of segment to be followed is chosen with the options of stairways, walkways and ticket validation/fare gate system. The Level of Service is chosen, and finally the length of each of the segment. When the entire path is set up with the input information about each of the segment related to LOS, length and position, the total commuting time and the partial times of each segment can be obtained. The outputs of the program are the partial times and the total commuting times shown by gender.

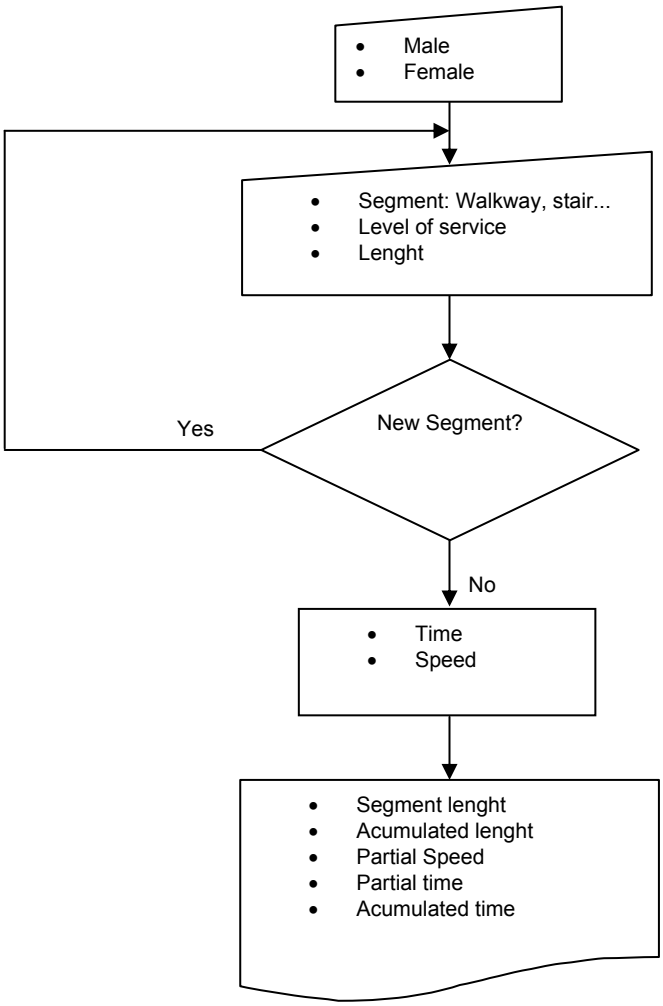

Figure 10. Flowchart of the computacional program

A sub-model was made specifically to simulate the queuing process in the fare gate system. The numerical code was implemented in Visual basic, and requires as input the number of commuters and the number of doors (or poles) of validation. Outputs are the number of commuters arriving to the system, the number of commuters that leave it, the number of commuters that accumulate in queue and the length of the queue. Figure 11 shows the flowchart of this sub-model, whose boxes with hatched lines are the main part of the Monte Carlo model for formation of queues. Figure 12 explains how the Monte Carlo model is used.

In this sub-model, a line of virtual control (LC) is established and crossed by commuters arriving at the validation ticket system. One or two doors (or poles) can be chosen for ticket validation. If there is more than one door, commuter chooses the one with shorter queue.

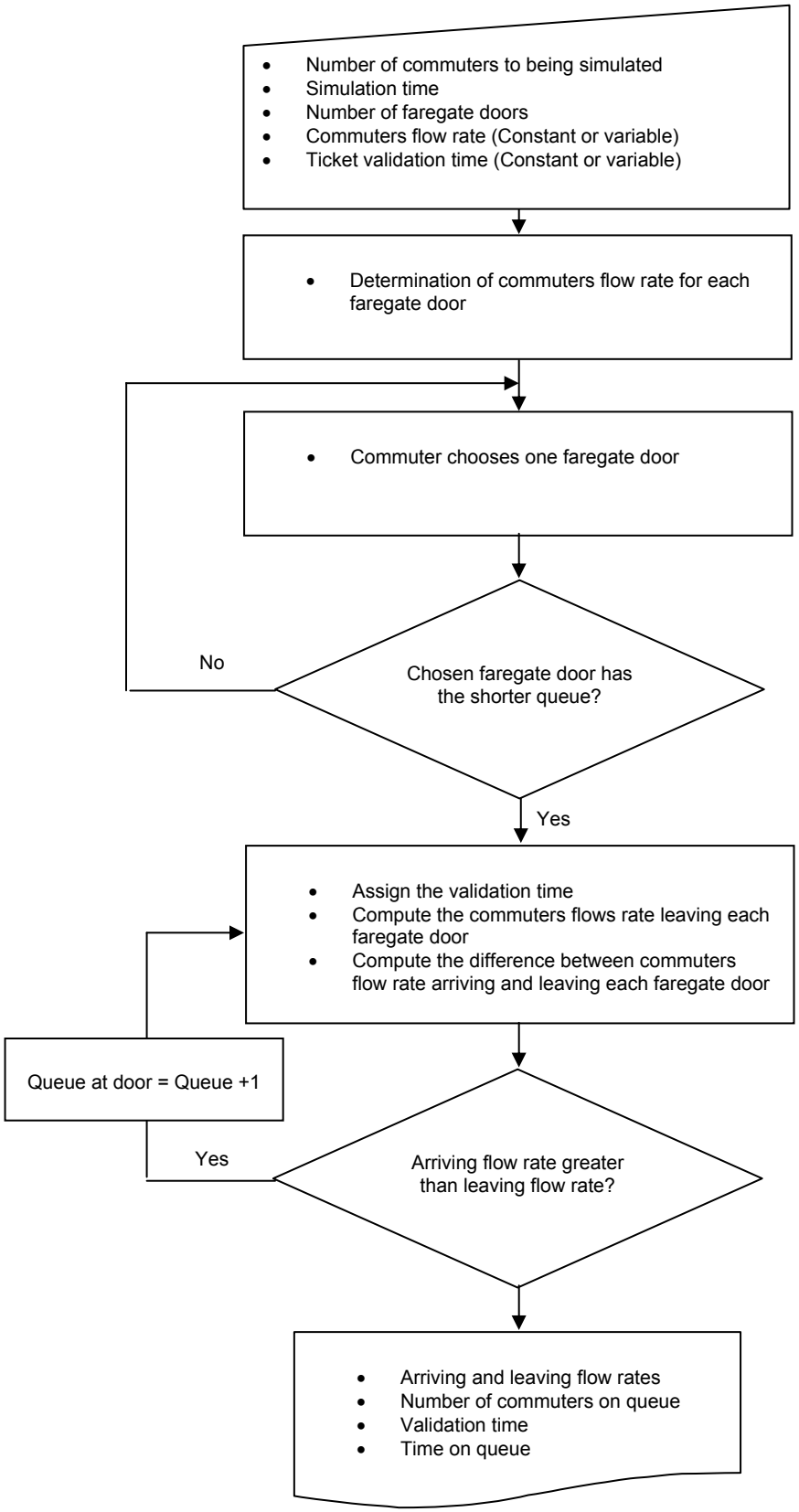

Figure 11. Flowchart of the code for the fare gate systems and queuing process

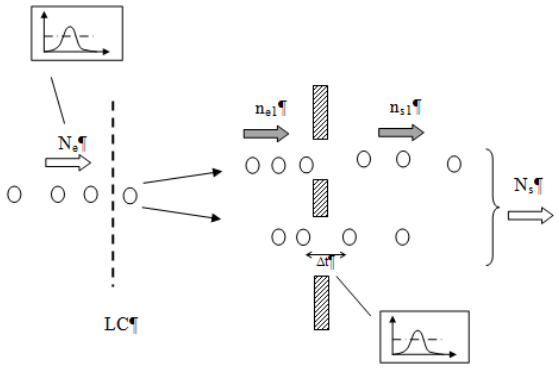

Figure 12. Monte Carlo model applied to the queuing process on fare gates

The user of the program can opt for a constant or a variable arriving flow rate of commuters (Ne) along the simulation time. For a variable arriving flow rate, the total number of commuters is equally divided throughout the simulation time. For a variable arriving flow rate, the total number of commuters follows a Poisson distribution throughout the simulation time, accumulating a larger number of commuters in one specific time band and thus simulating the behaviour of the arrival flows in peak periods. The experimental studies carried out in Campanhã station (Figures 6 and 7) provided the needed input for the distribution of probabilities of the Poisson function used in the Monte Carlo Model.

When the virtual commuters choose (the shorter) queue, an arriving flow rate distribution is calculated to each door (ne1). When arriving at the door, a time for validating the ticket is assigned randomly (Δ t). The time for ticket validation can also be constant or variable, accordingly with the choice of the user of the program. If the validation time is constant, the same Δ t is assigned to all the commuters; when the validation time is variable, one Δ t is randomly assigned to each commuter according to a Poisson distribution. Experimental studies carried out in Cais do Sodré (Figure 5) provided the needed input for the distribution of probabilities of the Poisson function. The sum of the validation times for the simulated commuters determines the exit flow rate for each door (ns1), and the sum of the two doors provides the leaving flow rate of the system (Ns). The queue for each door is obtained with the difference between the arriving flow rate and the leaving flow rate distribution of commuters (ne1 - ns1).

6 Numerical conclusions

The partial times of commuters were simulated using the Monte Carlo model described in figure 10 and based on the experimental results obtained at Cais do Sodré station.

Figure 13 shows the result of a numerical simulation of 20 commuters (symbols) on a similar journey to the ones done in Cais do Sodré station. The simulated journey was 155.5 meters length, constituted of walkways, stairs and ticket validation system. It was observed that at the beginning of the path all the commuters are close to each other in a corridor with 12m of length, and that at the end of the commute the faster commuter took 2 minutes and 11 seconds, while the slowest one took 3 minutes and 10 seconds. It is also clear that it is at the fare gate that commuters behave in a more

heterogeneous way. On this specific simulation, the ticket validation time followed a Poisson distribution with an average value of 2,8s based on the experimental studies in Cais do Sodré (Figure 5), without taking into account the formation of queues. Therefore, for a more accurate calculation of the partial time taken at the fare gate, the sub-program described in Figure 12 was applied.

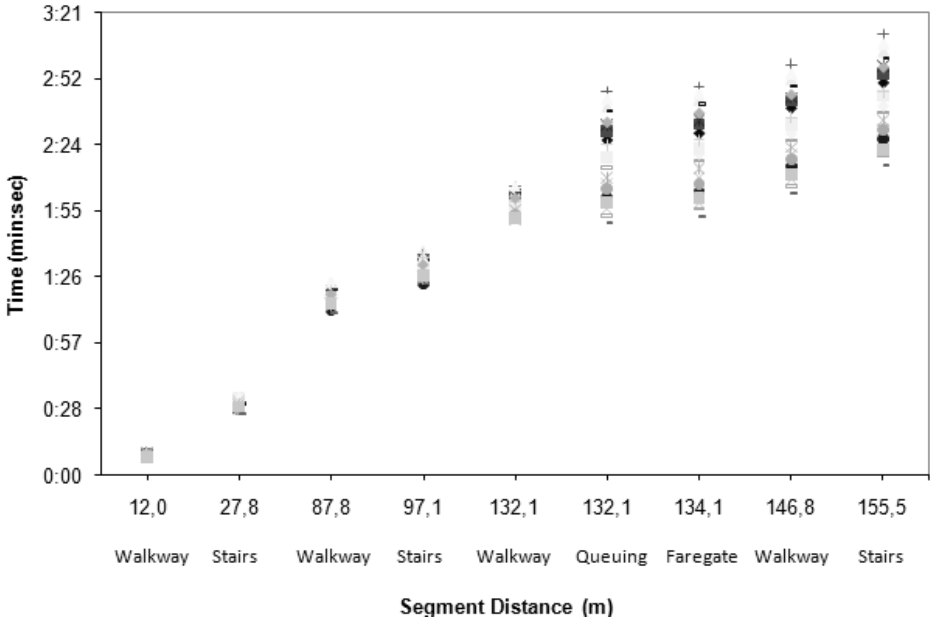

Figure 13. Simulation of commuters paths in Cais do Sodré

Experimental studies in Cais do Sodré and Campanhã were used as a reference for the numerical simulation of the ticket validation time and queuing. In a peak period in Campanhã station the arriving flow rate is 53 commuters/ minute (Figure 7), which results in a distribution from a minimum of 11 commuters for a 10 seconds period to a maximum of 20 commuters for each 10 seconds (Figure 8). Based on those values, one hundred commuters were simulated at a constant arriving flow rate equally divided along a two minutes period. Ticket validation time was also chosen as constant, with 2.8 seconds for two faregate doors (or poles).

Figure 14 shows the number of commuters passing the ticket validation system, for a constant arriving flow rate and a constant validation time. It can be noted that the arriving flow rate is constant (17 commuters for each 10 seconds) referring to two faregate doors (or poles); that represents an average arriving flow rate of 7 to 8 users to each door (or pole) in a time period of 10 seconds. The use of a constant time of validation leads to a maximum leaving flow rate of 10 commuters to each period of 10 seconds. The difference between the arriving and the leaving flow rates provides the number of commuters in queue.

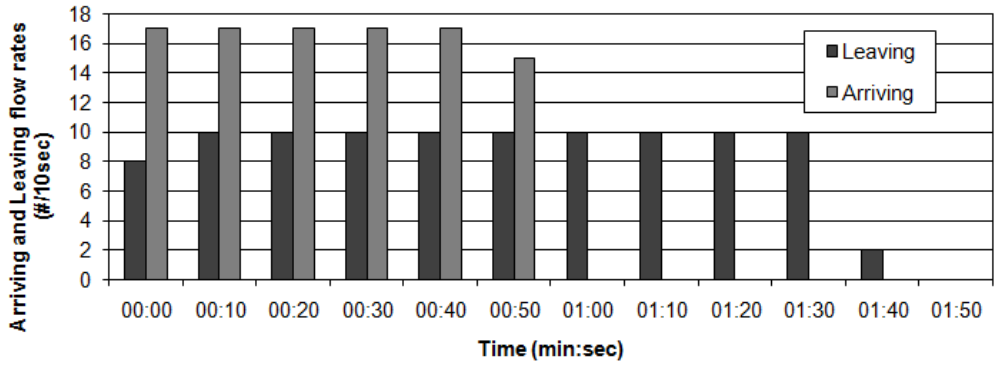

Figure 14. Arrival and exit flows of commuters at the ticket validation system

Figure 15 shows the number of commuters in queue in one of the faregate doors (or poles), under the conditions mentioned above (constant arriving flow rate and constant validation time). The previous figure showed that after 50 seconds, once there was a queue, despite it did not arrive more commuters to the system, the exit flow remains until 100 seconds (1:40). Figure 15 also shows that since the beginning of the simulation until the 50 seconds, the queue in one door increases up to 24 commuters, decreasing very fast until the queue disappears completely after 70 seconds (1:10).

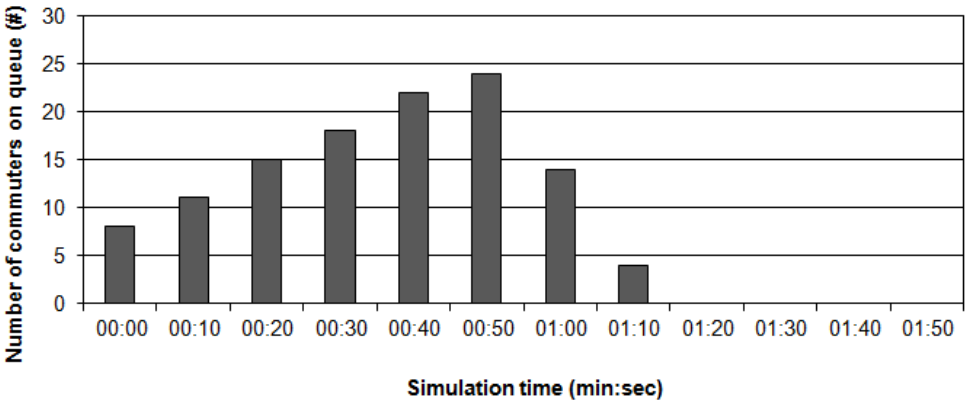

Figure 15. Number of commuters in queue

To analyze the influence of the variable arriving flow rate and the time of validation on the queuing process, a second simulation was carried out. The total simulation time was 3 minutes with 100 commuters and two faregate doors (or poles). Figure 16 shows that the arriving flow rate reaches a maximum value (39 commuters for 10 seconds) in the 45th second, and the leaving flow rate remains roughly constant on 10 commuters for 10 seconds. A variable arriving flow rate contributes to a longer distribution of the leaving flow rate than the previous simulation.

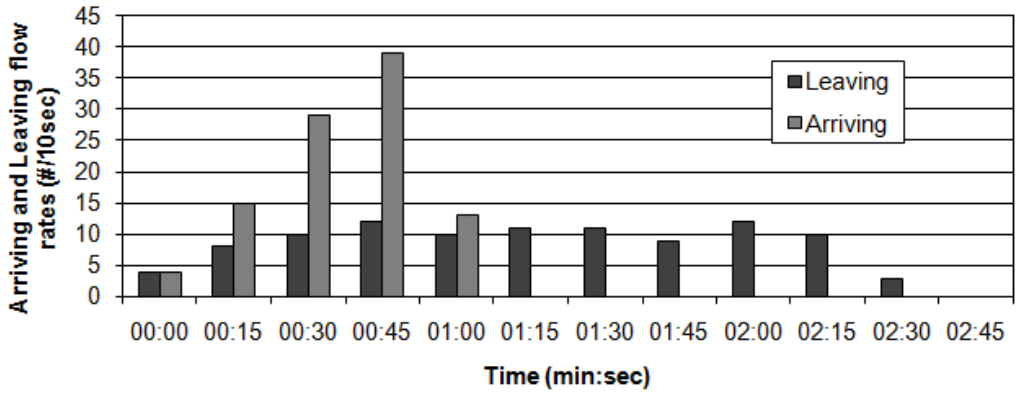

Figure 16. Commuters arriving and leaving at the validation system

Figure 7 showed the commuters arrival flow at the ticket validation system in Campanhã station, with a maximum rate of 53 commuters per minute and an average of 28 commuters per minute. Based on those values, a simulation was carried out for 50 users in two minutes, for two doors (Figure 17). This illustration can be compared to Figure 9, showing 17 commuters find zero or one commuter in the queue (higher probability) and that commuters do not find eight or more commuters in the queue, confirming the low probability of finding more than 6 commuters in the queue (worse case for the formation of queues in the stations).

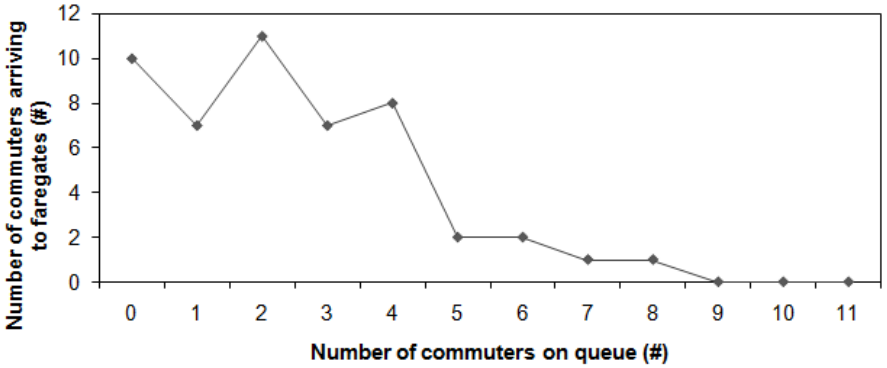

Figure 17. Number of commuters arriving and meeting commuters at the queue

7 Conclusions

Experimental studies of commuters' paths and ticket validation times were carried out in the multimodal stations Cais do Sodré, in Lisbon, and Campanhã, in Porto. Results from the experimental studies were used as an input for the development of a Monte Carlo model to simulate commuters' paths and for the development of a sub-program for the queuing and ticket validation processes.

Commuters' speeds in walkways measured in Cais do Sodré for two typical commuters are in accordance with the values published by TCQSM (2000). Commuters' speeds in stairs are in accordance with values established by Fujiyama and Tyler (2004).

The simulation of partial times of commuters in a similar path to the one in Cais do Sodré, showed that the greatest disparity of values occurs at the ticket validation system. The two

methodologies used to quantify ticket validation times in Cais do Sodré lead to values on average of 3,06s ± 0,76s and 2,8s ± 0,2s. Measurements in peak period in Campanhã station showed that a maximum of 53 commuters per minute arrive to the ticket validation system. The combination of the ticket validation time and the arriving flow rate of commuters to the ticket validation system, leads to the calculation of the queue length and the total time to overcome the system. The experimental results showed that there is a low probability of commuters that arrive to the ticket validation system to find 5 or more commuters at the queue.

This model provides an additional input on research carried out on commuting simulation, in particular on the calibration and validation of scientific values to a specific Portuguese reality. Further research should be carried out to include other segments on the commuting path analysis.

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Vertical contracts between airports and airlines: is there a trade-off between welfare and competitiveness?

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Airports and airlines have been increasingly establishing vertical contracts, which have important implications for policy issues, namely for regulation and price discrimination legislation. In this paper we develop a model to analyse the effects of three types of vertical contracts, regarding welfare, pro-competitiveness and the scope for regulation. We find that two types of contracts are anti-competitive, and that in all of them consumers are better-off, though within some conditions. We also conclude that regulation may improve welfare depending on the type of contract and that price capping has different effects according to the facility the price of which is capped. Moreover, we find that these agreement's effects exhibit a trade-off between pro-competitiveness and welfare and between price discrimination and welfare.

Keywords: Airlines, airports, vertical contracts

1 Introduction

When one airline has an important market share in an airport, both partners may be interested in establishing agreements concerning the use of the airport's facilities, which includes the fees and charges airlines pay. These agreements create a situation of price discrimination that favours the airlines that sign them, while those that stay out of the agreement pay higher fees and charges. On the other hand, vertical contracts may lead airlines to acquire market power in the upstream (airport) market, whenever they allow airlines to operate, for example, terminals, and so control the downstream market through the access to the input. Price discrimination and control, even if partial, of the input market, may be anti-competitive. But vertical contracts and collusions may also benefit consumers and be welfare-enhancing, as they may eliminate the so-called double marginalisation. Thus vertical contracts' effects often exhibit a trade-off between competitiveness and welfare.

The purpose of this paper is to analyse this trade-off, by examining three main types of vertical contracts between airports and airlines, and to find out which types of contracts and of clauses lead to results that make consumers better (worse)-off and which ones are pro (anti) competitive. Furthermore, this paper analyses the effects of airports regulation under vertical contracts. In fact, the issue of de-regulation is currently on the agenda of national authorities concerned with air transport and competition[46], it is also important to analyse how vertical agreements may change the scope for regulation. Indeed, vertical contracts lead to deep changes in the upstream market, where the airport sells its facilities to airlines, but these effects spill over downstream markets, where airlines sell flights to passengers. Such changes may lead politicians to question issues like the effects of regulation under these contracts, what prices should be regulated and what effects should be expected.

Using a model that considers the downstream and the upstream markets and so allows for a two-stage game, we analyse the effects of three types of vertical contracts in what regards three

[46] The United Kingdom has been a pioneer in these issues. See, for example, the Competition Commission (2008) and the Civil Aviation Authority (2008) documents.

main issues: (i) welfare and consumer surplus, (ii) pro-competitiveness, or the effects on other airlines that remain as outsiders and (ii) the effects of regulation.

Vertical agreements between an airport and one or more airlines are common. In Europe, they have not been disclosed, as they involve clauses that may go against articles 81 and 82 of the European Union Treaty, and so the European Commission has investigated and condemned some of these agreements[47]. In the United States (US) agreements between airports and the so-called "signatory airlines" are common and frequently fully disclosed. In Australia, these agreements can also be found in major airports, like in Sydney and in Melbourne. In Section 3 we take a closer look at the existing vertical contracts and at the clauses they involve.

As we show in Section 3, there is a wide variety of vertical contracts between airports and airlines, so that it is convenient, for our purposes, to establish a typology. Starkie (2008) considers three main types of agreements: (i) the European case (which we call the first case), where contracts are relatively new and focus on negotiated charges for the use of the airport facilities; (ii) the Australian case, (our second case) where agreements lie in long term leases on terminals; and (iii) the US case (our third case), with "majority in interest clauses" for signatory airlines.

We use Starkie (2008)'s three types of vertical contracts to develop three models for vertical restraints. Results differ much according to the type of contract and depend on the clauses (restraints) they include. Thus, in the first case, contracts are anti-competitive but welfare-enhancing. However, price regulation restores competitiveness and increases consumer surplus, even when allowing for the contract to persist. In the second case, vertical restraints are anti-competitive but may increase welfare, depending on airlines' efficiency in terminal operations. Price cap regulation may only restore competitiveness if is applied to the price airlines charge for leased terminals but not if it regulates airports' charges. In the third case vertical contracts are pro-competitive and also increase welfare, though only concession revenues may support the agreements. Additionally, in this case regulation is only useful if there are few airlines in the market. If markets are competitive enough, price cap regulation makes consumers worse-off.

Vertical relations have scarcely been dealt with in air transport studies (Oum and Fu, 2008). According to the same authors, the effects of vertical agreements are two-sided, and need further investigation. In this sense, this paper adds to literature as it is intended to fill this gap. Formal models on this issue were seldom developed, and conclusions on the sign of effects were never made clear. Mostly, and as far as we are aware, the effects of these vertical restraints on competitiveness and on welfare were never analysed. Vertical collusion between airports and airlines was analysed elsewhere (Barbot, 2008), considering the effects of a vertical merger (collusion) in the competition between two airports and between the airlines that use it. In this work, the role and the effects of other airlines (outsiders) were not assessed, as it is developed under the hypothesis that only one airline operates in each airport. The present paper does not focus on the issue of airport

[47] Examples are the cases of the Zaventem/Brussels National Airport in favour of the national flag carrier Sabena, of the Finnish airports of Helsinki, Vaasa, Turku, Pori and Tampere for a discount of 60% on landing fares on domestic flights of domestic airlines, of the Portuguese Airport Authority, ANA, which offered discounts of 50% on charges for domestic flights of domestic airlines and of Brussels Charleroi airport, which offered lower charges to Ryanair.

competition but rather of airline competition in a single airport and of market foreclosure[48] in the event of a vertical agreement. The issue is of great importance within the context of air transport policy. In fact, it is unclear if these arrangements are pro-competitive and welfare-enhancing, and it seems that policy makers hesitate when facing cases of vertical agreements as well as on regulation practices in presence of these contracts. As an example, Oum and Fu (2008) refer that the US Federal Aviation Administration (FAA) has shown concern towards exclusive deals between airports and airlines.

Also, the paper adds to general literature of vertical merger as it considers two types of agreements that are common in air transport but were not analysed neither for other industries nor within a theoretical framework.

The paper is organised as follows. Section 2 provides a brief literature review on the effects of vertical restraints. Section 3 specifies some forms of vertical contracts. Section 4 develops the models and results. Finally, in Section 5 some concluding remarks are presented.

2 The effects of vertical restraints: Literature

We shall first relate to vertical contracts in Air Transport literature. Starkie (2008) analyses the reasons and possible effects of vertical agreements between airports and airlines. Following this author, in Europe contracts are novel and result of air transport liberalisation. Before liberalisation, flag airlines were public entities that operated in public airports where they had a dominant position. There was no need of contracts as the vertical relation was between two public entities. With liberalisation these entities were often privatised, new airlines (in particular, low cost carriers) entered the market and many airlines started operating routes that were former preserved territories. Thus, air transport markets became more competitive but also more risky, which lead to the need of establishing vertical contracts. However, vertical contracts have a long duration and airlines will bear sunk costs, which will reduce their mobility in switching to other airports and so also airport competition will hampered. (Starkie, 2008). Thus vertical contracts are a novelty and tend to increase in number, which stresses the need to analyse their effects.

Oum and Fu (2008) suggest that both airports and airlines have incentives for vertical agreements, the former by being able to exclusively supply a dominant airline and so increase their market share towards other competing airports, and the latter by securing its operational needs as well as by getting competitive benefits over other airlines. Barbot (2008) shows that, however, that these benefits do not always exist and that they may be reaped out if other competing airports and airlines also engage in agreements.

Basso and Zhang (2007) focus on congestion delays with airport rivalry. In these authors' model there are two competing airports. A multistage game is used to determine capacities and fares, using congestion costs. Results regard the comparison between a monopoly and a duopoly facility, and a central planner one, in prices and congestion delays.

Basso (2008) analyses, as an extension, the case of two-part tariffs imposed by an airport, which, according to the author, leads to the same solution of joint profit maximisation by airports and airlines. With a two-part tariff the airport charges a price per flight plus a fixed fee. Though airlines

[48] We use foreclosure as the use of market power by one firm in one market to restrict output in another market, but excluding rival from this last market.

behave as horizontal colluders, the maximisation of joint profits allows the airport to capture part of the airlines' extra profits by means of the fixed fee. Basso (2008)'s paper differs substantially from the present one. In fact, this author considers an agreement with all airlines while I consider a contract with one (or more) airlines, but always leaving other airlines remain outside the agreement. This difference is important because, as will be shown in the paper, the existence of outsiders does not allow the airport to capture airlines' profits, but rather, it creates market power both in the downstream and upstream markets for one airline. Put in other words, in Basso (2008)'s paper there are no outsiders in the joint profit maximisation and pro-competitive effects cannot be examined, but only welfare effects. Besides, this author uses a Cournot setting in the downstream market, while I develop my paper with the Stackelberg model, though this does not make much difference to results, as will be shown below.

In what regards general Industrial Organisation literature on vertical relations, Tirole and Rey (2006) provide a wide survey on vertical restraints and merger. This literature is extensive and so we limit its review to the analysis of situations that are similar to our cases, in what regards the issues we focus, namely, the effects on market foreclosure and on welfare.

The debate on the effects of vertical restrictions on market foreclosure inside Industrial Organisation literature is also extensive. Ordover et al. (1990) provide a review of the critics addressed to the foreclosure result. These critics advocate that the excluded firms may have incentives to stay in the market. However, those incentives are based on the existence of other suppliers, which is not the case of this paper. Part of the criticism relies on the possibility of outsiders engaging in vertical contracts with other input suppliers, or simply buying the input from them at "market" prices. Another part claims that the upstream firm may not be interested in foreclosing the downstream market as it may lose buyers.

Ordover et al. (1990) give an example which is worth referring here: if the integrated downstream firm has a share of 10% the input supplier would lose 90% of the market. Our objection is that, in the case we are analysing, there is an airline with a larger market share. Airports would never establish contracts with airlines that are marginal in terms of market share. That is one of the reasons why we have chosen the Stackelberg model in the downstream market as it fits better real situations. In fact, the European cases mentioned in the Introduction of this paper involve contracts of airports and flag (dominant) airlines. In the Charleroi case, Ryanair agreed "to base between two and four aircrafts at Charleroi and to operate at least three rotations per aircraft leaving Charleroi over a 15-year period" (European Commission, 2004). This means that, if the contracting airline was not a leader of the airport's market share, the agreement planned that it would be. In fact, in 2002, the first year of the agreement, 94% of passengers departing from Charleroi were carried by Ryanair (European Commission, 2004). To engage in an agreement, it is necessary that one airline has a large market share. If it were not so, the validity of the criticism is a matter of time. If the airline is able to quickly fill the market (in the case, the slots) left by the foreclosed rivals, the argument is no longer valid. The same objection applies to a criticism referring to the fact that foreclosed rivals might well participate in the bidding for a contract with the upstream firm. Even if they were willing to, the airport would not probably be interested with in agreements with airlines that are marginal in terms of market share.

Effects of vertical mergers on consumer surplus have long been recognised as positive (Comanor, 1967). A merger of two successive monopolies increases consumer surplus, which was often expressed by the idea that successive monopolies are worse than a single monopoly. By eliminating double marginalisation vertical merger allows for lower downstream (consumer) prices. Outside the context of two vertically-related monopolies, there is a long literature considering two oligopolies or one oligopoly and competition, either in the upstream or in the downstream markets, and using Cournot or Bertrand competition. Results on welfare differ according to the models' hypotheses. But none of these works deals with the simple case of an upstream monopolist and downstream imperfect competition and homogeneous goods[49] which is depicted in this paper.

3 Types of agreements between airlines and airports

Literature on vertical merger shows that results depend crucially on the number of firms in each market and on the type of contract. In order to support the models developed in the next section and to set the limits within which their results are valid, it is necessary to review the types of agreements that airports and airlines are (or were) engaged in.

Contracts between airports and airlines have several forms, and clauses vary from case to case.

In Europe, these agreements have only been disclosed whenever they were investigated by the European Commission or by national authorities but they clearly aim at negotiating aeronautical fares. The Charleroi-Ryanair agreement is a good example of these contracts. The agreement involved a discount of 50% in landing charges (over the price charged to other airlines), and a discounted price for ground handling, by means of which Ryanair payed only about 10% of the price set for other companies (European Commission, 2004). In the Belgium, Finnish and Portuguese airports contracts, as referred above, the core of agreements was a discounted fare for flag airlines in domestic flights. This type of agreements is the base of our first case. Other types of agreements in Europe are not numerous. In Munich Airport, Terminal 2 is operated by a company that belongs to the airport and to Lufthansa and used exclusively by this airline and its partners. In Copenhagen airport, a discounted rate is offered to airlines that surpass a certain threshold of passenger numbers.

In the US, it is quite usual that some airlines (the so-called signatory airlines) sign contracts with airports. In general, these contracts establish that signatory airlines pay a lower price for the use of the airport's facilities, terminals and runways, (frequently, a price that approaches the operating cost), and a rent that intends to pay part of the airport investment. Such is the case of Atlanta International Airport Agreement[50]. We use the Atlanta agreement as the base for our third case.

[49] Comanor and Frech (1985) use an upstream monopolist but with two types of consumers, thus introducing product differentiation.

[50] "Under the Airport Use Agreements, the Signatory Airlines agree to pay landing fees to allow the City to recover certain operating and maintenance expenses as well as debt service plus 20% coverage on General Revenue Bonds issued to finance approved airfield capital improvements. The City has also entered into agreements that extend to 2010 with the principal passenger airlines serving Hartsfield-Jackson (the "Contracting Airlines") relating to their use and lease of the central passenger terminal complex (the "CPTC Leases"). The CPTC Leases provide for the calculation of terminal rentals and charges to allow the City to recover certain operating and maintenance expenses as well as debt service plus 20% coverage on General Revenue Bonds issued to finance approved terminal projects" (City of Atlanta Department of Aviation, 2007.

Other clauses are sometimes added. The “Airline and Tampa Airport Use and Lease Agreement” establishes that signatory airlines pay fees and charges based on the airport’s costs of providing facilities. They include not only the payment of investments, by means of specific rebates of debt service coverage but also sharing of the net remaining revenue. A similar agreement exists in Orlando International Airport.

In Dallas Fort Worth signatory airlines have a Use Agreement with the Airport Board. It is residual in the sense that all airport’s revenues that exceed the airport’s total costs (debt service, coverage, operation and maintenance costs) are returned to signatory Airlines. The Use Agreement allows signatory airlines to sublet their space to other airlines, whenever the former lease terminal space on an exclusive basis, as well as to be handled in it by signatory airlines. This contract approaches our second case.

Other airports, like Chicago O’Hare, have individual contracts with each signatory airline. Still, other agreements have been signed in Australia (for instance, at Sydney and at Melbourne[51]).

4 The model and results

4.1 General framework

The basic model assumes quantity leadership in the downstream market, where airlines sell tickets for flights to passengers, and, in the upstream market, where the airport sells its facilities (terminals, runways) to airlines, a situation of a single seller and a few buyers.

The application of Stackelberg quantity leadership to the downstream market seems more realistic. Table 1 shows a high concentration of airlines’ flights in the100 largest airports in the world, for 2005, with a mean for the first carrier’s share of 38%, and of 56% for the two largest carriers. Most of these high shares belong to flag carriers, in Europe and Asia, or to carriers that established their bases at particular airports in the US. These airlines may be considered as quantity leaders because, as first comers, they chose their quantities (as well as the best timetables) and left the remaining slots for other carriers. Thus it seems that the Stackelberg behaviour is more appropriate than the Cournot model to assess the effects of vertical contracts. Table 2 exhibits the same concentration in some European secondary airports in 2004, where the dominance of low cost carriers is clear.

The downstream market consists of a route operated by $n+1$ airlines, one leader and n followers. I assume that flights are identical, with neither horizontal nor vertical differentiation. Demand for flights has a simple expression, $p = a-bq$, where p is the price and q the quantity. For simplicity, it is assumed that the only cost airlines bear is the airport aeronautical fare, P, per passenger, while the airport has a constant marginal operational cost, c, per passenger, and a fixed cost, F.

The game is played in two stages. In the first stage the airport chooses the aeronautical fare, P, and in the second stage airlines choose their quantities.

[51] But terms of these agreements are not disclosed and were not known to the author.

Table 1. Main airlines' shares in the largest world airports, 2005

Ranking 2005	City	Airport	Proportion of flights by lead two carriers				
			Carrier 1	(1)	Carrier 2	(2)	(1)+(2)
1	Atlanta	Hartsfield Int.	Delta	39.8%	Atlantic Southeast	28.9%	68.7%
2	Chicago	O'Hare Int.	United	24.1%	American Eagle	20.7%	44.8%
3	London	Heathrow	British Airways	41.3%	bmi	11.4%	52.7%
4	Tokyo	Haneda	ANA	45.7%	JAL	39.8%	85.5%
5	Los Angeles	International	SkyWest	17.4%	Southwest	14.5%	31.9%
6	Dallas	Fort Worth	American	54.3%	American Eagle	30.5%	84.8%
7	Paris	Charles de Gaulle	Air France	41.8%	Regional	7.5%	49.3%
8	Frankfurt	International	Lufthansa	49.4%	Lufthansa City	6.2%	55.6%
9	Las Vegas	McCarran	Southwest	38.8%	America West	18.3%	57.1%
10	Amsterdam	Schiphol	KLM	52.1%	Transavia	5.6%	57.7%
11	Denver	International	United	32.0%	SkyWest	17.3%	49.3%
12	Madrid	Barajas	Iberia	37.7%	Spanair	14.7%	52.4%
13	Phoenix	Sky Harbor	Southwest	31.0%	American West	30.6%	61.6%
14	Beijing	Capital	Air China	37.2%	China Southern	17.2%	54.4%
15	New York	JFK	JetBlue	27.8%	American	14.8%	42.6%
16	Hong Kong	C hek Lap Kok	Cathay Pacific	24.9%	Dragonair	16.6%	41.5%
17	Houston	George Bush	Continental	83.7%	Colgan Air	5.2%	88.9%
18	Bangkok	International	Thai	31.5%	Bangkok	11.7%	43.2%
19	Minneapolis/St Paul	International	Northwest	47.5%	Northwest Airlink	15.7%	63.2%
20	Detroit	Wayne Country	Northwest	43.6%	Northwest Airlink	21.8%	65.4%
21	Orlando	International	Southwest	21.3%	AirTran	9.9%	31.2%
22	San Francisco	International	United	33.5%	SkyWest	27.1%	60.6%
23	Newark	Liberty Int.	Continental	71.4%	American	3.7%	75.1%
24	London	Gatwick	British	33.6%	easyJet	18.8%	52.4%
25	Singapore	Changi	Singapore	36.8%	Silkair	8.8%	45.6%
26	Tokyo	Narita	JAL	21.1%	ANA	16.9%	38.0%
27	Philadelphia	International	US Airways	29.4%	Air Wisconsin	22.4%	51.8%
28	Miami	International	American	51.0%	American Eagle	11.8%	62.8%
29	Toronto	Lester B Pearson	Air Canada	37.3%	Air Canada Jazz	23.2%	60.5%
30	Seattle Tacoma	Internation	Alaska	30.9%	Horizon Air	28.8%	59.7%
31	Sydney	Kingsford Smith	Qantas	44.8%	Virgin Blue	21.6%	66.4%
32	Rome	Fiumicino	Alitalia	39.8%	AirOne	13.2%	53.0%
33	Munich	F J Strauss	Lufthansa	28.6%	Lufthansa City	20.4%	49.0%
34	Jakarta	Soekarno-Hatta	Garuda	37.9%	Adam Skyc.	23.3%	61.2%
35	Barcelona	EI Prat	Iberia	26.5%	Spanair	14.2%	40.7%
36	Boston	Logan Int.	US Airways	11.2%	American Eagle	10.0%	21.2%
37	Charlotte	Douglas	US Airways	33.6%	PSA	24.4%	58.0%
38	Washington	Dulles	Mesa	26.4%	United	22.2%	48.6%
39	Seoul	Incheon	Korean Air	33.9%	Asiana	28.4%	62.3%
40	New York	La Guardia	American	11.6%	Delta	11.1%	22.7%
41	Paris	Orly	Air France	42.4%	BritAir	8.9%	51.3%
42	Dubai	International	Emirates	45.3%	Iran Aseman	5.5%	50.8%
43	Mexico City	Benito Juarez	Aeromexico	27.7%	Mexicana	27.5%	55.2%
44	Shanghai	Pu Dong	China Eastern	34.0%	Shanghai	13.6%	47.6%
45	Guangzhou	Baiyun	China Southern	52.4%	Air China	10.2%	62.6%
46	Kuala Lumpur	International	Malaysia	52.6%	AirAsia	26.3%	78.9%
47	Cincinnati	Northern Kentucky	Comair	58.1%	Delta	17.2%	75.3%
48	Manchester	International	CitiExpress	20.5%	bmi	8.1%	28.6%
49	Fort Lauderdale	Hollywood	Southwest	13.2%	Gulfstream	12.4%	25.6%
50	Salt Lake City	International	Sky West	50.1%	Delta Air	21.3%	71.4%
51	London	Stanstead	Ryanair	58.8%	easyJet	21.5%	80.3%
52	Taipei	Chiang Kai Shek	China Airlines	28.1%	EVA	21.4%	49.5%
53	Palma de Mallorca	Palma	Air Berlin	26.1%	Air Nostrum	12.4%	38.5%
54	Melbourne	Tullamarine	Qantas	43.5%	Virgin Blue	30.3%	73.8%
55	Honolulu	International	Hawaiian	26.6%	Aloha	20.7%	47.3%
56	Istanbul	Ataturk	Turkish	64.5%	Atlasjet	12.8%	77.3%
57	Baltimore Wash.	International	Southwest	49.1%	AirTran	11.0%	60.1%
58	Copenhagen	Kastrup	Scandinavian	45.5%	Cimber Air	11.0%	56.5%
59	Milan	Malpensa	Alitalia	35.5%	Alitalia Express	17.9%	53.4%

Ranking 2005	City	Airport	Proportion of flights by lead two carriers				
			Carrier 1	(1)	Carrier 2	(2)	(1)+(2)
60	Tampa	International	Southwest	27.2%	Gulfstream	11.9%	39.1%
61	Osaka	Itami	ANA	52.0%	JAL	31.1%	83.1%
62	Fukuoka	International	ANA	43.3%	JAL	32.6%	75.9%
63	Dublin	Dublin	Ryanair	34.5%	Aer Lingus	30.4%	64.9%
64	Sapporo	Chitose	ANA	47.5%	Japan	38.1%	85.6%
65	Zurich	Unique Zurich	Swiss	48.8%	Cirrus	3.9%	52.7%
66	Washington	Ronald Reagan	US Airways	28.5%	Air Wisconsin	10.8%	39.3%
67	Shanghai	Hongqiao	China Eastem	40.3%	Shanghai	21.6%	61.9%
68	Chicago	Midway	Southwest	69.4%	AirTran	10.9%	80.3%
69	San Diego	International	Southwest	33.9%	American Eagle	11.2%	45.1%
70	Mumbai	Chaprati Shivaji	Jet Airways	32.2%	Indian	14.5%	46.7%
71	Stockholm	Arlanda	Scandinavian	36.3%	Skyways AB	13.2%	49.5%
72	Sao Paulo	Congonhas	TAM	48.6%	Gol	32.4%	81.0%
73	Sao Paulo	Guarulhos	Varig	29.2%	TAM	25.6%	54.8%
74	Vancouver	International	Air Canada Jazz	24.2%	Air Canada	20.5%	44.7%
75	Osaka	Kansai	Ali Nippon	27.0%	Japan Airlines	25.3%	52.3%
76	Manila	Ninoy Aquino	Philippine	32.1%	Cebu Pacifjc	17.7%	49.8%
77	Brisbane	International	Qantas	45.9%	Virgin Blue	29.0%	74.9%
78	Brussels	National	SN Brussels	31.2%	Virgin Express	9.1%	40.3%
79	Antalya	International	Turkish	26.7%	Atlasjet	14.6%	41.3%
80	Oslo	Gardermoen	Braathens	43.3%	Norwegian	18.6%	61.9%
81	Vienna	International	Tyrolean	38.1%	Austrian	21.1%	59.2%
82	Shenzhen	Baoan	Shenzhen	28.1%	China Southern	27.8%	55.9%
83	Johannesburg	International	South African	28.1%	Comair	14.9%	43.0%
84	Dusseldorf	Rhein Ruhr	Lufthansa	19.0%	Eurowings	14.2%	33.2%
85	Delhi	Indira Gandhi	Jet Airways	21.7%	Indian	19.7%	41.4%
86	St Louis	Lambert	Trans States	22.4%	Southwest	18.6%	41.0%
87	Oakland	International	Southwest	62.8%	JetBlue	8.2%	71.0%
88	Athens	Elefhterios Vem.	Olympic	45.7%	Aegean	23.0%	68.7%
89	Moscow	Domodedovo	Siberia	29.7%	Transaero	10.5%	40.2%
90	Chengdu	Shuangliu	Air China	33.9%	Sichuan	28.9%	62.8%
91	Portland	International	Horizon	35.3%	Southwest	14.3%	49.6%
92	Nagoya	Okinawa	ANA	43.9%	Japan Transocean	29.3%	73.2%
93	Seoul	Gimpo	Korean	56.7%	Asiana	40.1%	96.8%
94	Jeddah	King Abdulaziz	Saudi Arabian	74.5%	Egyptair	4.1%	78.6%
95	Malaga	Malaga	Air Nostrum	14.3%	easyJet	13.5%	27.8%
96	Nagoya	Central Japan Int.	JAL	33.9%	ANA	27.1%	61.0%
97	Moscow	Shereme1yevo	Aeroflot	53.7%	Arkhangelsk	8.2%	61.9%
98	Kunming	Wujiaba	China Eastern	48.4%	China Southern	17.8%	66.2%
99	Berlin	Tegel	Lufthansa	23.9%	Airberlin	13.6%	37.5%
100	Cleveland	Hopkins	Continental	57.3%	CommuterAir	10.1%	67.4%

Source: Airline Business, December 2006.

Table 2. Main airlines shares in some European secundary airports,2004

Airport	% of main airline (number of flights)	Airline
Charleroi	RYANAIR	93.0%
Beauvais	RYANAIR	85.0%
Ciampino	RYANAIR	68.2%
Stansted	RYANAIR	58.0%
Girona	RYANAIR	96.0%
Hahn	RYANAIR	89.2%
Orio al Serio	RYANAIR	48.0%
Skavsta	RYANAIR	73.9%
Luton	EASYJET	50.3%
Torp	WIDEROE	75.0%

Source: Airports' websites, 2004

4.2 Basic model with no agreement

In the basic model, in the second stage airlines compete in quantities in the usual Stackelberg fashion. Each one of the followers (or airline *i*) maximises its profits, $\pi_i = (p\ (q_i+(n-1)q_j+q_D)\ -P)q_i$, where q_D is the quantity of the leader and q_j is the quantity of any of the other followers. As costs are identical, $q_j = q_i$, and the best reply functions (BRFs) will depend only on q_D. Using the followers' BRFs the leader maximises its profit, $\pi_D = (\ p(q_D+nq_i(q_D))-P)q_D$ and find its quantity, $q_D\ (P)$ while the followers will determine their quantity, $q_i\ (P)$, depending on the leader's.

In the first stage the airport maximises its profits, $\pi_A=(P(q_D+nq_i(q_D))-c)(nq_i(q_D)+q_D)-F$, with its derived demand function, $q(P) = q_D\ (P) + q_i\ (P)$, finding solutions for all variables. Results are in Appendix 1.

4.3 First case: Vertical merger

In this case the leader airline and the airport negotiate the fare, P_1 that the leader will pay for using the airport facilities. The other *n* airlines will pay a fare *P*, as before, with $P>P_1$. The negotiation aims at both partners obtaining the highest joint profits so that the solution for this case is the same of a vertical merger.

This merged firm maximises, in both markets (in q_D and *P*), its joint profits, $\pi_C = (p(q_D+nq_i(q_D))-c)q_D+(P-c)nq_i\ (q_D)\ -F$, using the followers' BRFs. Results for all variables are in Appendix 1.

The price P_1 will be obtained by negotiation, depending on the bargaining power of each partner, but this price is not relevant for our analysis.

Proposition 1: *An agreement between one airport and the leader carrier established to negotiate a lower fare for the airline: (a) is anti-competitive, as the other airlines are driven out of the market; (b) if the demand function in the downstream market is linear, it increases welfare and consumers' surplus.*

Proof:

(a)The merger foreclosures the dowstream market by making $P=p$. If making $P<p$ were a profit maximising solution for the merger, it would face competition and have $\pi_C = (p(q^*_D+nq_i(q^*_D))-c)q^*_D+(P-c)nq_i\ (q^*_D)\ –F$. With $p=P$, it will be a monopoly in the downstream market and have a maximum profit of $\pi_F = (p_F(q^*_F)-c)q^*_F–F$. It is necessary to show that: $\pi_F > \pi_C$. Let $\pi_M = (p_M(q^*_M)-P)q^*_M–F$ be a monopolist's profit in the downstream market with unitary cost *P*. Then, $\pi_M +(P-c)nq_i\ (q^*_D)$ is always higher than π_C. If $\pi_F > \pi_M +(P-c)nq_i\ (q^*_D)$, $\pi_F >\pi_C$. This happens if $(p_F(q^*_F)-c)q^*_F> p_M(q^*_M)q_M\ -Pq_M+Pnq^*_i\ –cnq^*_i+cq_M-cq_M = (p_M(q^*_M)-c)q_M\ +(P-c)(nq^*_i – q^*_M)$. But, as $(nq^*_i – q^*_M)<0$, if $(p_F(q^*_F)-c)q^*_F>(\ p_M(q^*_M)–c\ q^*_M$, the above inequality holds. Note that $(p_M(q^*_M)-c)q^*_M$ is the profit of a monopolist in the downstream market with cost *c* (or the profit of the merger). But if it is so, the monopolist will never have chosen q^*_M because q_F originates the highest profit in this case. So, the inequality $p_F(q^*_F)-c)q^*_F >(p(q^*_D+nq_i(q^*_D))-c)q^*_D+(P-c)nq_i\ (q^*_D)$is true and means that the merged firm

prefers to make $P=p$, and so make the outsiders' profits equal to zero and become a monopolist in the downstream market. The agreement is anti competitive.

(b) If demand in the downstream market is linear, the sum of the n airlines' BRFs will have the form: $q_i=A -Bq_D$, with $B<1$. Then the whole quantity, q, is $q= A+(1-B)q_D$, an increasing function of q_D. But q_D is higher (and so does q) when $q_i=0$ than when $q_i>0$. Then the merger provides a higher quantity than the pre-merger situation. The higher quantity leads to a lower price and a to a higher consumer surplus.

The profit of a downstream monopolist with marginal cost P is higher than the sum of all firms' profits in the pre merger situation. Besides, the sum of this monopolist's and the initial airport's profits is lower than the merger's profit (a monopolist with marginal cost c), so that the sum of all profits and thus welfare will be higher with the merger.

Joint profit maximisation, by eliminating double marginalisation, offsets the downstream monopoly effect and consumer surplus and welfare will be higher.

Re-doing the model with a Cournot game in the downstream market, the airport colluding with one of them leads to the same result. So there is no need of quantity leader. Stackelberg model was used as it seems to depict better real situations. A contract between the airport and two or more airlines would also not change results, provided that there were some outsiders left out of the agreement. In this situation the merged airlines would act as colluders in the downstream market.

Corollary 1: *If a regulator sets a price P_R, $p>P>P_R>c$, in the upstream market, (a) the leader and the airport may, under certain conditions, be interested in signing the agreement (b) with the agreement, the outsiders will remain in the market and (c) if demand in the downstream market is linear regulation increases consumers surplus.*

Proof:

(a) The leader and the airport may agree in negotiating a lower price, P_N ($P_N< P_R$). The merger profit would be $\pi_F = (p(q^*_F+nq_i(q^*_F))-c)q^*_F+(P_R-c)nq_i\ (q^*_F) –F$. The merger is now a Stackelberg leader with cost c. A lower cost yields a larger quantity and a higher profit margin. The outsiders' quantity q_i increases as the followers' cost (P_R) is smaller, but also decreases because the leader's quantity is higher. The difference between the merger's profit will be higher than the sum of profits of the leader and the airport under regulation if $(p(q^*_F+nq_i(q^*_F))-c)q^*_F+(P_R-c)nq_i\ (q^*_F)>(p(q^*_D+nq_i(q^*_D))-c)q^*_D+(P_R-c)(nq_i\ (q^*_D)+ q^*_D))$. If the gains in the downstream market outweigh the losses in the upstream market, which depends on price elasticities, the agreement will be interesting for both partners.

(b) Now the merged firm cannot set $P=p$. With any price P_R, $p>P>P_R>c$, the outsiders will make profits and remain in the market.

(c) Then regulation is pro-competitive but does not eliminate incentives for contracts of this type. However, and it can be easily computed from the expressions in Appendix 1, downstream quantities increase for any $P_R<P$. Then, downstream prices fall, and so consumer surplus is higher.

This case corresponds to the situations referred above of European airports discriminating prices amongst airlines (Finish and Portuguese airports, or the Charleroi agreement). Our

conclusions show that, if there are no capacity constraints[52], there is no reason to condemn these agreements if aeronautical fares are regulated. If they are not, the regulator will face the trade-off between an increase in welfare and a loss in competitiveness.

4.4 Second case: Airlines in the upstream market

Starkie (2008) describes the Australian case as one in which one or more airlines lease and operate terminals. The same is true for the agreement in Dallas Forth Worth. All airlines that remain outside this agreement use the terminal facilities provided by those (the signatory airlines) that explore them. Part of the upstream market services are now supplied by one airline.

In order to model this situattion we divide the airports' facilities in two items: terminals, with a constant marginal cost of *t*, and runways, with constant marginal cost of *r*. Suppose then that the dominant airline now fully operates the terminal, using its facilities and selling them to other airlines at a price P_1, while the airport operates the runway for all airlines at a price P_2. Previous to the agreement $c=t+r$, but afterwards the airline may have a higher (or lower) efficiency in the terminal operation.

The dominant airline's profits will be $\pi_D = (p(q_D+nq_i(q_D))-t-P_2)q_D +(P_1-t)nq_i (q_D)$, and each of the followers' profits will be $\pi_i = (p (q_i+(n-1)q_j+q_D) –P_1-P_2)q_i$. As in the basic model, outsiders have a BRF, derived from their profit maximisation. The leader maximises its profit using the followers' BRFs, and from there results the derived demand for the airport's facilities, now with two firms exploring them. In the upstream market the leader and the airport compete in prices P_1 and P_2 for complementary goods (the terminal and the runway). The airports' profits are now originated only by the revenues of the runway facilities: $\pi_A = (P_2(q_D+nq_i(q_D))-r)(q_D+nq_i(q_D)-F$. Solutions for the upstream prices yield solutions for all other variables and are presented in Appendix 1.

Proposition 2: *With a linear demand function in the downstream market, a contract between the leader airline and the airport, stating that the airline operates and sells part of the airports' facilities, (a) is anti-competitive and (b) decreases consumers' surplus and welfare, unless the leader airline is able to increase the efficiency in the facilities it operates*.

Proof:

The proof uses the expressions of Appendix 1.

(a)The profit maximising solution for the leader is to set $q_D = \frac{a-t-r}{4b}$ and $q_i=0$. Then $n=0$. In the first stage (upstream market), the best solution for the leader and for the airport is to set $P_1 = p-P_2$, resulting zero profits for the followers, which are driven out of the market.

With this contract the leader can, by itself, foreclosure the market by setting $P_1 = p-P_2$. In the first stage, the leader and the airport compete in the upstream market, with BRFs $P_1(P_2)$ and $P_2(P_1)$ that are negatively sloped, as goods (terminal and runway) are complements. Setting a higher P_1 will lead to a lower P_2, which causes a fall in the leader's costs. Moreover, if $P_1= p-P_2$, the leader will

[52] Constraints on capacity might limit the outsiders' quantity.

have monopoly profits in the downstream market. The two benefits outweigh the losses derived from not selling the terminal facilities to the other airlines, under the assumptions of Proposition 2 (linear demands). If demands are not linear, the result depends on the balance between gains from being a monopolist and gains from selling the terminal facilities, or on downstream and upstream demand elasticities.

(b) Consumers' surplus is lower after the agreement then before it if:

$$\frac{(a-t-r)^2}{32b} < (2n+1)^2 \frac{(a-c)^2}{32b(n+1)^2}. \qquad (1)$$

If *c=t+r*, this inequality holds for any *n>0*[53]. Then, if there are no efficiency improvements, consumers' surplus decreases. It can only be higher if the leader improves enough the terminal operations efficiency, or if:

$\frac{a-(t+r)}{a-c} > \frac{2n+1}{1+n}$. This ratio depends positively on *n*, which means that the more airlines in the market before the agreement, the higher should the ratio be, or the more should the leader increase terminal operations efficiency in order to improve consumers' surplus.

Comparing welfare after and before the agreement, the former should be lower if:

$$7\frac{(a-t-r)^2}{32b} - F < (2n+1)^2 \frac{(a-c)^2(6n+7)}{32b(n+1)^2} - F \qquad (2)$$

It also happens that this inequality holds for any *n>0*, or that, when *c=t+r*, welfare is lower after the agreement.

Proposition 2 provides interesting policy insights, as it shows that this type of contracts should only be allowed under the condition of airlines improving the efficiency of terminal operations.

Corollary 2: *If the leader airline does not improve efficiency in the airport facilities it operates, an agreement set under the conditions of Proposition 2, may only be interesting for both partners if the leader airline pays a rent to the airport that compensates it for its losses. There is an interval of values in which values for this rent exist.*

Proof:

The airport loses profits with the contract, as it now only sells part of its facilities. Suppose that *c=t+r*, and make *k=a-c=a-(t+r)*. The rent, *R*, should be higher than the airport's losses:

$$R > k\frac{n}{8b(n+1)} \qquad (3)$$

On the other hand, the rent should be lower than the leader's gains with the agreement:

$$R < k\frac{n}{16b(n+1)} \qquad (4)$$

[53] Notice that *n* is the number of followers in the market before the agreement.

It is possible that such a value of R exists for any $n>0$. Then, there are incentives for the agreement provided that the negotiated rent lies between those two limits.

Corollary 3: *In the case of an agreement in the conditions of Proposition 2, if the regulator price caps P_1 all airlines will stay in the market but if only P_2 is regulated then regulation cannot prevent the agreement from being anti-competitive and the monopoly in the downstream market will persist.*

Proof:

Let P_1^* and P_2^* be the upstream market prices under the agreement. If the regulator sets any price cap for the terminal facilities, P_1^R, $t<P_1^R<P_1^*$, the leader cannot by itself be a monopoly in the downstream market, by eliminating its competitors. This result can only be achieved if the airport would set P_2 such that $P_2=p-P_1^R$. In the upstream market, the airport's BRF is $P_2(P_1)$, and is negatively sloped. As P_1 falls with regulation, the airport increases P_2. The airport may push up P_2 up to the limit $P_2=p-P_1^R$, which would eliminate the followers, or keep it below that value. The first alternative leads to a monopoly in the downstream market, a smaller number of passengers and less market power for the airport. The second alternative keeps competition in the downstream market, with more demand and more market power for the airport. The airport would never give up demand and accept a downstream monopoly that would lead to a fall in P_2. It will prefer to set $P_2<p-P_1^R$.

If P_2 is regulated, it must be set below the initial price, $P_2^R<P_2^*$. In the upstream market the leader alone determines P_1. As its BRF is negatively sloped, it may charge a higher P_1 and eliminate the followers in the downstream market. As shown in Proposition 2, the leader prefers this solution.

Then, the regulation of airports where these types of agreements exist should focus on the price of the facilities that one (or more) airline operates, and not on those under the operation of the airport.

4.5 Third case: Price discrimination

This case depicts many of the agreements between an airport and the so-called signatory airlines in the US, which are established in a way that airlines pay the airport the variable costs of its facilities plus a part of the fixed costs. As shown in Section 3 they sometimes contain a clause that allows the airlines a share in the airports' revenues. In our model, we shall disregard this clause and so assume that the dominant airline pays exactly the cost c for using the airport facilities, as well a part, k, of the airport's annual fixed costs, in the total amount of kF, which is agreed between the two partners. The other airlines pay a price, P, for the use of the airport's facilities.

Let q_D^C be the leader's quantity after the agreement. The dominant airline's profits are now: $\pi_D = (p(q_D^C+nq_i(q_D^C))-c)q_D^C - kF$, and the airport's profits: $\pi_A = (P(nq_i(q_D^C))-c)nq_i-(1-k)F$. An outsider airline will have profits of $\pi_i = (p(q_D^C+nq_i(q_D^C))-P)q_i(q_D^C)$.

Proposition 3: *An agreement between an airport and an airline, by which the airline pays the cost of using the airport's facilities plus a fixed rent, does not foreclosure the downstream market.*

Moreover, if the demand function in the downstream market is linear consumer surplus and welfare will be higher with the agreement.

Proof:

The leader cannot control the downstream market as all the airport's facilities are directly sold to the outsiders by the airport, which determines *P*. From the expression of the airport's profits, $\pi_A = (P(nq_i(q_D))-c)nq_i-(1-k)F$, it is clear that it will never make $P=p$, or it would lose all revenues, except kF, which only covers part of the fixed costs and is not relevant for the determination of *P*.

Using the expressions of Appendix 1 it is easy to show that the difference in consumer surplus after and before the agreement is $\frac{1}{8}(3n^2+7n+3)\frac{(a-c)^2}{(n+2)^2 b}$. This expression is always positive. This difference increases with *n*, meaning that the higher the number of airlines in the downstream market, the more consumers benefit with the agreement. A similar positive difference is obtained for welfare:

$$\frac{1}{16}(2n^4+15n^2+35n^2+30n+6)\frac{(a-c)^2}{(n+2)^2(n+1)^2 b}, \qquad (5)$$

which is always positive.

Then, under the conditions of Proposition 3, this kind of agreement is not anti-competitive and leads to a higher welfare. However, these contracts are price discriminatory as the signatory airlines pay only the cost of the facilities while the other airlines pay a full price *P* that includes a profit margin. As Rey and Tirole (2006) point out, anti-discrimination legislation may have a perverse effect of decreasing welfare by restoring the monopoly power of the input supplier.

If the demand in the downstream market is not linear, it is true that q_D will always be higher, as the leader's costs are now lower ($c<P$). This rise will cause a fall in q_i. But the airport's demand is smaller now, as the leader is out of this market, and *P* will fall, which will cause a rise in q_i. The final result in q_i and in the total quantity will depend on the outsiders' best reply function, and on price elasticity in the upstream market, which depends on the downstream demand function. If the total quantity rises, consumer surplus will increase.

Now we analyse the conditions of the agreement. It is easy to see that the leader's profits are higher as its costs are lower after the agreement. As for the airport, it loses part of its revenues (those from the leader's use of its facilities), has a smaller demand and charges a lower price. So, the rent airlines pay to the airport, kF, must, at least, compensate it for its losses.

$$kF>(P(q_D+nq_i(q_D))-c)(nq_i(q_D)+q_D)-(P(nq_i(q_D{}^C))-c)nq_i(q_D{}^C) \qquad (6)$$

The leader will only pay a rent kF that does not diminish its profits:

$$kF< (p(q_D{}^C+nq_i(q_D{}^C))-c)q_D{}^C -(p(q_D+nq_i(q_D))-P)q_D \qquad (7)$$

Corollary 4: *With a linear demand function in the downstream market, there is not a value for the rent the leader airline pays to the airport that is interesting for both parties*.

Proof:

The rent should have an upper limit equal to the leader's gains with the agreement and a lower limit, equal to the airport's losses:

$$kF < \frac{1}{4}(2n+3)\frac{(a-c)^2}{(n+2)^2 b} \text{ and } kF > \frac{1}{4}(n+1)\frac{(a-c)^2}{(n+2)b} \quad (8)$$

From the expressions in Appendix 1 it is easy to show that the extra profits the leader earns with the agreement are smaller than the profits the airport loses for any *n>0.618*. Then there is no value of *kF* that matches the above conditions, or, put in other words, that makes the agreement interesting for both partners. Thus, or it is a public airport and is not interested in profits, but only in attracting more traffic, or it can pay the losses with concession revenues[54]. These revenues not only increase the airport's profits but also have effects on all the model's variables. Namely, they induce the airport to lower aeronautical charges in order to get more passengers, and consequently induce airlines to lower their fares.

Corollary 5: *If, under the agreement, a regulator sets a price cap $P_R<P^*$, where P* is the equilibrium price with the agreement, and if the downstream market demand function is linear, regulation will only lead to a higher consumer surplus if there is a single airline behaving as follower in the downstream market.*

Proof:

The price cap not only affects the equilibrium quantities of the airport and of the airlines that remain outside the agreement (non-signatory airlines), but also the leader's quantity, through the followers' BRFs. Suppose *P** is the upstream equilibrium price for the airport's (runway) facilities, with the agreement and before regulation. The regulator sets a price P_R, $c<P_R<P^*$. With a smaller input price, q_i will be higher, as the followers have a lower cost, but, as q_D is lower, with linear demand functions in the downstream market, the whole quantity, *q*, is smaller for *n>1*. In fact, and as can be seen in Appendix 1, the difference between the two quantities (after and before regulation) is equal to $-\frac{1}{2}(n^2-2)\frac{P-P_R}{b(1+n)}$, which is negative for any *n>1.4*. For any *n>=2*, downstream quantities will be lower, and prices higher, leading to a lower consumers' surplus. Consumers will only be better-off if there is a single follower, or in the case of a duopoly.

With more than one follower there is no point for regulation. Moreover, the agreement is pro-competitive, but regulation only changes the relative quantities of the airlines, by increasing q_i and decreasing q_D. If the market is competitive enough (or if it has more than one follower), the agreement is more efficient without regulation.

[54] Re-doing the model with concession revenues, and even in the simplest option (considering that each passenger spends a fixed amount in concession activities) yields too complex results to be analysed.

5 Concluding remarks: Some policy issues

This paper is intended to answer to questions that are currently of great importance for designing appropriate policies for the air transport industry, namely how vertical relations between airports and airlines affect competition and welfare, what is the scope for price discrimination legislation, and how regulation performs when there are vertical restraints.

According to findings of Industrial Organisation literature, pro-competitiveness and welfare effects depend on market structures and on the clauses included in vertical contracts. We concluded that price negotiation (or vertical merger) and the operation of terminals or other airport facilities by airlines are anti-competitive.

The first case typically exhibits the trade-off between competitiveness and welfare (as the merger increases consumers' surplus and welfare), leaving politicians a decision on allowing or not agreements, which means making (or not making) passengers or other airlines (with implications on other variables, like employment) better-off. However, regulation may balance the trade-off, by leaving consumers better-off and by giving room for the merger but not for market foreclosure. Additionally, and as the agreement improves consumers' surplus but price discriminates amongst airlines, politics should review the scope for price discrimination legislation.

The second form of vertical contract only increases consumers' surplus and welfare if there are enough improvements in terminal operations by the airlines. The lesson that can be learnt (though within the restrictive model framework of this paper) is that these arrangements should be allowed under the condition of airlines achieving a higher efficiency in terminals operations. Welfare-enhancing regulation should focus on this point, and pro-competitiveness regulation should focus on capping the price signatory airlines charge to others, but not the price the airport charges all airlines.

The third form of contract is pro-competitive and increases welfare. So, it seems that there is nothing wrong with these contracts. The only problem that there is no incentives for airports signing them, except if they are public and have other aims than mere profits, or if they can compensate losses with higher expenses in concession activities' goods and services. Moreover, it seems that regulation cannot add much, unless the market has few firms. This third form of vertical contract is also price discriminating, which adds another reason for questioning the point for not allowing this practice.

Finally, we should point out that anti-competitive results may not happen in a way that all airlines kept outside agreements are driven out of the market. Additional market imperfections, like slots' grandfathering rights hold by these airlines, or the leader's lack of capacity to supply the whole demand in the downstream market may prevent this result. Thus results should be understood as a tendency, or an increase in the contracting airline's share, which does not withdraw the validity of the outcomes for policy purposes.

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Appendix 1

1 Basic model

Downstream demand function: *p = a-bq*.

CS = Consumers' surplus

W = Welfare = consumers' surplus + sum of profits of all airlines + airport's profits

Results:

$$P = \frac{1}{2}(a+c); p = \frac{3a+2n(ac)+c}{4(1+n)}$$

$$q_D = \frac{a-c}{4b}; q_i = \frac{a-c}{2b(1+n)}; q = \frac{(a-c)(2n+1)}{4b(n+1)}$$

$$\pi_D = \frac{(a-c)^2}{16b(1+n)}; \pi_i = \frac{(a-c)^2}{16b(1+n)^2}; \pi_A = \frac{(a-c)^2(2n+1)}{8b(1+n)} - F$$

$$CS = \frac{(a-c)^2(2n+1)^2}{32b(1+n)^2}; W = \frac{(a-c)^2(2n+1)(6n+7)}{32b(1+n)^2} - F$$

2 First case

Results:

$$P = p = \frac{1}{2}(a+c)$$

$$q_D = q = \frac{a-c}{2b}; q_i = 0$$

$$\pi_F = \frac{(a-c)^2}{4b} - F; CS = \frac{(a-c)^2}{8b}; W = \frac{3(a-c)^2}{8b} - F$$

$$\text{Re}\,gulation:$$

$$q_D = \frac{(a-c)}{2b}; q_i = \frac{a-c-2P_R}{2b(1+n)}; q = \frac{a-c+2n(a-P_R)}{2b(1+n)}$$

3 Second case

Results:

$$P_2 = \frac{a+r-t}{2}; p = \frac{3a+t+r}{4}$$
$$q_D = q = \frac{a-t-r}{4b}; q_i = 0$$
$$\pi_D = \frac{(a-t-r)^2}{16b} - F; \pi_A = \frac{(a-t-r)^2}{8b}$$
$$CS = \frac{(a-t-r)^2}{32b}; W = \frac{7(a-t-r)^2}{32b} - F$$

4 Third case

$$P = \frac{a+2cn+3c}{2(n+2)}; p = \frac{3an+4a+4cn^2+9cn+4c}{4(1+n)(n+2)}$$
$$q_D = \frac{(3n+4)(a-c)}{4b(n+2)}; q_i = \frac{a-c}{4b(1+n)}; q = \frac{(a-c)(4n^2+9n+4)}{4b(n+1)(n+2)}$$
$$\pi_D = \frac{(a-c)^2(3n+4)^2}{16b(1+n)(n+2)^2} - kF; \pi_i = \frac{(a-c)^2}{16b(1+n)^2}; \pi_A = \frac{(a-c)^2 n}{8b(1+n)(n+2)} - (1-k)F$$
$$CS = \frac{(a-c)^2(4n^2+9n+4)^2}{32b(1+n)^2(n+2)^2}; W = \frac{(a-c)^2(4n^2+15n+12)(4n^2+9n+4)}{32b(1+n)^2(n+2)^2} - F$$

Regulation:

$$q_D = \frac{a-c+n(P_R-c)}{2b}; q_i = \frac{a+c(n+1)-P_R(n+2)}{2b(1+n)}; q = \frac{a(n+2)-cn(1+n)+P_R(n^2-2)}{2b(n+1)}$$

BSC: a tool for managing change in a passenger public transport company

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Companies at the public sector have the mission to assure services which effectively contribute for the quality of life of the community and to make these services available to all citizens. Therefore, people expect that they offer services with quality and customer oriented, but using the available resources with parsimony, efficiency and effectiveness. To correspond to this expectation from the society, such companies need to incorporate new concepts of management, able to drive their strategy to the value creation for the community. In this context, this paper describes an adaptation of existent management control tools to the specificities of a passenger public transport company. The Balanced Scorecard (BSC) was originally designed for the private companies' environment. Many researchers proposed modifications of the original metrics in order to adapt this tool to the public sector. This paper proposes a new perspective, the value creation for the Stakeholder, as the prime strategic objective of the BSC, in order to align the efforts of the company to the achievement of its role. The idea is to be able to get convergence between customer satisfaction and financial drivers. Other objective of this study is to reinforce in the culture of the company customer oriented principles. This new approach also allows the development of a strategic map for the company, which describes its strategy through a cause-effect chain of the objectives and actions on course.

Keywords: Public transport, Strategic alignment, Balanced Scorecard, Management control, Travel behavior

1 Introduction

Public transport companies must have equity and efficiency as one of their main principles as they are using resources from the society in order to satisfy the mobility needs of the community. Nowadays, more than the mere accomplishment of these social responsibilities it is expected from these companies to contribute for improvements in other aspects of its activity which affect the society. Transport users and community expect that such companies tackle pollution and congestion, and demand more quality and customer oriented services. More than just meeting the social necessities they require from these companies a more reliable, fast, safe and comfortable service.

Besides, the development of policies capable to correspond to these stakeholders[55] expectations, public transport needs to create long term strategies for the outcome challenges and opportunities. This paper proposes the adaptation of existing management control tools to the public transport sector in order to facilitate the implementation of new strategies for the modernization of these companies. Additionally it will describe all the stages covered by their introduction at STCP, the main public transport operator in the city of Oporto, Portugal.

The use of strategic maps and BSC is proposed in order to translate the strategy in clear objectives, to design solutions and initiatives that best meet these objectives and to develop measures for monitoring and evaluating performance over time. First of all it is necessary to develop

[55] In this study stakeholder means all the actors affected by the activities of the company, including the community, users and non-users of the service, the legislative bodies, the environment, the company's employees and the government.

a new structure of BSC, adapted to the particularities of the public transport sector. Based in this structure a new model for the strategic dissemination and management control system of the company will be developed.

Beyond that, the implementation of the BSC seeks to reinforce in the culture of the company customer oriented principles. With this purpose, this study integrates methods of increasing knowledge on customer expectations, using analysis of their behaviour and their attitudes towards transportation.

2 New challenges for public transport activity

In the later decades Europe observed a great increase in the car use, between 1970 and 2000 the number of cars almost trebled from 62.5 million to 175 million (EC, 2001). This excess of traffic has implications in congestion and accidents which affect the daily life of the citizens and has negative impact in the cities economy. Moreover, the resultant noise and air pollution and its effects on health are of greater concern in towns and cities. Nitrogen oxides and small particles have a disturbing effect on the health of the citizens and carbon dioxide is the main greenhouse gas causing climate change.

In this context, transport takes a crucial role in public policies once that, according to Vuchic (2005), experiences have shown that public transport has great importance for the quality of urban life, contributing for the traffic reduction through the offer of alternative means of travel. But to accomplish this target, transport system must be sustainable from the economic and social as well as environmental point of view.

In order to stimulate this modernization in the public transport companies, the Portuguese government formalized with the board of directors of several public companies a new model of contract, complemented by an annual sustainability report, beyond the traditional model of accountability report. These documents extend the evaluation of the company to non-financial performance measures such as efficiency in the operations, quality level of the service, environmental sustainability and social impact, complementing the budgetary and financial targets.

Furthermore, European Union concluded recently a new regulation for the passenger public transport sector. The European statute of October 2007 determined the creation of contracts of concession, which will implement new rules of controlled competitiveness. This statute entails that the introduction of a regulated competitiveness between operators allows services provision more attractive, innovative, at lower costs and not susceptible to compromise the execution of the specific missions trusted to public operators. The current operators have a term of ten years, until 2019, to adapt themselves to this new reality, in order to compete with other public and private companies, from all over the world, for exclusive rights of operation over given areas, during specific periods of time.

In the later years, STCP has been adapting its strategy and structure to prepare itself for these upcoming challenges. The basis of this modernization is the focus on the customer orientation, considered as a crucial point in the activity of the company.

Moreover, the company aimed to adapt its network to integrate a new mode of transport in the city of Porto, the light rail. STCP assumed itself as one of the components of a wider transport

system, instead of keeping its traditional positioning as the dominant operator in the city. With this new market positioning, the STCP seeks to contribute to the balance between the modes of transport in the city of Oporto and to the development of the intermodality.

This proposal seeks to use the BSC and strategic maps to translate this new strategic approach in an easier language, facilitating the discussion inside the company. Furthermore, the BSC will support the effective introduction of new acts in the company, such as new quality policy and security and environmental certification.

3 State of the art

3.1 BSC and the public sector

The BSC was originally developed by the researchers Robert Kaplan and David Norton as a performance management tool capable of giving a fast but comprehensive view of the business to top managers. It includes financial measures that tell the results of actions already taken, and it complements the financial measures on customer satisfaction, internal process, and learning and growth, operational measures that are the drivers of future financial performance (Kaplan and Norton, 1992). In their second article (Kaplan and Norton, 1996), these authors introduced four new management processes - translating the vision, communicating and linking, business planning and feedback and learning - that, separately and in combination, contribute to connect long-term strategic objectives with short-term actions.

In this study the BSC will be used in a broader perspective, as a change management tool capable of clarifying the strategy and communicating it through the company, engaging people and creating synergies for the prosecution of a common goal.

The evolution of the BSC can be characterized in four steps – a system for performance management, a strategic management system, a tool for the communication of the strategy and finally a methodology to support the management change (Pinto, 2007).

This evolution was possible due to the capacity of the BSC to link the companies' long-term strategies with short term actions, to align its management system and to communicate the strategy, objectives and initiatives through the company, allowing the alignment of people, processes and infrastructures to make the necessary changes in the strategic direction. This development can be chronicled through subsequent Kaplan and Norton articles and books (1992; 1996; 2000; 2006).

A decisive point for this evolution was the creation of the strategic maps. They provide a visual representation of the company's critical objectives and the crucial relationships among them that drives organizational performance. Moreover, they show the cause-and-effect links by which specific improvements create desired outcomes (Kaplan and Norton, 2000). According to Pinto (2007) this tool had impact in all the BSC implementation process, but mainly in two aspects, the communication of the strategy and the translation of the strategy in operational terms.

The BSC and its first set of metrics were originally created to be used in the private sector. But, as Kaplan and Norton (2001) quote, in 2000 the BSC was already completely accepted and adopted by non-profit and public organizations all over the world. As a result, several researchers described the introduction of the BSC in different types of public companies, either using the four

original metrics or adapting them to the specificities of the service under analysis (Beckles, 2006; Greatbanks and Tapp, 2007; Lang, 2004; Niven, 2003; Radnor and Lovell, 2003).

According to Phillips (2004), these metrics must be changed for the public organizations because they generally only pursue mission effectiveness and efficiency. That is, they want to accomplish their mission as efficiently as possible. So, he proposes the use of the BSC with the efficiency, effectiveness and impact perspectives, and suggests a list of performance measures which should be used.

Beckles (2006) argues that private organizations report mainly to their private shareholders, while public organizations respond to a broader range of stakeholder groups including citizens, public interest groups, and legislative bodies. Therefore, the researcher proposes the public good, the body that addresses the public interest values, as a fifth perspective, complementing the traditional metrics. Radnor and Lovell (2003), in the other hand, used the same metrics proposed originally by Kaplan and Norton, except by a change in the name of the financial perspective to cost perspective.
Niven (2003) proposed a structure of the BSC for public and non profit companies in general by changing its original metrics. He argues that if for profit-seeking enterprises to improve shareholder value is the endgame, the public and non-profit companies are completely oriented by its mission. In this sense he defined the mission as a new perspective, and all the other perspectives must converge for this main purpose.

3.2 Customer orientation in the public sector

Marketing is a societal process by which individual and groups obtain what they need and want through creating, offering, and freely exchanging products and services of value with others (Kotler, 2000). But if for private sector the focus is in the client satisfaction, for the public sector the focus is in the stakeholders' satisfaction. Besides, the purpose of the marketing driven to the public sector is to select targets and actions which contribute for the common well, those which create the higher level of welfare for the greater number of people (Kotler and Lee, 2008).

The high increase in car ownership in the last decades and the difficulty to attract customers who have different choices, greatly increased the importance of the marketing in the public transport sector (Vuchic, 2005). According to Shiftan et al. (2008) transit ability to capture riders depends on how successfully its services can compete against the car in each travel market.

But to achieve significant results from marketing, in the public transport companies, it is not enough just to equate it with advertising and public relations or to perform research and develop promotional programs. It is imperative that these organizations develop organizational cultures that are rider-oriented. Such cultures would go beyond the motions of performing marketing functions to develop a philosophy of operation that is rooted in the concept of customer satisfaction (Smith, Razzouk, and Richardson, 1990).

It can be considered that, if marketing strategies were applied correctly, the company would be able to completely understand the needs of the customer in order to adjust the product or service to be sold by itself, requiring the minimum of promotion initiatives. But to achieve this level of understanding of the customers' needs it is necessary to differentiate them through segments capable of identifying the profiles of distinct groups or buyers who might prefer or require the service

offered. Just by segmenting its marketing companies would be able to define policies to attract more users to public transport and to adjust the service to the customer necessities. Thus, the company can correctly use the marketing mix to pursue its objectives in the target markets (Kotler, 2000). The marketing mix is a set of marketing tools that entails seven variables to be used by service providers in order to satisfy their customers; service itself, price, promotion, place, participants, physical evidence and process of service assembly (Fisk, Grove, and John, 2008).

Many transport companies often use undifferentiated marketing strategies, designed to appeal to a public at large, for instance, the inhabitants of a defined area. They attempt to use a simple and cheap marketing strategy with a single service and promotion package to attract passengers (Vuchic, 2005). But this type of marketing is not enough when the target is to attract the largest number of users for public transport. In this case the best solution is to build a more sophisticated program, using differentiated, concentrated and individual marketing strategies oriented for specific segments. However, these types of strategies have a high cost, and to keep them affordable it is necessary to identify segments of people that are most motivated to use public transport. The public transport sector is traditionally segmented by social, demographic or geographic data. But recent studies indicated that this type of segmentation does not provide information regarding the willingness of people to use public transport. These studies defend the use of behaviour segmentation in the basis of its marketing strategies, complementing the traditional methods. This new approach seeks to complement the quantitative based data with psychological analysis of perceptions, identity, social norms and habit to understand travel mode choice (Anable, 2005). Most of these researches use the Theory of Planned Behaviour (Ajzen, 1991) to determine the market segments more worthy to target, composed by people with great potential to mode switch (Anable, 2005; Beale and Bonsall, 2007; Beirão and Cabral, 2007, 2008; Jensen, 1999; Y. Shiftan, M. Outwater, and Y. Zhou, 2008).

4 Implementing the BSC

4.1 The adaptation of the BSC

As a public transport company, the mission of STCP is the value creation for the stakeholder, the basis of its strategy. Thus, this study proposes this perspective as the central one in its BSC structure (Fig. 1). Other alteration is to join the budgetary control to the financial perspective, in order to control the financial enablers and constraints of the public sector. The other perspectives are similar to the original metrics: client, internal processes and infrastructure.

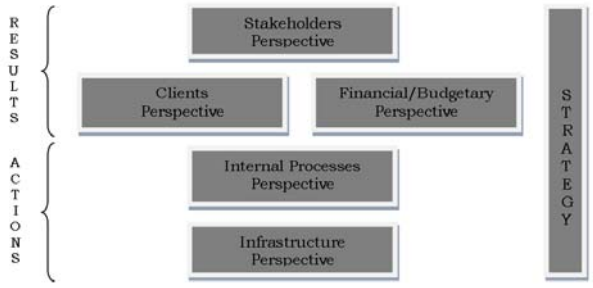

Figure 1. Balanced Scorecard structure for public transport companies

With the purpose of using this methodology as a tool for management support, it is determinant to define the cause-effect relationships between these perspectives. The structure sets the client perspective at the same level of the financial/budgetary one. This assembly assures that they will support and constraint each other for the achievement of the central target of the company, the value creation for the stakeholder. After all, the challenge in a cause-effect relation is to assure synchronism between all the perspectives.

This proposal of BSC adapted for public transport companies was presented to the board of directors of STCP and approved for implementation.

4.2 Integrating the BSC in the management control system

Rather than acting as just an additional component of the performance management process, the BSC can act as a unifying force, tightening the links between the various dimensions of the system and making the whole significantly stronger than the sum of the parts (Niven, 2003). Therefore, the first step of the implementation of the BSC in STCP will be to find a place in the overall system allowing the maximization of the considerable value it has proven to deliver.

The management contract, formalized between the board of directors of the STCP and the government, entails the strategic orientation of the company, describing the 10 principles which drive this strategy, its vision and mission, the strategic objectives and the performance indicators which control them. Internally, this document is complemented by departmental management contracts formalized between the board of directors and the heads of the departments.

These contracts are used as a basis for the development of activity plans, which enclose the initiatives and temporal targets of each department, and boards of drivers, which entail the departments' performance measures and targets.

Complementing the board of drivers, for the day-to-day control management, there are indicators for the processes. The company has 18 documented processes, with their respective procedures and internal procedures, derived from a quality certification recently obtained by STCP. Similarly, there are additional indicators derived from the environmental and security certification. These indicators, however, are not yet entirely associated to the performance measures of the management contracts, activities plan and board of drivers. Figure 2 resumes the structure used by the company to disseminate its strategy.

This study proposes that the dissemination of the strategy in the company will use just three documents (Fig. 3), according to the following concepts. The management contract describes the strategy formulation of the company, the BSC assumes the central role in the management control and the process indicators will be responsible for the task management.

These three types of management activities are differentiated by Anthony and Govindarajan (2007) according to the following: strategy formulation is the least systematic of the three, task control is the most systematic, and management control lies in between; strategy formulation focuses on the long run, task control focuses on short-run activities, and management control is in between; strategic formulation uses rough approximations of the future, task control uses current accurate data and management control is between; the planning process is much more important in strategy

formulation, the control process is much more important in task control, and planning and control are approximately of equal importance in management control.

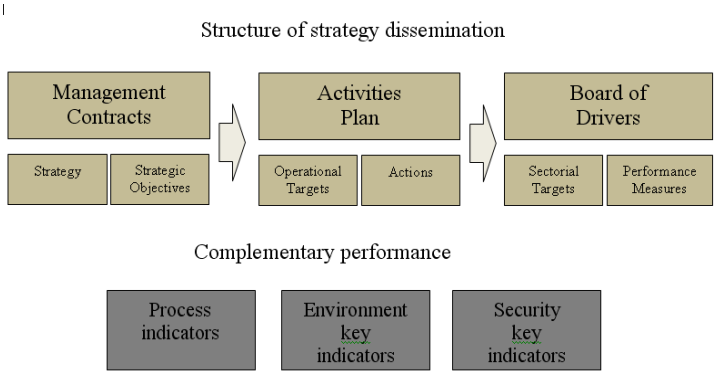

Figure 2. Current STCP strategic dissemination system

Figure 3. Proposal for reorganization of STCP strategy dissemination

Management control is the process by which managers influence other members of the organization to implement its strategy. In order to become an aggregating tool, in the STCP's management control system, the BSC needs to integrate other elements besides the strategic planning[56] and the performance measurement, such as evaluation and reward, budgeting and resource allocation (Anthony and Govindarajan, 2007).

Connecting the evaluation and reward systems to the companies' performance measures results is crucial to motivate the employees for the strategic tasks prosecution and consequently to internalize all over the enterprise the strategy on course. According to Kaplan and Norton (1996) mere awareness of corporate goals, however, is not enough to change many people's behaviour. Somehow the organization's high-level strategic objectives and measures must be translated into objectives and measures for operating units and individuals.

In STCP, this methodology is currently applied just for the head of departments. About 95% of the employees are covered by the Professional Evolution System (PES), formalized between the company and the labour unions. The remainders are not covered by any system. The PES evaluates the employees by their personal results and is connected to the promotion system of the company, but it does not involve financial reward. The introduction of the BSC will connect the evaluation and reward of each single employee to the BSC departmental's performance measures related to their daily activities.

[56] Strategy formulation is the process of deciding on new strategies, whereas strategic planning is the process of deciding how to implement the strategies.

The departmental budgetary system of STCP is based on two documents: the operating budget, for the department's regular tasks, and the investment plan, for the projects requiring independent budgets. The BSC will facilitate the definition of the investment priorities, once that it organizes the information regarding the initiatives on course and determines the most critical projects targeted to the achievement of the strategy. As quoted by Kaplan and Norton (1996) the very exercise of creating a balanced scorecard forces companies to integrate their strategic planning and budgeting processes and therefore helps to ensure that their budgets support their strategies.

4.3 The process of implementation of the Balanced Scorecard in STCP

For people to act on the words given by the vision and strategy statements, these statements must be expressed as an integrated set of objectives and measures, agreed upon by all senior executives, that describe the long-term drivers of success (Kaplan and Norton, 1996). So, the first step for the BSC introduction was a discussion between the board of directors and the heads of departments in order to build a consensus about the organization's strategy and a common language in the company. At this point, a BSC workgroup, responsible for further implementation, was created.

The first author of this paper was integrated in this workgroup, for a participant observation data collection. In the case study strategy research, the participant observation is a special mode of observation in which the researcher is not merely a passive observer. Instead, he may assume a variety of roles within a case study situation and may actually participate in the events being studied (Yin, 1994).

The BSC and strategic map concepts were presented all over the company, through discussion meetings at each department. The main topics discussed were, the clarification of the BSC language, a detailed discussion of the STCP's strategy, the definition of the strategic objectives which better translate it and the determination of the role of the departments' activities for the strategy achievement. Kaplan and Norton (1996) defends that broader participation in scorecards takes longer, but it offers several advantages. Information from a larger number of managers is incorporated into the internal objectives, the managers gain a better understanding of the company's long-term strategic goals and such broad participation builds a stronger commitment achieving goals.
Later, using the information collected in the meetings, the BSC group defined the STCP strategic map, with the enterprise's strategic objectives and the cause-effect relationships, and the STCP Balanced Scorecard, with the performance measures, targets, initiatives and responsible persons.

5 Results

Strategy implies the movement of an organization from its present position to a desirable but uncertain future position. As the organization has never been to this future place, the pathway to it consists of a series of linked hypotheses. A strategy map specifies these cause and effect relationships, which makes them explicit and testable (Kaplan and Norton, 2000).

In the STCP strategic map (Fig. 4), the three perspectives in the top (stakeholder, financial/budgetary and clients) include the company's lag indicators, which show the result of the implemented strategy. The bottom perspectives (internal process and infrastructure) entail the drivers for the strategy prosecution, dealing with the central competences of the company, related to

operations, processes, technologies, structures, information systems, internal communication and skills and capacities of workers. They are controlled by the lead indicators, which show the progress for key areas in implementing strategies (Anthony and Govindarajan, 2007).

5.1 Economic rationality

The first objective in the stakeholder perspective is the economic rationality, which encloses the company's compromises with its only shareholder. Accordingly to the strategic principles of the company, it refers to diminishing the operational deficit, namely through the control of costs, and the improvement of the operational efficiency, seeking to reduce the impact of its activities in the public accounts. This objective is reflected in the STCP's mission as the action of a rigorous model of management which pursues the operating economy, without loosing the opportunity to expand the activity, where the demand justify it and the space of the concession allow it.

At a financial/budgetary level this objective is influenced by the cost structure optimization, the utilization of resources, and the increase of demand and income. The appropriate management of the relationship with the customers and the improvement of the service quality both aim to increase demand. Many of the operational drivers will influence these top objectives, namely development/optimization of the service; maximization of business partnerships; internal efficiency and customers' gaining.

5.2 Environmental and social benefits

The social responsibility is related to the social service provided by the company. About 30% of the kilometres travelled by the company have exclusive social concern, through services in remote areas or night and week-end services with reduced demand, and special rates are attributed to minors, students and retired. The environmental sustainability is directly related to the reduction of the level of emissions of pollutants in the atmosphere.

In the mission this responsibility is translated in various dimensions as to contribute for the reduction of individual transport and corresponding reduction in the pollution level and to develop its activity through an integrated management system in the dimensions of quality, environment and security.

Both environmental and social results are influenced by the increase of demand, based in the shift of car users to public transport users, once that the reduction of cars flow decreases emissions, congestion, accidents and other problems caused by the excess of traffic in big cities.

5.3 Contribution for the improvement of the integrated transport system at Oporto

The market positioning of STCP suffered a substantial change since the introduction of a light rail transport service as a new transport mode in the metropolitan area of Oporto. As described in the STCP's report and accounts of 2008, yesterday the company was characterized for its position of exclusive public transport operator in the city of Oporto, but today the company chose to be one of players, indeed the most important one, in an articulated system with the light rail, in order to contribute more effectively to the integrated transport system in the region.

This target is implicit in the social and environmental benefits objective. In the operational level it was identified as the necessity to articulate the transport system, but also to promote and support the collaboration between transport operators in the metropolitan area of Oporto, namely by making efforts to unify marketing, sales network, public information and complaints services.
This objective was defined in accordance with the European Union proposal to put the emphasis on exchanges of good practice aiming at making better use of public transport and existing infrastructure (EC, 2001).

5.4 Customer orientation

Strategically, the customer orientation is one of the main objectives of the company. However, despite its existence in the STCP's strategic formulation in the later years, there is a general perception in the company that its principles are neither translated in the process of the company nor interiorized by its employees. This occurs because STCP, as any other public company, historically considered the government as its prime client. This mentality should be definitively changed, once that the real STCP's client is the stakeholder, including the public transport users and potential users.
In this project the target is to implement the customer orientation in the culture of the company, influencing all the processes and activities in the companies related to the service supply. As a result the customer orientation objective crosses different perspectives over the strategic map, influencing several objectives.

Services are inherently relational. Perceived relationships are not enough to make customers loyal, but they are a central part of loyalty (Grönroos, 2007). The customer relationship objective, in the client perspective, has the target to develop a partnership relation between STCP and Oporto community. STCP seeks to consolidate its image of reference as a social service provider in Oporto. This image, however, is closely dependent of the quality of service offered. As quoted by Beale and Bonsall (2007) marketing draws attention to the product and, unless the product meets potential customers' needs, any positive effect of the marketing will only be short-lived and a whole new group of potential users will find their worst prejudices confirmed.

In the operational level the basis for the customer orientation will be the introduction of a new approach for the definition of the company's target market, based in the behavioural segmentation. Merely satisfying and retaining customers is hardly a strategy. A strategy should identify specific customer segments that the company is targeting for growth and profitability (Kaplan and Norton, 2004). In the public sector specifically this strategy is intended to attract more car users to the public transport system, and consequently increase the demand for the service. This new approach is reflected in the segmentation and customer gaining and retention objectives.

The information to the public seeks to provide information about the system and services, thus facilitating attractive and convenient transport to current and potential passengers (Vuchic, 2005). It implies the coordination of the several components of the company's information system, in order to make available to the public useful advices regarding lines, schedules, prices, alterations in the service and promotional campaigns. The lack of this type of information most of the times are very prejudicial for the public transport users, resulting in a negative impact in the image of the operator and in the worst scenario loss of clients.

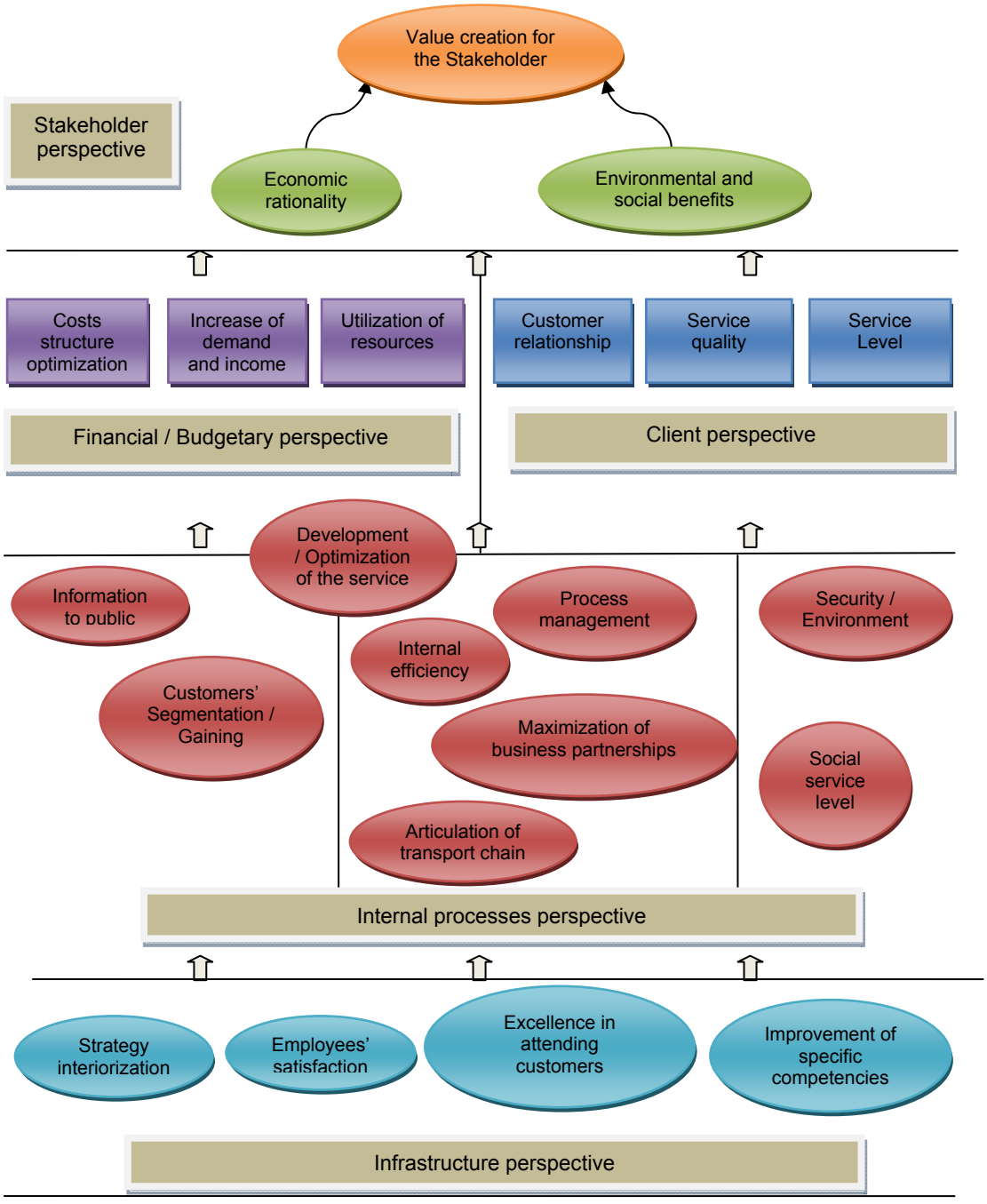

Figure 4. STCP strategic map

5.5 Infrastructure perspective

According to Kaplan and Norton (2000), the foundation of any strategic map is the infrastructure perspective, which defines the core competencies and skills, the technologies and the corporate culture needed to support an organization's strategy. Specifically, the organization must determine

how it will satisfy the requirements from critical internal processes, the differentiated value proposition, and customer relationships.

Firstly, it was identified the necessity to improve the knowledge of the strategy on course in the company. Besides the improvement of the top-down communication in the company, it is proposed to foment the goal congruence, which means that the goals of an organization's individual members should be consistent with the goals of the organization itself (Anthony and Govindarajan, 2007).

It is also intended to increase the specific competencies all over the company. This objective proposes the technical upgrading in critical areas with responsibility for the realization of the main activities in the company. The quality in the attendance, particularly, is one of the central competences of the company, because it has direct consequences in the customer satisfaction, and consequently will be monitored in a detached objective.

Finally, one of the most important objectives in the STCP strategic map is the employees' satisfaction. This objective has a crucial role in the employees' motivation and engagement in the implementation of the initiatives proposed by the project. The intention is, at first place, to create a satisfaction inquiry for the employees in order to determine how the company is evaluated. This inquiry will also determine the needs and expectations of the employees and their willingness to collaborate in the strategy on course. Such information will be used in order to create new initiatives looking for the raise of the overall satisfaction regarding the company, and consequently to stimulate an active participation in the changes on course.

6 Conclusions

This study has proposed a methodology to implement the BSC and strategic maps as management change tools in public transport companies, based in the case study of STCP, as a reaction to the new upcoming challenges for these companies. The bibliographical review indicated the necessity to adapt the traditional metrics of the BSC to the particularities of the public sector. As a result, the structure proposed in this paper has the stakeholder in the central role, and the customer and financial/budgetary perspectives interacting in a lower level.

This structure was used to start a discussion over all the departments of the company about the strategy proposed for the next years, allowing the development of a common language and engaging the employees in its prosecution. The resultant strategic map clarified the cause-and-effect relationships between the strategic objectives and actions, which was most of the time unclear for the employees. Furthermore, the BSC simplified the management control system, clarified the indication of the responsible person for each action and highlighted the key performance indicators.

For the next phase of the project it is planned the development of departmental BSC's, in order to define the role of the departments in the achievement of the global goals. However, the main difficulty for a more efficient implementation of the BSC in STCP is to introduce it in the employee's evaluation system and beneficiation. The current evaluation system of the company is very rigid and it has been used since many years ago.

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European metros: Benchmarking Efficiency

A Portuguese perspective

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This research is aimed at examining the performance of metros in Europe, using for the purpose two methods, the application of performance indicators and the non-parametric technique of DEA. The work was divided, essentially, into three parts. In the first part, an extensive documentation review related to urban public transport was carried out in order to understand what were the relevant issues and who were the stakeholders involved. The benchmarking concept is presented along with a brief overview of the existing organisations in transport benchmarking. In the second part, related to metros organization in Portugal, it has been considered, among other things, the national legislation on public transport, the sector institutional structure, the system financing, the various public services providing models, the state involvement and the transport services contracting schemes (e.g. public-private partnerships, PPP). In the third part, a framework of performance indicators was proposed and 8 indicators of efficiency and effectiveness for the 39 European metros were analyzed in detail. Later, the DEA methodology was applied to build three models for 37 metros, with different inputs (extension of the network, staff, vehicles and other operating cost) and different outputs (vehicle-kilometres, passenger and passenger-kilometres). The input-minimisation version of DEA was used for all the models, and each one of them was tested with both constant and variable returns to scale. Both benchmarking methods have shown that London and Moscow metros are efficient. The metros of Lisbon and Oporto showed a poor performance and are placed below the European average.

Keywords: Metro, efficiency, Portugal, performance indicator, data envelopment analysis

1 Introduction

This research arises from the need to analyze the performance of metros in Portugal in comparison to the rest of Europe. Therefore, they were used benchmarking techniques. The benchmarking application developed in this document reflects the increasing importance of metro systems as an alternative to private transport in urban centres and its role as an element of social cohesion and sustainable urban mobility.

According to (ERRAC, 2004), a metro system must meet four conditions: it must be electrically driven; move in a dedicated lane (surface, elevated or underground) separating itself from other traffic; present high frequencies and deal with large flows of passengers per hour per direction.

Based on these principles, Union Internationale des Transports Publics (UITP) classifies metro systems into two types: conventional metro, a tracked, electrically driven local means of transport, which has an integral, continuous track bed of its own (large underground or elevated sections); and light Rail, a tracked, electrically driven local means of transport, which can be developed step by step from a modern tramway to a means of transport running in tunnels or above ground level. This broad definition encompasses a wide array of situations, from conventional tramway to tram-train solutions.

In 2006, according to UITP data, there were about 206 metro systems in Europe, encompassing a wide range of solutions. Of those, only 36 systems were classified as conventional metro and other 18 were classified as hybrid systems (running in a dedicated track partially underground), making a total of 54 systems, which were the subject of this review.

Leonard (2001) proposes the following terminology, which seems quite enlightening. Benchmarking is a process. It is the means by which we try to achieve a superior level of performance, in a particular area, changing current practices in the company, leading to improvements in its performance. Benchmark is a standard of excellence, the basis of comparison to similar results. Best practice is the mean by which the maximum level of performance (benchmark) is reached.

The benchmarking process can be developed inside or outside the company. It can be a systematic performance comparison between departments of the same company (internal benchmarking) or it can compare the performance of one company with other organizations or competitors in the sector (external benchmarking).

The cyclical process of Benchmarking can be described in 9 steps, as shown in Figure 1, adapted from Hanman (1997). The first 4 steps are the scope of this research. Generally, it can be defined 3 levels of benchmarking in 3 increasing degrees of commitment and cooperation, as described in Table 1 (EQUIP, 2000).

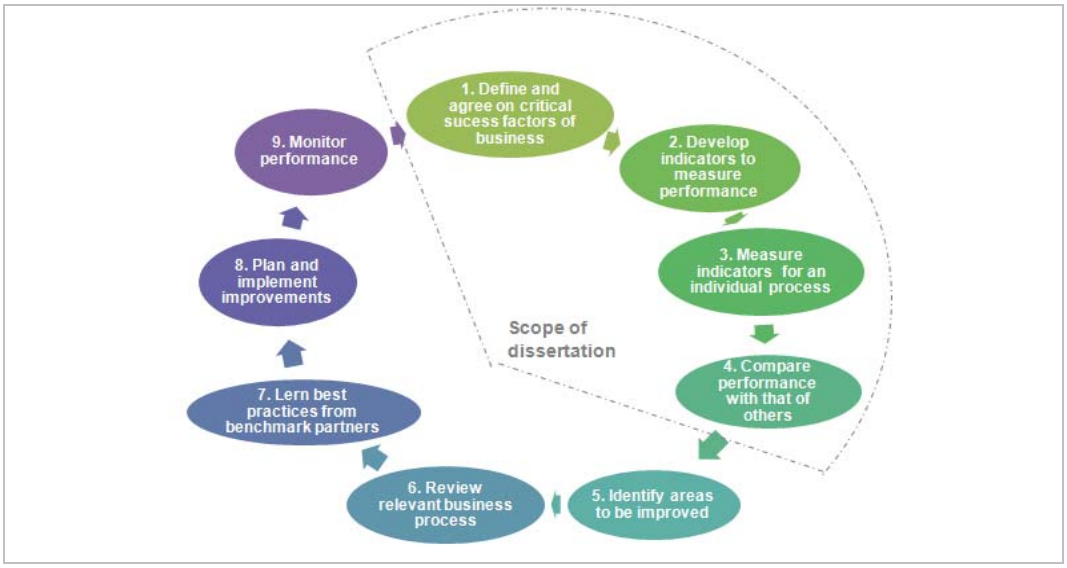


Figure 1. The continuous improvement process of benchmarking – a nine stage model

Table 1: Benchmarking levels

Level	Category	Elements
I	Self-Assessment	Measure your own company's performance (over time)
II	Comparison	Compare your performance with database of anonymous indicator value. Identify improvement areas and best "standards"
III	Partnering	Work with relevant partners, perhaps with some outside the direct business sector. Exchange confidential information. Learn best practices and the means of implementing the necessary changes. Ideally, this should be a two-way process.

The process of external benchmarking between operators, corresponding to the level III, is not common. The main reasons for this are confidentiality, lack of efficient tools to identify comparable practices and a remarkable resistance to information dissemination. In spite of this, there are several

organizations, groups such as Comet, NOVA, ALAMYS, UITP, EMTA, ERRAC, among others, who have been doing, among other things, benchmarking projects on public transport (PT), especially on metro. In this context, the European Union has supported various projects, such as BEST, BOB and the MODUrban.

Despite the various benchmarking studies published about PT, the majority does not focus on one specific mean of transport, providing only a comparison between PT and private transport. The benchmarking studies focused on metro publicly available are rare and therefore more valuable. Nevertheless, its use was very helpful to this research and for that reason must be pointed, the article from Costa, (1998) and Frasquilho, (2005).

2 Organization of metro systems in Portugal

2.1. National legislation applicable to the transport sector

The Portuguese public transport system structure is based on the Law on Inland Transport system (the so called Lei de Bases dos Transportes Terrestres, LBTT), Law No. 10/90 of 17 March. Chapter IV of this law presents the foundations for the planning and operation of transport in the Portuguese metropolitan regions, foreseeing the institution of Metropolitan Transport Authorities (MTAs). Despite that they have been planned in the 90s, the AMTs were only created more than 13 years later, by Decree-Law (DL) No. 268/2003 of 28 October. This decree, renewed by Law No.1/2009 of 5 January, establishes the MTAs in Lisbon and in Oporto.

2.2. The transport sector institutional structure in Portugal

The institutional organization is composed by various entities (Cruz, 2006):

1) The Government and directly dependent entities:

- The Government, responsible for decision and financial levels (financing the railway infrastructure for surface light rail, subway and train and road infrastructure together with the municipalities covered);
- Directly dependent on the Government, as the old General Directorate for Land and Inland Waterway Transport (DGTTF), which assumes the competences of regulating the land and inland waterway transport sector, and regarding railways, the National Institute of Railway Transport (INTF);

2) Municipalities, responsible for urban and local transport concessions for urban and municipal road operators, school lines and road design on municipal network (Law 10/90, LBTT);

3) Metropolitan Areas and Regions, which competencies are dependent on the framework of the future MTAs, envisaged on Law 1/2009 of 5 January. These authorities will have powers of regulation and coordination on various modes of transport within the limits of the corresponding metropolitan area. This coordination task is particularly difficult due to the complex interaction between the various stakeholders involved in the urban public transport system and its diverging goals. According to ISOTOPE (1998), an urban public transport system encompasses 3 levels of relationship, representing different stakeholders and conflicting interests:

Table 2: Stakeholders and interests at policy, agents and customers' levels

Level	Represented Segments	Specific goals
Policy level	Citizens in general	Welfare maximization, congestion relief and environmental protection
	Tax payers	Low subsidies volumes
	Lower income groups	No exclusion through price
	Minorities	Easier social integration
	Urban areas needing rehabilitation	Attraction of businesses and employment
Agents' level	Authorities	Avoid excessive burden
	Operators	Fair conditions of access to market/operations in markets
		Conditions for stable commitment and innovation
Customers' level	Passengers	Good accessibility (in space and in time)
		Ease of use and attractive service

2.3 Financing metro systems

A metro system, given its size and infrastructure, requires heavy investment. Its financing may refer to 3 categories, namely infrastructure, rolling stock and operation of the system (financing the public service). The Durable Infrastructure Investment (DIFs), apart from the use of EU funds (European Regional Development Fund - ERDF), is usually supported by the state, given the weight and importance of this financial effort, but in some cases may be partly or entirely covered by local government and regional authorities (cities and metropolitan authorities). Regarding investment in rolling stock, this is normally supported by the operator through its own equity and debt. This practice is common, especially when the market is opened to the private sector.

Financing a metro system operation involves public service component. The metro system subsidization policy differs from country to country. In Barcelona, the Autoritat del Transport Metropolita (ATM) fully subsidizes the operation of the system, covering the operating deficit each year. Although the avoidance of transport operators' indebtedness this policy does not bring incentives for efficiency by itself.

One way to encourage efficiency is to estimate the deficit incurred by the operator, covering this amount and only this amount that should be stated in contract. Thus, if the operator presents excessive costs causing higher deficits, they must be borne solely and exclusively by the operator. This situation is common in public-private partnership contracts (e.g., metro concession of Lille, by Keolis).

In Portugal, several PT operators receive annual compensation from the State, in name of public service obligations (PSO), but in a lower proportion than the estimated cost of these obligations. The underlying model of public transport services financing is determined by the respective ministry, without revelling the underneath criteria to transport companies. In future, PSO should be, according to the EU transport sector strategic guidelines for the transport sector, subject of contracts between the state and the transport operators.

2.4 Public transport services providing models

In general, the Portuguese scenario can be segregated into three distinct parts (Cruz, 2006):

1) Public transport services provided by public transport operators, owned by the state and under its control, direct or indirect;

2) Municipal operators responsible for:

Municipal services, managed by the City Council;

Local authority services, managed by an autonomous unit of the City Council with administrative and financial autonomy, but without legal personality, and

Municipal and inter-municipal enterprises, where management services are delegated to enterprises established in Municipal Assembly, with administrative and financial autonomy and legal personality. There may be the involvement of a private entity, leading to the creation of joint ventures (Institutional Public Private Partnership). The private capital choice, under the new legal regime for the local business sector (SEL), must go under concourse.

3) Private operators, who pursue their activities through some kind of concession, lease or management contract. This entails, among other things, municipal and inter-municipal concessions, where the public partner is the city council or the municipalities association. The process must go under concourse.

2.5 Transport services contracting schemes in Portugal

The transportation systems in Portugal are mostly run by companies comprised in the State business sector, varying the type of contract (or the lack of it). The direct management by the State or through companies created specifically for this purpose proved to be inefficient. The trend is the state interference reduction and the degovernmentalization of the regulatory activity. For that purpose are suggested public-private partnerships (PPP) as a form of contracting public services. Conceptually, the PPP usage is based on:

- The historical evidence that public sector has difficulty in controlling inherent risks of large scale infrastructure projects;
- The transfer of these risks to the private sector (to a greater or lesser extent);
- Higher funding costs if the responsibility for the initial investment is transferred to the private sector.

Among the different types of contractual PPP, one can distinguish:

- Concession contracts - where the investment is borne by the private and this is directly paid by users of the service (direct award of tariffs). The commercial risk is majority private and the concession contract term is usually set between 20 and 35 years;
- Lease contracts - in which the investment is public, but the operator is paid by users through the direct award of tariffs. The commercial risk is shared between private and public parties and the delegation contract varies between 8 and 15 years;
- Management contracts - where the financing is provided by the State who imposes the tariffs to be charged to users by the private management. The operator is paid by the state. In this type of contract, the risk is mostly public and the period of delegation varies between 2 to 5 years, in general;
- Contracts for outsourcing - which relates to a management contract of a very short period. The institutional PPP refers to the creation of joint ventures (entry of private capital in the company). The former regime of SEL (Law No. 58/98 of August 18) did not required, in companies of majority public capital, that the entry of private capital should be subjected to concourse procedures. This situation was altered by the creation of a new legal regime of the SEL (Law No. 53-F/2006, from Dec. 29), which requires the existence of competition for the choice of private capital for the municipal enterprises (E.M.) and their submission to regulation of the sector.

The contract of public service through the approval of "Public services contracts" after contest was identified as the main solution to cover the budget deficits coming from historical operating deficits of public transport operators, to regular with transparency the payment of the public service obligation to operators, either public or private, and allow a more efficient transport system (where each player fulfils its goals).

The Portuguese Code of Public Contacts (Código dos Contratos Públicos) have entered into force on July 31, but can be simultaneously used with the previous legislation till the end of the year, by the time it will hold exclusivity. The goal set by the new code is to achieve greater transparency in the relations between authorities and operators through the debureaucratisation of contract processes (greater speed and accuracy of procedures, equality, competition and the provision of efficient services).

3. Efficiency of metro systems

3.1 Introduction

In this study two different techniques were used to evaluate metro operators' performance, namely the calculus of performance indicators and the non-parametric methodology of Data Envelopment Analysis (DEA). In 2006, there were some 206 metro systems in operation in Europe. Out of the 206 metros systems (including heavy conventional metro and light rail solutions), there were picked 54 systems (36 heavy conventional metro plus 18 hybrid solutions), scattered in 25 countries.

3.2 Performance indicators

One of the first advantages of performance indicators usages relates to the need for collection and compilation of information from the organization. This measure requires first and foremost a self-knowledge on the company's activity, which justifies, by itself, its implementation. Furthermore, the determination of these indicators allows a more conscientious and proactive management. If one compares the figures recorded in different organization it can even serve as a stimulant to improve the company performance.

The determination of the various performance indicators begins with the indicator's definition and calculus formula or measurement criteria. After being calculated, it follows the interpretation of the results. The explanation of the results is made through the analysis of explanatory factors. These factors attempt to justify or reflect on results validity, based on data directly or indirectly related with the sector. They can be classified into controllable or not controllable. In the first group, the controllable factors, are all factors that are in some way under the operator action, and in the second one, those which the operator does not have intervention (e.g., population density or GDP per capita).

After the interpretation of results, the next step is the comparison with the benchmarks. These values, considered as appropriate, are associated with current practices in the sector, i.e. the average values. In the analysis, it was applied a margin of 5% to the average values, resulting in a band of values where the located operators have acceptable performance. Operators with superior performance are, in case where the objective is to maximize the ratio, above the reference band (e.g., passengers carried per employee), or vice versa, below the reference band when the goal is to minimize the indicator (e.g., operating costs per employee).

This research has proposed a framework of indicators (Figure 2) that are judged to be appropriate to review a metro performance, and has been organized into 6 groups, namely supply and demand, human resources, quality of service, economic and financial indicators, efficiency and effectiveness. The list of indicators was drawn up having as a starting point, tables proposed by other studies and organisations.

Supply and Demand:
- -Seats available per carriage
- -Seats available per train
- 1- Average distance travelled by each passenger in the network
- -Passengers per capita
- -Passengers per vehicle-km
- -Passengers per seat-km

Human Resources:
- -Workshop hours by employee
- -% Non qualified professionals
- -% Qualified professionals
- -% Higher qualified professionals
- -% Workers employed in the medium border
- -%Workers employed in the intermediate border
- -%Workers employed in the higher border
- -Absenteeism rate
- -No. Annual Hours worked by employee

Efficiency:

Production Levels
- -Vehicle-km made/Vehicle-km forecasted
- -Train passages made/ Train passages forecasted

Human Resources' Productivity
- 6- Vehicle-km per employee
- -Seat-km per employee
- -Vehicle-km per working hour
- -Seat-km per working hour

Capital Productivity
- 7- Vehicle-km per vehicle
- -Seat-km per vehicle
- 8- Vehicle-km per net km
- -Seat-km per net km
- 9- vehicle-km per station
- -Seat-km per station

Effectiveness:

Occupancy Levels
- -Occupancy rate
- -Passengers per vehicle

Human Resources' Effectiveness
- 10- Passenger-km per employee
- -Passenger-km per working hour

Capital's Effectiveness
- 11- Passenger-km per vehicle
- 12- Passenger-km per net km
- 13- Passenger-km per station

Quality of service:

Accessibility
- -Lift Availability
- -Escalators Availability
- -Presence of information systems through variable message signs with sound system

Security
- -Fatalities per passenger
- -Suicides per passenger
- -Travel Accidents per passenger
- -Incidence Rate of industrial accidents
- -Frequency of industrial accidents

Environment
- -Energy consumption per passenger-km
- 2- Energy Consumption per vehicle-km
- -Energy Consumption per seat-km

Reliability
- -Rolling Stock Availability
- -Average distance between failures
- -Hours between failures
- -Punctuality
- -Average time of delay per trip

User Satisfaction
- -Complaints by passenger

Economy and Finance:

Revenues
- -Traffic Revenue per passenger
- - Traffic Revenue per passenger-km
- -Operational Revenues per passenger
- - Operational Revenues per passenger-km
- - Operational Revenues per seat-km

Costs
- -Weight of staff costs in operational expenses
- - Weight of staff costs in total costs
- -Total costs per vehicle-km
- 3- Operational expenses (OPEX) per vehicle-km
- -Maintenance Costs per vehicle-km
- -Administrative Costs per vehicle-km
- -Investment expenditure per vehicle-km
- -Total Costs per passenger
- 4- OPEX per passenger
- -OPEX per station

Other results
- -Total revenues / OPEX
- 5- Operational Revenues/ OPEX
- -Operational Revenue excluding subsidies / OPEX
- -Net income/deficit for the year per passenger-km

Figure 2. Proposed Framework of Indicators

Each of the 6 groups of indicators has particular goals. The first attempt to assess the levels of supply and demand experienced in each metro system. The performance of a transport system is intimately connected to these two factors, more specifically, to the ability of adjust supply to demand.

The second group attempt to evaluate the performance of the actual body of the organization, discussing, among other factors, the rate of absenteeism. Staff training is also addressed, with consequences on the quality of service and implications for the ability to work.

The third group concerns to the quality of service. This includes several factors, ranging from issues of accessibility for people with reduced mobility, issues of environmental protection or issues of reliability (of rolling stock and punctuality). The satisfaction of the customer is also important.

The fourth group relates on economic and financial indicators, indicators related to cost control, with revenue analysis and other results, such as operating costs coverage by revenues.

The efficiency indicators are divided into 3 categories, allowing one to examine the production levels (through performances rates of vehicle-kilometres and trips), the levels of labour productivity (through ratios that relate the vehicle-kilometres and seat-kilometres produced with the staff) and the levels of capital (ratios which relate vehicle-kilometres and seat-kilometres produced with vehicles, stations or the network length).

The last group concerns the effectiveness indicators, subdivided into three groups: levels of occupation, labour effectiveness and capital effectiveness. Among the indicators related to levels of occupancy, one can distinguished 2 measures of occupation (one absolute and other relative). The efficiency ratios are usually expressed by linking the volume of passengers or the passenger-kilometres with vehicles, with network length, with stations or with staff.

As an example of this performance indicator methodology application it were determined 13 performance indicators, yellow shaded and numbered in Figure 1 (1 indicator of supply and demand, 1 indicator of quality of service, 3 economic and financial indicators, 4 indicators of efficiency and 4 indicators of effectiveness) for a sample of 35 metro operators, a set of 18 European countries.

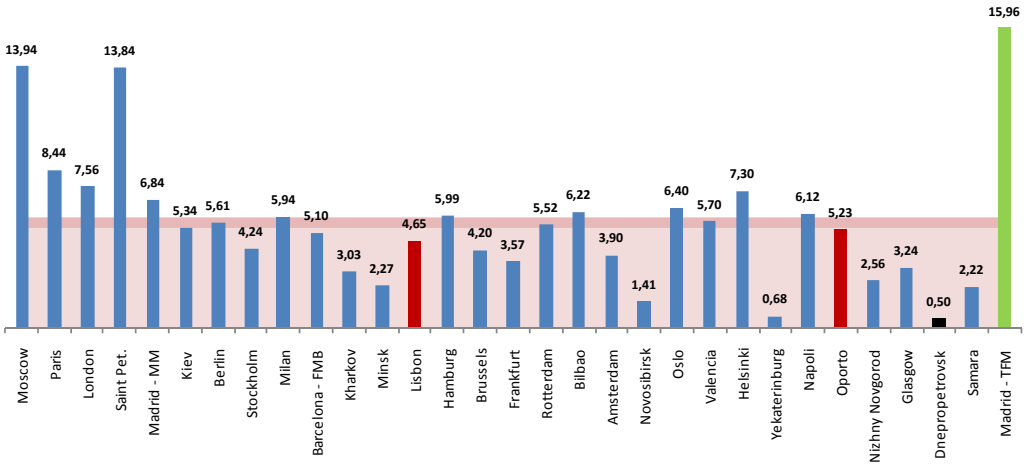
For each indicator was made a "fact sheet" that identifies and characterizes it with a graph of benchmarking which sets the values observed for the various operators. The range where it's considered that the operator has a acceptable performance (range of reference) is coloured with dark pink. It is shown here, as an example, the analysis of the indicators 1, 2, 3, 4 and 5, and the resume table of results for the indicators of efficiency and effectiveness (see table 2).

Table 2. Summary of results for indicators of efficiency and effectiveness (the 3 best and worst performances)

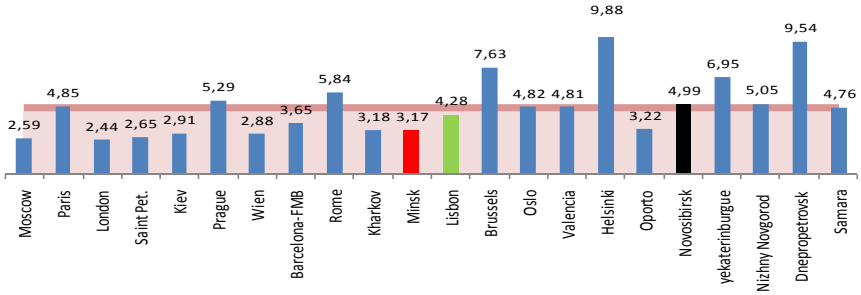
	Ranking	I6	I7	I8	I9	I10	I11	I12	I13
Best	1st	Helsinki	Frankfurt	Moscow	Moscow	Helsinki	Saint Pet.	Moscow	Moscow
	2nd	Berlin	Moscow	Saint Pet.	Saint Pet.	Milan	Moscow	Saint Pet.	Saint Pet.
	3rd	London	London	London	London	Moscow	Helsinki	Paris	Paris
Worst	1st	Genova	Genova	Valencia	Valencia	Dnepro.	Glasgow	Valencia	Valencia
	2nd	Samara	Stockholm	Oporto	Oporto	Samara	Samara	Samara	Glasgow
	3rd	Brussels	Glasgow	Stockholm	Genova	Yeka.	Yeka.	Oporto	Oporto

Although the performance indicators allow a quick and accessible reading of an organization activity, there are some limitations associated to their analysis of results. The major flaw is that they are partial measures of productivity that relate only one of the production factors (input) and one of the results (outputs) that the organization "produces". Furthermore, the application of performance indicators in the analysis does not include the operational and institutional environment (Marques and Brochado, 2007). The possible explanatory factors (population, GDP per capita, average distance to the stations, absenteeism rate of the employees, climate, rate of motorization, among others), although influence and explain in some way, the results for the various indicators, are difficult to be directly correlated to each indicator individually.

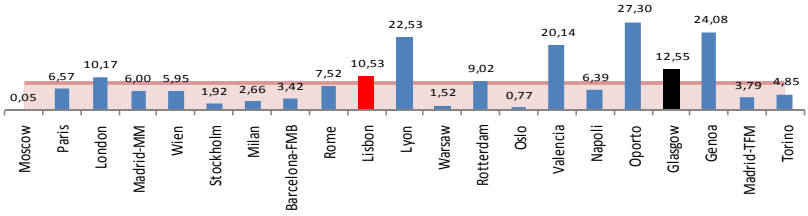
Indicator 1: Average distance travelled by each passenger in the network (km)
Reference value (benchmark): 5,60km.



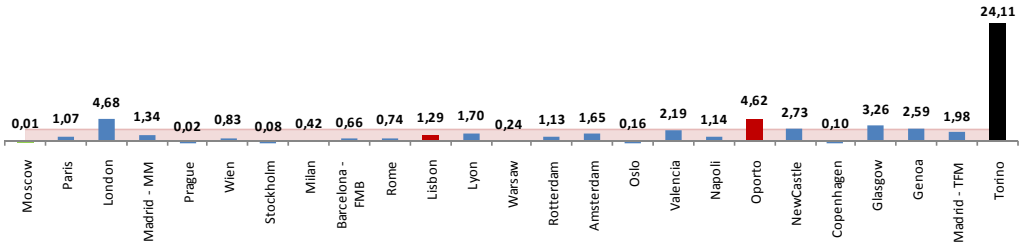
Indicator 2: Energy consumption (Kwh) per Vehicle-km
Reference value (benchmark): 4,79kwh/vehicle-km



Indicator 3: Operational Expenses after Purchasing Power Parities (EUR) per Vehicle-km
Reference value (benchmark): 8,52€ / vehicle-km

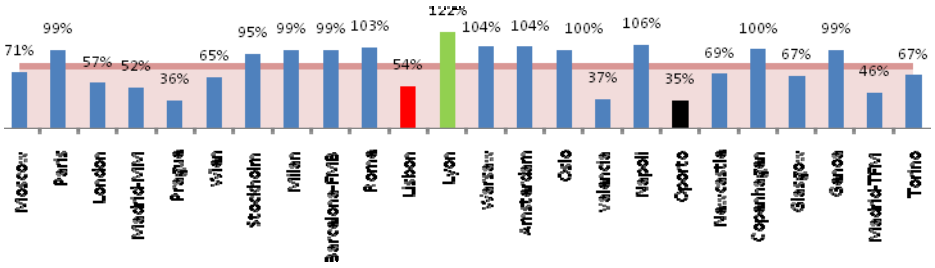


Indicator 4: Operational Expenses after Purchasing Power Parities per passenger
Reference value (benchmark): 2,35€/passenger



Indicator 5: Operational revenues / Operational expenses (%)

Reference value (benchmark): 78,5%.



Another thing to keep in mind is the treatment of outliers. The outliers relate to observations that have a large distance of the remaining sample or are inconsistent with this. In the analysis of performance indicators, the outliers concern operators whose performance is, in the various indicators, distant or out from the average of the sample. In such cases, we must examine what causes this disparity and whether it is justifiable or not. The direct analysis of the benchmarking graphics suggests two possible outliers, namely Moscow and Turin metros. To ascertain the reliability of these observations is necessary to analyze further these two operators using other statistical methods.

To circumvent all the problems, there were developed other approaches of performance evaluation, based on frontiers of production or cost. These frontiers can be assessed by parametric or non-parametric methods. This research applies the non-parametric approach Data Envelopment Analysis (DEA). The great advantage of this methodology in relation to performance indicators is to enable aggregate, in one measure of valuation, multiple inputs and multiple outputs. The DEA technique was applied in assessing the performance of the various European metro operators, for the year 2006.

4.3 Data Envelopment Analysis

The methodology of Data Envelopment Analysis (DEA) is a non-parametric technique of mathematical programming, aimed at assessing the relative performance of organizational units, in the presence of a uniform set of multiple inputs and multiple outputs. As a non-parametric approach, instead of assuming a function to the production frontier (as in parametric methods), it constructs the frontier by the best practices observed in the available sample. It doesn't need, therefore, a prior specification to the weights of each input/output, neither requires judgments on the production function form. In the presence of an industry with multiple inputs and outputs, the efficiency of each operator is assessed by the distance that separates him from the frontier.

This methodology was developed by Charnes, Cooper and Rhodes in 1978 (Charnes et al., 1978) based on studies conducted by Farrell in the 50's (Farrell, 1957). In those initial studies, Farrell uses as a reference, an industry which employs two inputs (x_1 and x_2) to produce a single output, for the most simple case of constant returns to scale (CRS). In the 80s, (Banker et al., 1984) introduces the possibility of variable returns to scale (VRS). These may be increasing returns to the scale or decreasing returns to the scale.

In the simplest case of a production process with a single input and single output, efficiency (measured in relation to the optimal value) can be described as (1) or as (2) in the case, more usual, of an industry that employs multiple inputs in the production of multiple outputs.

$$Efficiency = \frac{Output}{Input} \quad (1) \qquad Efficiency = \frac{weighted..sum.of\ .outputs}{weighted..sum.of\ .inputs} \quad (2)$$

This approach requires the prior definition of weights to be applied to the inputs and outputs under study for the several operators, which carries beyond the difficulty in measuring the actual inputs and outputs, the determination of weights to be applied (Benito et al., 2005). The method of DEA has overcome this difficulty by allowing each operator to establish their own weights, with a view to achieving the most favourable combination when compared with other operators of the sample (Charnes et al., 1978). Thus, one operator's efficiency (hk) can be maximized affecting the efficiency of all operators to below or equal to one. Mathematically the problem can be stated as follows:

$$\text{Max: } hk = \frac{\sum_{i=1}^{I} a_i y_{ik}}{\sum_{j=1}^{J} b_j x_{jk}} \quad (3)$$

subject to

$$\frac{\sum_{i=1}^{I} a_i y_{im}}{\sum_{j=1}^{J} b_j x_{jm}} \leq 1 \;,\; m = 1, \ldots, k, \ldots, M$$

$$a_i, b_j \geq 0 \quad i = 1, \ldots, I; \; j = 1, \ldots, J$$

where,

y_{ik} - output i of unit k
x_{jk} - input j of unit k
a_i - output i weight
b_j - input j weight
M- number of units
I - number of outputs
J - number of inputs.

The resolution of the simplified model (imposing a constant value to the denominator) results in values for each hk between zero and one, which match the efficiency of each operator. If hk is equal to 1, the unit k is efficient in relation to others. If it's less than 1, the unit k is within the boundary of production, and is therefore considered relatively inefficient.

The dual formulation application (minimizing) in linear programming allowed to build a distinct approach to the efficient frontier, formed by the union of linear segments (facets) parallel to the axes that minimize the amount of inputs while maintaining the level of output production. In such formulation, the selection of weights falls on the operators and not on the inputs and outputs as in the previous. According to this formalization, the operator k is considered effective if the slacks are null and if hk is equal to the unit, namely when there is no composition of weights such that the efficiency of k is exceeded by that of another unit. Conversely, if hk is less than the unit and/or if the slacks are positive, the values of λ_m will lead to a composite unit whose efficiency surpasses that of k, which is considered inefficient in relation to units in the PF. The extent of that inefficiency is given by hk, which represents the highest proportion of current levels of input k that the company should use to ensure at least the current levels of output.

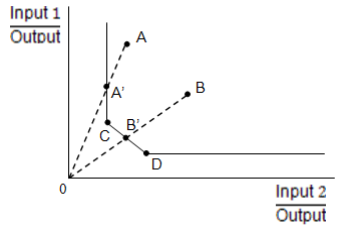


Figure 3. Efficiency evaluation and input slacks

For the operator A, the technical efficiency (TE) is given by OA '/ OA and for B by OB' / OB. From the figure analysis you can gauge that, despite of being situated on the production frontier, the point A' is not globally effective, as it is possible to reduce the production of inputs while maintaining the same level of output (it is technically efficient but not allocatively efficient). This approach has the underlying principle of CRS, which does not always correspond to the reality of the industries studied. Banker et al. (1984) introduced in a model adaptation that would allow them to accommodate the possibility of VRS. In the model BCC (Banker et al., 1984), the aggregate or overall efficiency of a particular unit in the assumption of VRS can be decomposed into two parts, pure technical efficiency (PTE) and scale efficiency (SE). The scale efficiency counts the degree of savings that would occur if the operator is in great scale, and ranges from 0 to 1. For values equal to unity, there is scale efficiency. If there is a difference between the TE returned by the models of DEA assuming CRS and VRS, one can concluded that the operator has scale inefficiency.

In this research it was analyzed the European metro performance based on the non-parametric approach DEA, using the software Excel Solver DEA proposed by Zhu (2002), assuming CRS and VRS. Three models were developed with different combinations of consumed inputs and produced outputs by the operators. The inputs and outputs needed to be quantifiable and the more homogeneous possible between operators. From the inputs and outputs available, it were selected those that best characterize the dynamics of the industry.

The model 1 includes three inputs and two outputs obtained for 37 metros in Europe.

Figure 4. Model 1

In the second model it was added a fourth input related to operating costs. The operating costs (operational expenses, OPEX) from the profit and loss accounts of the several metro reports included the consumption of stocks, supplies and services and external costs with staff. As the model also full, the staff of the corporation, the cost inputted to the model cannot be directly the operating costs, to avoid inflate the total labour force in the model. This makes it necessary to first exclude the costs of personnel. These new costs deducted will be "other operational costs" (other operational expenses, OOPEX).

The third model replaces passenger for passenger-km, which is more accurate in assessing the actual use of the service. It was evaluated 26 metros.

The various models were geared towards the minimization of inputs. The following graph illustrates the TE (blue), and gains from scale economies (in red) to 37 metros of operators in Europe, which form the model 1. The same type of analysis was done for the other two models.

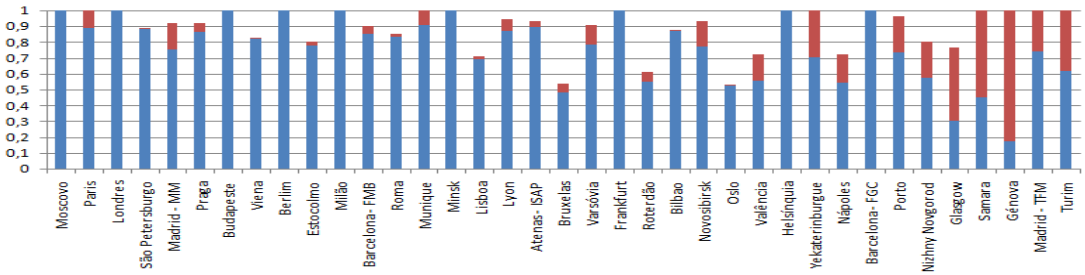


Figure 5. Technical efficiency (blue) and scale economy gains (red) in model 1

The graphs presented for each model shows there are scale economies, giving greater gains in efficiency of operators with lower volume of passengers carried. Yields are therefore increasing the scale. Table 3 summarizes the main results returned by the models. Table 4 shows for example, the targets of Lisbon and Oporto metro operators, in model 1, assuming CRS.

Table 3. Summary results of the different models for metro operators

	Model 1	Model 2	Model 3
TE average (CRS)	0,76882	0,84939	0,68297
PTE average	0,89353	0,96191	0,82737
SE average	0,86190	0,87917	0,82547
Minimum TE	0,53074	0,77578	0,40890
Minimum SE	0,17218	0,21181	0,27412
TE Lisbon (RCE)	0,69292	0,83284	0,49101
PTE Lisbon (RVE)	0,70684	0,89335	0,59839
TE Oporto (RCE)	0,73608	0,84614	0,61736
PTE Oporto (RVE)	0,96155	1	0,77123

Table 4. Targets of metro operators of Lisbon and Oporto for model 1, considering CRS

	Lisbon		Oporto	
	Actual Value	Target	Actual Value	Target
Net extension	35,60	35,60	58,88	58,88
Vehicles (unit)	338	338	72	72
Staff (unit)	1702	1179	426	314
Peers	Berlin, Helsinki, Budapest, Moscow		Helsinki, Budapest, Moscow	

5 Conclusions

From the analysis of performance indicators one could see that the various metro operators, like the other companies of TP, have high operating costs compared to the revenue generated. For most metro operators tested, operating revenues do not cover the operating costs of the system. The average rate of coverage of operating costs by operating income is around 78.5%. The situation is even worse for the Portuguese metros, not even reaching the 50%.

The Russians metros, Moscow and St. Petersburg, present in most indicators of efficiency and effectiveness, better performance. London is an efficient metro, showing good results in the ratios of productivity. Focusing on effectiveness indicators, Paris is effective in the usage of the stations and network. Helsinki presents the best results in terms of productivity and effectiveness of labour. As for the worst performances, Valencia appears to be the winner. Genoa and Glasgow are not in a favourable position neither. The Oporto metro presents a poor overall performance, in both efficiency and effectiveness indicators; although we must bear in mind its recent entry into operation (2003).

The DEA technique results corroborate the conclusions drawn from the performance indicators analysis. The Portuguese landscape is not favourable, showing low levels of efficiency and effectiveness in comparison with the average rate of the economy (Lisbon and Oporto metros have always appeared inefficient). Moscow and London metros are generally effective for the 3 models. In terms of reference for the Portuguese metros, the listed peers are Moscow, Helsinki, Barcelona-FMB and Berlin metros.

In general, operators show a large dependence on operating subsidies. The fact that they are not valued monetarily neither contracted leads to the allocation of subsidies in random value, granted according to the financial availability of the State, which usually leads to insufficient value in relation to investments, forcing the bank debt. To control the indebtedness of the industry and ensure an improved quality of service is necessary to promote measures to improve the effectiveness and efficiency. These consist firstly in match supply to demand, by increasing the supply in times of increased demand by users and cut off those periods.

Regardless of whether or not entrance into force of MTAs, the large volumes involved in the financing of the system require the definition of new strategies and funding schemes. Operators must be able to attract higher levels of revenue through alternative means of revenue from traffic, should be eligible for more funds, coming, for instance, from taxes on companies that benefit directly from the metro network, as in France through the Versement du Transport. So that the need for funding is the lowest possible, it is necessary to reduce the operational costs of the system. This can be achieved in various ways, including by reducing the operator's staff and bet on increased productivity through training and qualification of its employees. Monitoring the average age of the fleet also helps to reduce the costs of maintenance and increase the levels of reliability (lower number of failures, greater punctuality).

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Short papers

Comparative analysis of integrated planning in three European Metropolitan Regions

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The increasing complexity of territories and urban polarizations in atypical areas, make urban rail networks have a crucial role in structuring cities, especially the ones with form and dimension of a metropolitan region. Regional and urban railway networks within vast areas tend to counterbalance and distribute in the territory the urban weights of population, employment and services, and guide the process of reorganization of the activities in metropolitan contexts. Territorial planning nowadays searches for an equilibrium between increasing transports' efficiency and the harmonization of places, so that rail connections (be they undergrounds or urban trains) would help in transforming the use of the given spatial distributions, for possibly influencing the reshaping of urban structures, and sometimes for modifying the form of metropolitan cities. This paper analyses three recent integrated land-use transport European plans (Naples, Barcelona, the South Wing of the *Randstad*), with the aim of highlighting similarities and differences in interpreting the phenomenon of metropolitan regions, and the ultimate goal of offering some hints which flourish from the confrontation of different approaches in solving similar problems and achieving comparable goals.

Keywords: Integrated spatial planning, metropolitan regions, urban rail networks

1 Railways and urban structures

Policy makers and planners are facing the problem of urban areas which have being progressively changing their form and structure under the pressure of different – and sometimes opposite – socio-economical tensions. This brought to an alteration in the way cities are observed: no more auto-sufficient entities enclosed in their administrative borders that hold a given number of residents, offices and services, but dynamic interactions of a variety of actors with their diversified offers and demands, potentialities and necessities at a wider geographical scale.

Therefore the ways of availing oneself of present opportunities and responding to current needs have dramatically changed. So have spatial planning and policy making, forced to trespass the old concept of “town” for creating the ones of “metropolitan area” first and “metropolitan region” more recently, stressing on the importance of the (socio-economic) *structures* rather than the (mainly geometrical and based on quantitative distributions) *forms* of those metabolic agglomerations tied together by mobility infrastructures.

Territorial studies search for an equilibrium between transport efficiency and its impact on crossed places, aware of the fact that interventions on the transport system generally induce variations on the physical environment and the urban structure. In this way what was conceived as a simple connection between two areas becomes a tool for shaping and structuring the territory. Therefore, within integrated territorial strategies, transport planning turns from a practice aimed at allowing people's mobility into a tool for urban planners and policy makers for providing solutions to metropolitan regions. A coherent programme for urban railway mobility should plan new urbanizations close to stations and the chance of qualitatively (with services, offices and dwellings) maximizing the role of areas around train and subway stations, with the ultimate goal of tackling the

gap between transport capacity and activities density (Campos-Venuti, 1999). Changes in accessibility caused by interventions on transport may induce to a more coherent distribution of “weights” in the territory, affecting the location of families, businesses, services and so on, which, together with urban interventions provided both in terms of new settlements and rehabilitation of existing areas, may result in a different land use.

This paper briefly summarizes some of the conclusions of a empirical research that took place between 2006 and 2008, considering just the interactions between urban structures and infrastructures in the urban regions of Barcelona, Naples and the South Wing of the *Randstad* from the planners' technical perspective, neglecting therefore the other fundamental processes taken into account in the whole work, like policy making, governance and socio-economical stakeholders' interactions. The article focuses on how much urban structures and infrastructures interact in spatial planning, as to say how well territorial plans and railway plans overlap. The objective is to observe local attempts to merge two separated technical visions (urban and transport) for ideally achieving an integrated spatial planning and to evaluate how adequate are new local railway projects in consideration of the diverse territorial peculiarities.

To the end, in this context the word “railway” indicates every kind of urban mean of transportation on rail tracks, be tramways, undergrounds or urban train infrastructures.

2 Urban or transport planning, distributive or disseminating goals

A correct evaluation of plans should verify how well projects interpret the urban form and structure of areas where they will be implemented and how they will influence their changes. One of the main difficulties lies on the fact that a territory is not an algebraic summation of complex micro-systems, but the result of dynamic interactions between local history and global perspectives, consolidated practices and innovative solutions, limits and potentialities, and of course the interaction among groups and between stakeholders. Urban structures and forms therefore are cultural and socio-economic outcomes, but at the same time they are the solid foundations on which projects are based on.

The assessment process here summarized was aimed at testing how innovative and consistent were the efforts towards a proper integrated spatial planning.

Two are the main questions the work starts from:

1) how much a plan spreads either from an urban or a transport necessity;

2) how much the infrastructural part of the plan has a *distributive* (for ameliorating the mobility fluxes among the present urban system) rather than a *disseminating* (for leading changes in the form and the structure of a city) goal.

The first question has more to do with the technical branch which rules the planning processes, and rises from a more passive approach, because it simply takes to grasp if plans want to answer to questions generated either by urban or transport problems, while the second focuses the attention on a more proactive vision, strategic in tackling centripetal journeys and exploiting new railway transport interventions for directing cities' expansions and/or for fomenting urban regenerations.

Taking a closer look at transport planning, the following question is about the role of train and underground stations. Giving the fact in all three case-studies there is the goal of building new stations, it is necessary to understand what was the land use planning rationale (and transport rationale) put forward for the selection of the station sites in the context of their surrounding development. That is necessary for understanding if there was one overall plan or strategy and, If so, what was the stated rationale. Moreover the research also aimed at discovering if in the determination planners considered (and how) the role of the station, and if they also plan for land use change within the station precinct, for understanding what are the logic and the main reasons that inspire territorial planning, which projects are infrastructure led and which are about a genuine attempt to stimulate integration with land use and changes in the activity location, for verifying what are the major forces that lead in the decision of where building a new station.

3 Case studies: territory and projects

The case-studies for this research are the infrastructural interventions in the wide areas of Barcelona (Spain), Naples (Italy) and the *Stedenbaan* project (the Netherlands). One of the main reasons for this choice is that in the preliminary studies some strong similarities emerged between projects taking place in these regions. First of all they are about railway infrastructures in metropolitan areas where the goal is to create a wide but integrated urban network on a regional scale. Secondly, the three cases are united by a policy of “recycling” or re-qualifying existing infrastructure, and in the three cases this opportunity is given by the new European High Speed Lines that will free up some regional railways, so far used for the longer national and the international journeys, and now available for local purposes. Last but not least, specific case-studies literature mentions a direct impact of the new infrastructure on land-use.

3.1 Barcelona

The metropolitan area of the Catalan capital embraces 36 municipalities and comprehends 2,6 million people, while the metropolitan region has around 4 million residents. The new line 9 will be the crucial element for re-qualifying the wide but ineffective railway transport system of the Metropolitan area of Barcelona, not planned for being inter-modal. The line with its 41 kilometres length and 43 stations will transversely cut through the whole metropolitan area and create interchange nodes with all present urban railways, becoming the axis for an integrated and efficient network on railway, rationalizing the flows (currently nearly exclusively centripetal), maximizing the accessibility of some crucial areas (such as the “*Zona Franca*”, the biggest industrial estate in Spain, and the so called “*Zona Alta*”, the rich part of the city of Barcelona) so far neglected by railway public transport, redistributing flows to the other lines, optimizing the potentialities of the whole transport system. Apart from this role of “feeder line”, it will embrace various municipalities, directly connecting marginalized areas with some of the economic epicentres of the province, and will also hit the freight port, the airport, the new High Speed Line and the future “City of Justice” in L' Hospitalet, serving more or less directly one area of approximately 3 million inhabitants.

The second fundamental project is the “Línea Orbital Ferroviaria” (Orbital Train Line), which main goal is to break the radial configuration of the infrastructures of the metropolitan region and to

contribute to a different articulation of the territory, preventing people's centripetal journeys. It is also conceived for giving a train service that connects the cities of the second metropolitan crown, having as final destinations the coastal towns of Mataró (north-east) and Vilanova a la Geltrú (in the south-west). The line will pass through Granollers, Sabadell, Terrassa, Martorell and Vilafranca del Penedès without going through the city of Barcelona, also linking the small towns of the province with that 80% of local industrial estates not served by public transport (Diputació de Barcelona, 2005).

3.2 Naples

The Metropolitan Region of Naples (3,832,622 inhabitants in 2007) includes most towns of border provinces of Salerno and Caserta, and the new plan adopted for creating a Regional Metropolitan System is an interesting example of correlated transport and territorial planning. In 2007 the length of the Naples's underground was of 53 km, 45 of it deriving from re-interpreted regional lines, and 68 stations (23 new, which should become 53 in 2011) including 12 interchange nodes (that should increase up to 18 in 2011). According to the plan, which aims at expanding city strategy to the whole administrative region, in 2011 in the Campania Region there will be 1,400 km of railways, 423 stations, 28 big park-ride facilities and 21 interchange nodes. The plan has in the railway infrastructure of Naples its strategic epicentre and aims at merging existing lines in a transport network through the construction of new interconnection tracks, new stations and new possibility of modal interchange. At the same time planners believe urban interventions for building the new stations might have an impact on the improvement of life's quality and urban environment, while strong are the expectations on economic dynamics. Moreover bettering the accessibility could stimulate a change in the activities location, as to say in the structure of the city, also thanks to the increase of land and real estate value around stations. The Plan regulates further urbanizations favouring those along railways and around the stations.

3.3 Stedenbaan

The project is part of Bestuurlijk Platform Zuidvleugelit that has being developed in the southern Province of the Randstad, an area where in total reside 2.8 million people and that comprises the cities of The Hague, Rotterdam and a dozen of other towns with at least 65,000 inhabitants. In compliance with the dictates of Dutch planning the scope is not just to create a railway network, but a proper urban web, a sort of meta-city that thanks to the possibilities offered by this “new” efficient transport network would integrate its different parts and jointly develop. The urban transport service - new kind of high-grade local train, quite similar to German S-Bahn - would be obtained mainly reusing existing railway infrastructures freed from the construction of two specific new lines, the High Speed connecting Rotterdam city directly to Schiphol airport (Amsterdam) and the High Capacity from Rotterdam port to Germany. 15 new stations and urban intensification around old and new stations (180,000 new houses will be built between 2010 and 2030) are the fulcrum around which the whole plan rotates, in total respect of ABC policies.

4 Evaluating the integration of spatial visions

A strategy for the development of a polycentric metropolitan region is theoretically pursued in all three cases in question, but when verifying the actual attempt to functionally reorganize the territory through the development of a multipolar model one can observe a natural inclination in the Stedenbaan, despite current roll-out be limited to only 4 new stations instead of 15 of the original project. On the short run this change can distort the strongly polycentric program for transforming it into a plan mainly based on densifications around current railway stations, if the schedule for building new houses will not be programmed along the implementation of new stations.

Naples bores the brunt of being a municipal plan and the modest ambition of cooperating with neighbour towns cannot be confused with a policy willing to create a proper metropolitan region. In the southern Italian city the emerging strategy, on the contrary, is perfectly suited to current physical and economical situation of the city - which is not polycentric - without any proper attempt of changing it. The urban structure of the city is and remains highly polarized while new railway projects merely try to capture radial traffic flows.

The Barcelona transport Plan on the other hand has a great propensity in creating a meta-communal network, with a solid focus on regional dynamics, but infrastructure projects seem to be more "responding" to present necessities rather than trying to influence urban expansion. Projects tend to bring order to a long run non-planned urban sprawl that dispersed on the territory small towns and industrial estates that in the last ten years have being steadily growing in number of residents and workforce. New railways and undergrounds strategies are more focussed on current urban distributions rather than aiming at steering a dissemination of dwellings and activities, thus showing a more distributive goal rather than an ambition of influencing changes in the land use and in the form of the urban region. Nonetheless, the creation of two big semicircular railway structures, the Line 9 of the underground within the Barcelona's Metropolitan Area and the Orbital Railway line in its outskirts proof Catalan technician's goal of tackling centripetal journeys.

Having saying that, strategical matrices in Naples and in Stedenbaan are almost opposite. In Naples, despite the declared ambitions of Transit Oriented Development, designed infrastructures have a preponderant distributive role. In the two Mediterranean cities there is more “re-action” than “pro-action”, while on the contrary in the Zuidvleugel the disseminating strategy aims at building a metropolitan region on the basis of current rail infrastructure, exploiting those planning potentialities that polycentric urban structures offer. In the Netherlands the strong overlap between urban developments and their accessibility by railways reflects the design philosophy of disseminating functions coherently, while the relationship between transport infrastructures and land-use is tight, but not even here it is possible to label the planning process as integrated, because despite proceeding more or less simultaneously, plans are separated. Technicians avail themselves just of the opportunity of confronting the specific outcomes of each process, neglecting the potential that only an intersectant land use transport observation during the whole process can unveil. Moreover, the prevalence of a distribution goal rather than disseminating in Holland as well is confirmed by the selection of the areas where to build the new train stations, strongly influenced by the managerial choices done by NS (the national railway company), as to say in already heavily urbanized areas which density ensures a high number of potential customers.

Another problem seems to lie in the poor role of interchange nodes as potential cores of new urban centralities, meaning polyfunctional areas with balanced housing, facilities and offices and not specialised areas like dormitories, shopping centres nor business districts isolated from the city. In the three analysed cases there is a consistency of infrastructure's planning within the territory, but a certain “shyness” makes projects being auxiliary to current urban structure and not willing to maximize local resources for reflecting the stated strategic proposals. Despite stating the goal of reshaping the territory into a polycentric structure, planning strategies in Campania and in the Catalonia are centred on the biggest city around which satellite towns "rotate": local interventions in services and infrastructure are conceived in order to meet (and solve) potentialities and weaknesses of the city of reference, namely Naples and Barcelona, rather than enforcing the whole metropolitan region.

Barcelona's plan pursues fostering the outgrowth of a territorial polycentric structure through strategies aimed at facilitating transversal and tangential journeys. On the contrary in Campania the declared objective of encouraging the creation of a polycentric region through the new railway interventions clashes with the infrastructure projects, clearly centripetal and conceived for radial flows. Shifting from the south to the north of Europe, it emerges a strong difference in planning philosophy: while in Campania and in Catalonia planning cores are local capitals, Naples and Barcelona precisely, in the Netherlands it is the very network of cities and rail infrastructures that planning is based on.

Not rarely planning processes are still confined in the set of technical skills inspired to hydraulic and merely based on mathematical representations, therefore some of them have difficulties in going beyond Christaller and Hausman (or Cerdà) teachings. From this point of view Naples is clearly the less fortunate example among the three, with a mere “defensive” rather than proactive approach. As far as is concerned the identification of the areas were the introduction of a railway-based mass transport was considered necessary, Neapolitan interventions were prioritized just following technical feasibility parameters and a general transport coherence, and only at a later stage considering urban and environmental features, thus relegating socio-economic impact studies to the accessory role of legitimating previous quantitative analysis. In other words, the choice of where building a new station or where letting pass the underground is mainly transport-based and disjointed from a territorial analysis, because spatial information seemed to be collected just on the basis of its serviceableness within the standardized technical process, which means for strengthening process coherence rather than for a proper understanding of the territory. Not only the planning process in Naples leaves out of the spatial analysis all those elements and variables that give uniqueness to places and landscapes (all factors that would contribute to an adequate understanding of phenomena) but – lowering the evaluation magnifier to a more specific tool - also the applied model within planning does not even seem to have the characteristics of Land-Use Transit Integration (LUTI), given the separation between not just the analysis but also the projecting of land interventions and mobility.

Although having the three cases different matrices (transport-based in Naples and Barcelona, currently more urban-oriented in the Zuidvleugel, despite being launched as a mere transport plan) the coherence evaluation between projected infrastructures and urban development confirms that

railway transport will "accompany" territorial growth – most of the time foreseen as a linear development of current situation - rather than trying to steer urban structure according to well delineated interests and strategies, making planners behaving almost like passive spectators in the evolution of urban dynamics.

All projects in analysis tend to maximize local resources, but territorial interventions rarely have an influence on territorial structure, while urban interventions related to railway projects far more often focus on small works of “urban design” that - despite proclamations, especially in Naples – can be hardly mistaken with innovative and decisive urban restructuring. This is proved by the role of stations, within their precinct there is no attempt of land-use change, and their potential impact to the surrounding area not completely exploited, being “functional” in Holland and Barcelona, "artistic" in Naples. In any case (except for some modest attempts of urban regeneration in Naples) stations do not have a role in stimulating the changes in their areas, missing the chance of affecting the territory according to a strategy aiming at creating balanced metropolises that would have in interchange nodes both the structural elements of current urban distribution and structuring tools for building up a polycentric region.

5 Conclusion

The importance of understanding if a plan originates whether from a territorial or a transport necessity is not a mere academic exercise, but it is a necessary passage for perceiving what was the perspective planners used in giving answers to territorial problems, hence possibly the best way for having the right instruments in assessing a plan and – consequently - looking for other ways, strategies, visions in making it more apt for responding to local needs. The evaluation is obviously strongly tied to the comparative analysis between a territory and the given plan.

The integration between urban and mobility is still lacking. The planning process emerging from the case-studies is “for closed compartments”, with a modest and ex-post interaction between structural and infrastructural matters. The dialogue between technicians is only based on the confrontations of the unit-specific outcomes, thus demonstrating not just a lack of communication and cooperation between urban and mobility planners, but that spatial planning is still artificially divided at least in two separated branches, with their specific methods, rationales and goals.

Despite an ex-post attempt of interconnecting the two separated planning results, the analysed plans clearly demonstrate either a more markedly urban or transport vocation. Transport and urban planning methods follow different procedures and objectives, and LUTI models help in finding a connection between urban and infrastructure projects generated by two separate processes, but even so humble is the outcome of such an *a posteriori* attempt.

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Tomorrow the city organized from the places of connection between networks of collective transport?

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The western contemporary city remains largely organized by the automobile as the predominant transportation mode. The uncertainty which characterizes the replacement of the unrenewable energies by renewable energies, the strong decrease of the biodiversity partially due to the increasing fragmentation of spaces by the urban sprawl, also the social disparities increase, etc., should lead the town planners, the decision-makers and most of the actors of the city to modify the models they use to plan the development of the city. There's not an unique model to design the city of tomorrow. But some elements can assure a part of its sustainability. The ones that we present concern the relation between the spatial organization of built-up areas and the transport. This spatial organization is established from the centrality, admitting that an urban area can be structured from a network of central places. These places locate main urban functions, service, business, activity, culture, etc., which must be accessible to the whole population, knowing that these functions cannot all be distributed in any place of the city. The urban centrality of tomorrow should be organized from the places of interconnection between the various transport systems which structure the urban spaces; it's our hypothesis.

La ville contemporaine occidentale reste en grande partie organisée à partir du mode de transport qu'est l'automobile. L' incertitude qui pèse sur le remplacement des énergies non renouvelables par des énergies renouvelables, la forte diminution de la biodiversité due en partie à l'accroissement de la fragmentation des espaces par l'étalement urbain, l'aggravation des inégalités sociales, etc., devraient conduire les urbanistes, les décideurs et la plupart des acteurs de la ville à modifier les modèles qu'ils utilisent pour planifier le développement des espaces urbains. Nous ne pensons pas qu'il existe un modèle unique de la ville de demain. Celle-ci peut être conçue à partir de quelques éléments assurant une part de sa durabilité. Ceux que nous présentons portent sur la relation entre l'organisation spatiale des agglomérations urbaines et les transports. Cette organisation spatiale est établie à partir de la centralité, admettant qu'une aire urbaine est un ensemble qui peut être structurée à partir d'un réseau de lieux centraux. Ces lieux centraux rassemblent les fonctions urbaines principales, de service, de commerce, d'activité et de culture, etc., qui doivent être accessibles à l'ensemble de la population, sachant que ces fonctions ne peuvent pas toutes être distribuées en tout lieu de la ville. Notre hypothèse est que la centralité de demain devrait être organisée à partir des lieux d'interconnexion entre les différents réseaux de transport qui structurent les espaces urbains57.

1 La centralité

Plusieurs théories développées par la géographique tentent depuis plus d'un siècle de rendre compte de l'organisation des agglomérations urbaines. L'une des plus anciennes, illustrée par le modèle de Burgess, considérait que l'organisation de la ville correspondait à une distribution centre périphérie, en zones radio concentriques à partir d'un seul centre qui concentre les activités financières et commerciales. Ce modèle, comme celui du à Hoyt, le modèle par secteur radiant, ne représente pas toute la diversité de l'organisation de la plupart des agglomérations françaises et européennes contemporaines. Celle-ci correspond d'avantage au modèle des noyaux multiples, déjà proposé au début de la seconde moitié du vingtième siècle par R.D. Mckenzie. Cependant, ces trois premiers modèles ne s'excluent pas totalement les uns des autres car ils se rapportent à des réalités différentes qui peuvent être toutes présentent ensemble (Bailly, 2004). Le modèle des noyaux multiples correspond à l'agglomération en tant qu'organisation poly centrale, c'est-à-dire à des villes organisées par plusieurs lieux de centralité. Ces lieux comportent des activités qui ne peuvent pas être distribués en tout lieu de la ville. Le rassemblement en un même site peut même être une

[57] *L'urbanisme des réseaux correspond en ce texte à l'organisation des espaces urbains à partir des réseaux et notamment des réseaux de transport. La question du développement durable conduit à prendre en compte également d'autres réseaux, plus naturels, les réseaux « verts » et « bleus » : l'espace habité est un arrangement spatiale entre ces trois catégories de réseaux.*

condition de leur viabilité. C'est ainsi qu'une agglomération, comme toutes les organisations, est mono centrale pour une ou plusieurs activités, poly centrale pour d'autres. L'analyse de quelques agglomérations françaises nous a conduit à développer une théorie voisine de celle de R.D. MCKenzie ; nos agglomérations contemporaines se développent et s'organisent à partir de la poly centralité. La position d'un lieu central dépend de plusieurs facteurs dont l'accessibilité. Un espace très accessible peut devenir un lieu de centralité. Et à l'inverse, un lieu pour lequel sa centralité doit être maintenue, doit être accessible.

Pour rendre compte de la position des sites principaux qui concentrent les activités commerciales, les activités industrielles et celles de services, nous avons été conduit à utiliser un modèle qui prend en compte deux types de composants spatiaux, le bâti et la voirie d'un coté et de l'autre, les infrastructures de transport qui relient la ville à son extérieur et réciproquement. Ces infrastructures sont aujourd'hui multiples. Ce sont les réseaux autoroutiers, les rocades urbaines, les gares ferroviaires, les aéroports, les ports maritimes, voire les ports fluviaux, etc. Ces infrastructures jouent un rôle bien particulier : ce sont des interfaces qui relient un milieu donné à son environnement. Nous avons pu vérifier que ces interfaces jouaient un rôle prépondérant dans la localisation des lieux centraux d'une agglomération (Thibault, 2005 convention n° 0220449). Dès lors que l'accessibilité est l'une des conditions de la centralité, elle se définit à partir de la combinaison deux composantes. La première est la position relative du lieu considéré au restant de l'aire urbaine. La seconde est sa position relative par rapport aux infrastructures qui relient l'espace urbain à son extérieur.

Les deux schémas suivants illustrent l'application de ce principe à deux cas élémentaires. Pour le premier, l'accessibilité d'un lieu à l'extérieur est établie à partir de sa distance à la sortie la plus proche. Pour le second schéma, l'accessibilité d'un lieu à l'extérieur est établie à partir de sa distance aux quatre sorties. Avec le premier cas, les lieux centraux sont proches des sorties. Avec le second, les lieux centraux sont au centre géométrique de l'espace.

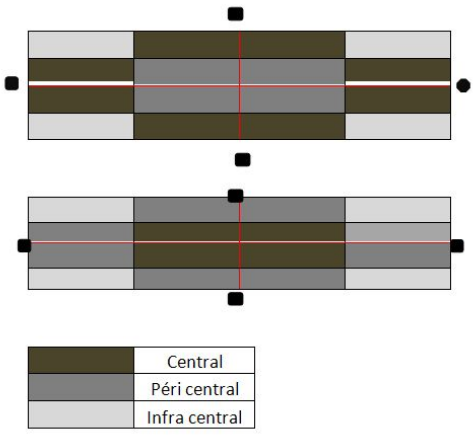

Figure 1. *Centralité et accessibilité*

Cette définition de la centralité par l'accessibilité permet de rendre compte de l'évolution de la centralité au sein des agglomérations urbaines. C'est un phénomène historique avec le changement

et la superposition, au cours du temps, de nouveaux moyens de transport et de nouveaux systèmes d'accès aux agglomérations urbaines.

Aujourd'hui, les agglomérations urbaines possèdent plusieurs lieux centraux. Ce sont les centres anciens, les centres d'activités, de services et de commerces, modernes et contemporains, liés aux modes de transports modernes et contemporains, le transport ferroviaire, le transport aérien, le transport routier, etc. Parmi ces centres, ceux qui comportent les centres commerciaux et les zones d'activités récemment construits, sont localisés à proximité des grandes infrastructures, autoroutes et rocades, qui assurent leur accès par l'usage de l'automobile. Ces centralités correspondent à des agglomérations urbaines qui se sont très largement étalées à partir des années mille neuf cent soixante dix, lorsque l'automobile est devenue en Europe occidental le moyen de déplacement dominant.

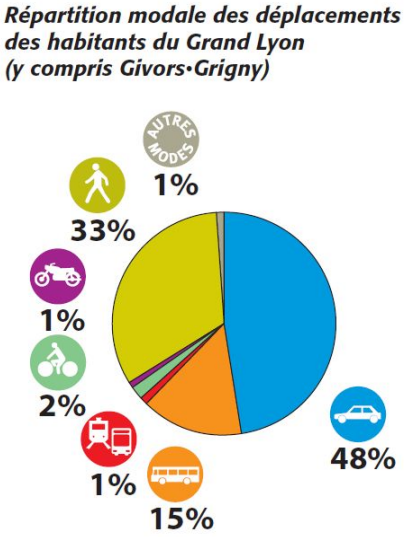

Figure 2. *Extrait «Observatoire des déplacements de l'agglomération lyonnaise», décembre 2008 Agence d'urbanisme pour le développement de l'agglomération lyonnaise*

Avec l'automobile, la réalisation de rocades et le développement des réseaux autoroutiers, l'urbanisation s'est très largement répandue, organisant très schématiquement les aires urbaines à partir de trois modes de déplacement principaux, la marche à pied, les transports en commun et le transport individuel avec l'automobile. Avec ses trois modes dominants, les aires urbaines correspondent approximativement au schéma suivant, quasiment radio concentrique.

2 Les transports

Les agglomérations urbaines occidentales sont poly centrales. Cette poly centralité associe différents type de centres, des centres anciens, bien souvent patrimonialisés, aux centres récemment construits en bordure des agglomérations, dédiés principalement aux activités commerciales et à l'implantation des zones d'activités. Ces derniers sont quasiment au centre d'un espace dès lors que l'on considère l'aire urbaine qui les enveloppe. Ils ont été conçus sur la base d'un mode de transport quasiment unique, l'automobile. Avec ce mode, c'est tout le paysage urbain qui s'est transformé avec

le développement de la périurbanisation et celui de l'habitat individuel, très marqué en France comme dans d'autres pays, les Etats Unis notamment. Aujourd'hui encore, malgré les politiques qui visent à réduire sa domination au sein des centres d'agglomération, l'automobile reste un mode privilégié de transport et l'un des facteurs de l'organisation de la spatialité des agglomérations urbaines.

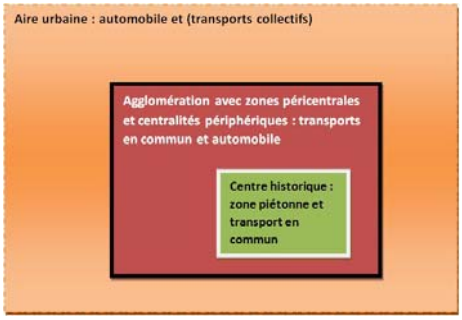

Figure 3. *L'agglomération des trois villes*

Pour autant son avenir est toujours incertain. Cette incertitude devrait conduire les décideurs urbains à envisager des scénarios de recomposition de la ville tenant compte, non pas tant de sa disparition que d'un usage qui pourrait être moindre.

L'incertitude du devenir de l'automobile, comme nous la connaissons depuis plus d'un siècle, est liée à la raréfaction des ressources pétrolières. Cette raréfaction qui ne semble plus faire de doute, s'accompagne d'une demande toujours plus forte en pétrole par des pays qui aujourd'hui développe leur parc automobile, la Chine, l'Inde, etc. S'il faut partager équitablement la ressource pétrolière sur la base de son niveau de production actuelle, les pays européens devrait diviser par deux les volumes utilisés.

Population (en milliard)	***Océanie***	***Amérique du Nord***	***Amérique du Sud***	***Europe***	***Afrique***	***Asie***	***Monde***
2000	***0,03***	***0,309***	***0,519***	***0,728***	***0,78***	***3,68***	***6,046***
2050	***0,046***	***0,391***	***0,805***	***0,631***	***1,75***	***5,26***	***8,883***
Consommation en 2003 (milliers de tonnes)	*non renseignée*	*836 583*	*330 205*	*860708*	*100 918*	*1 223 080*	*3 351 494*
Consommation égalitaire entre grand ensembles régionaux		*171288,73*	*287698,54*	*403554,02*	*432379,31*	*2039943,42*	
Conso 2003/Conso égalitaire		*0,20*	*0,87*	*0,47*	*4,28*	*1,67*	

Figure 4. *D'après Le marché du pétrole (Collicard, 2005)*

Cette division n'est pas un facteur qui limite à lui seule l'usage de l'automobile, puisque sont actuellement connues des solutions de remplacement (éthanol, bi-motorisation, amélioration du rendement des moteurs, etc.). Mais à terme, avec l'épuisement des ressources, l'utilisation du pétrole devra être abandonnée (dans quarante, cinquante années ?).

La fin du pétrole conduit à envisager quatre modes de substitution, l'usage de carburants issus de la biomasse, le moteur à hydrogène, le moteur électrique et les combinaisons. A ce jour, le moteur électrique semble viable. Mais nous ne savons pas encore s'il sera possible de produire toute

l'électricité nécessaire au remplacement du parc actuel de voitures. Aucune certitude n'existe et trois issues peuvent être envisagées,

A. un monde sans voiture ou avec si peu,

B. un monde de l'automobile à utilisation réduite,

C. un monde de l'automobile sans réduction d'usage.

Le monde urbain actuel correspond à la dernière hypothèse. Les deux premières conduisent à modifier et même transformer en profondeur sa situation actuelle.

3 La biodiversité

Un moindre usage de l'automobile conduit à modifier en profondeur les espaces actuellement urbanisés et qui n'ont de relation avec les agglomérations urbaines que par l'usage de ce mode de transport ; l'étalement urbain ne devient plus viable. Plusieurs autres raisons devraient nous conduire à réviser l'occupation de ces espaces périurbains. Parmi celles-ci, la diminution dramatique de la biodiversité est l'une des plus importantes. Rappelons que cette diminution est due à de multiples facteurs, la pollution de notre environnement, le changement climatique, la fragmentation des espaces par l'urbanisation discontinue. Elle est également due au développement de l'agriculture industrielle qui détruit les réseaux écologiques naturels. Les derniers travaux du comité français de l'Union Mondiale pour la nature (UICN) révèle que 10% des espèces de mammifères sont menacées et en voie de disparition en France métropolitaine (UICN comité français, 2009).

4 Un urbanisme de réseaux

L'incertitude pesant sur le devenir de l'automobile, celle portant sur les résultats négatifs dus à la fragmentation des espaces, mais également tout un ensemble d'autres facteurs, comme la question énergétique, l'évolution du lien social, etc. doivent nous conduire à envisager un modèle de la ville qui ne soit plus celui à partir duquel la ville est actuellement en développement. Ce modèle doit favoriser deux grands facteurs. Le premier concerne l'étalement urbain. Il ne s'agit pas de concentrer tout l'habitat au sein des seules grandes agglomérations urbaines, que de concevoir l'urbain à partir d'un réseau de villes, qui ne sont pas étalées.

L'autre facteur porte sur les transports. L'organisation spatiale du monde urbain doit être organisée de façon dominante à partir des réseaux de transports en commun. Nous ne savons pas s'il est possible de produire suffisamment d'électricité pour remplacer le parc automobile actuel par des véhicules électriques. Par contre l'alimentation de réseaux de transport en commun plus denses est probablement faisable. Ces réseaux doivent organiser l'espace des agglomérations et les réseaux de villes. C'est à partir d'eux que nous pourrons être en mesure de faire face aux incertitudes en matière de déplacement, ayant pour but de ne pas trop réduire l'offre de mobilité.

Une telle option conduit à relier de façon forte les réseaux de transports en commun qui organisent quasiment à eux seuls l'espace des agglomérations, à ceux qui relient entre elles les agglomérations. Un tel urbanisme de réseaux serait alors polarisé par les centres multimodaux qui assurent cette liaison. Ce sont des interfaces qui relient une agglomération au monde urbain et qui

relient entre elles les parties de cette agglomération. Ces interfaces seraient appelés à être de véritables centres urbains, associant services, commerces, etc., les centralités de demain.

5 Aujourd'hui, les deux villes des PDU

En France, la relation entre l'organisation des transports et l'organisation des aires urbaines est assurée depuis les années quatre vingt, par deux outils de l'urbanisme opérationnel, les Plans de déplacements urbains (PDU) et les Schémas de cohérence Territorial (ScoT). Ces deux schémas stratégiques doivent être compatibles entre eux (Certu, 2006).

Obligatoires pour les agglomérations de plus de 100 000 habitants, les PDU traitent de multiples domaines, allant de la sécurité des déplacements à l'organisation du stationnement, des réseaux de voiries, la livraison des marchandises, le développement des transports collectifs, etc.

L'analyse de ces Plans qui ont été réalisés jusqu'à ce jour, montre qu'ils s'appuient quasiment tous sur un même modèle générique de l'organisation des transports, encore cohérent avec le schéma des agglomérations urbaines présenté ci avant (voir figure 3). Selon ce schéma, les aires urbaines sont constituées à partir de quatre types d'espaces urbains :

1. *Un ou des centres historiques aménagés en partie ou en totalité avec des zones piétonnes, traversées ou non par des transports en commun.*
2. *Des zones péricentrales d'agglomération avec une présence plus ou moins forte des transports en commun et une forte présence de l'automobile.*
3. *Des centralités périphériques, dominées par l'usage de l'automobile, au mieux en bout de lignes de transport en commun.*
4. *Le restant de l'aire urbaine avec une domination de l'usage de l'automobile.*

Les aires urbaines sont schématiquement rapportées à deux types d'espaces urbains, la ville 1, l'agglomération centrale, la ville 2, son complément au sein de l'aire urbaine

6 Ville 1 : Développement des transports en commun

Les Plans de Déplacement Urbain se prononcent tous pour une réduction de la place de l'automobile, notamment dans la partie centrale des aires urbaines, c'est dire au sein d'une bonne partie des agglomérations urbaines. Pour ce faire, le développement des réseaux de transport en commun est prôné, notamment le développement des réseaux de surface comme le tramway, qui depuis plus d'une vingtaine d'année a fait un retour remarqué au sein des grandes agglomérations françaises.

Du nord au sud le tracé proposé est le suivant :
Place François Mitterrand (terminus)
Rue de Jemmapes
Nouvell rue dans l'îlôt (à l'ouest de l'avenue Maginot) pour rejoindre la rue Pinguet Guindon (tracés en variantes)

Figure 5. *Tours, développement du tramway (Sitcat, 2003)*

7 Ville 1. Développement de l'interconnexion

La réorganisation des réseaux de transport collectifs à l'intérieur des agglomérations urbaines s'accompagne d'un renforcement des pôles d'échange intermodaux, train/tram.

8 Relation Ville 1 à Ville 2

Les Plans de déplacements urbains proposent selon les agglomérations deux types de relation entre l'agglomération et son aire urbaine. La ville 2 étant celle de l'automobile, la ville 1 est ceinturée autant faire que ce peut de parkings relais automobile/transports en commun afin que la voiture n'envahisse pas la ville 1 (voir figure 7).

Dans le second cas, les PDU ou les ScoT préconise le développement du transport en commun pour une partie de la ville 2, soit par l'usage d'anciens réseaux ferrés existants (figure 8, PDU de Rennes), soit par la mise en place de nouveaux réseaux (figure 9, Scot du Grand Lyon). Ce second mode de relation n'empêche pas la mise en place du premier.

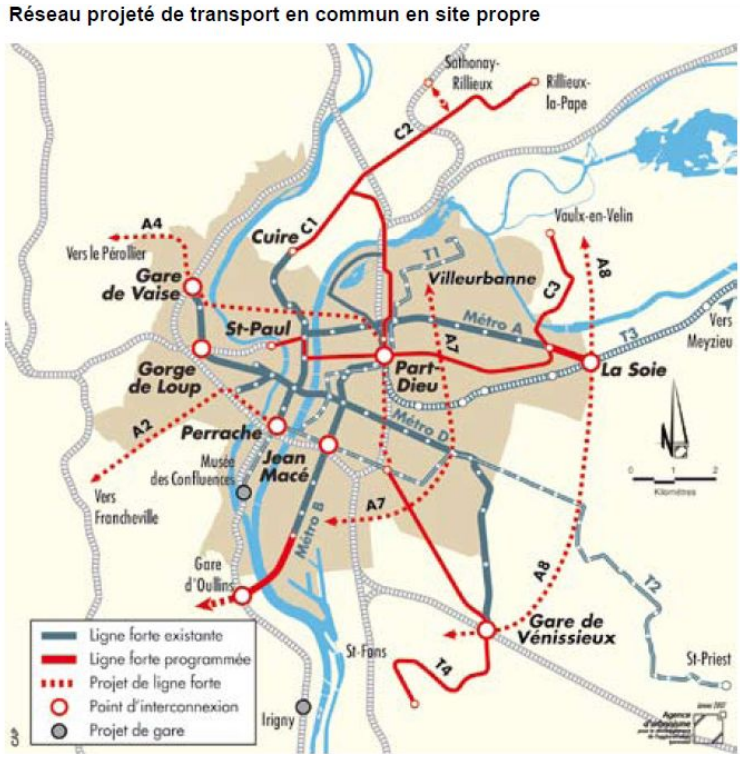

Figure 6. *Points d'interconnexion (Agence d'urbanisme pour le développement de l'agglomération lyonnaise, 2007)*

Figure 7. *Parcs relais ville1/ville 2 exemple de l'agglomération de Tours (Sitcat, 2003)*

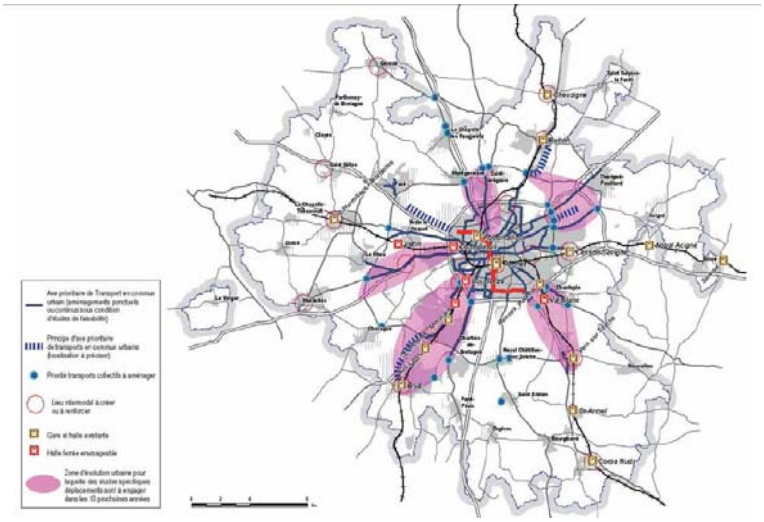

Figure 8. *(Rennes Métropole, 2007)*

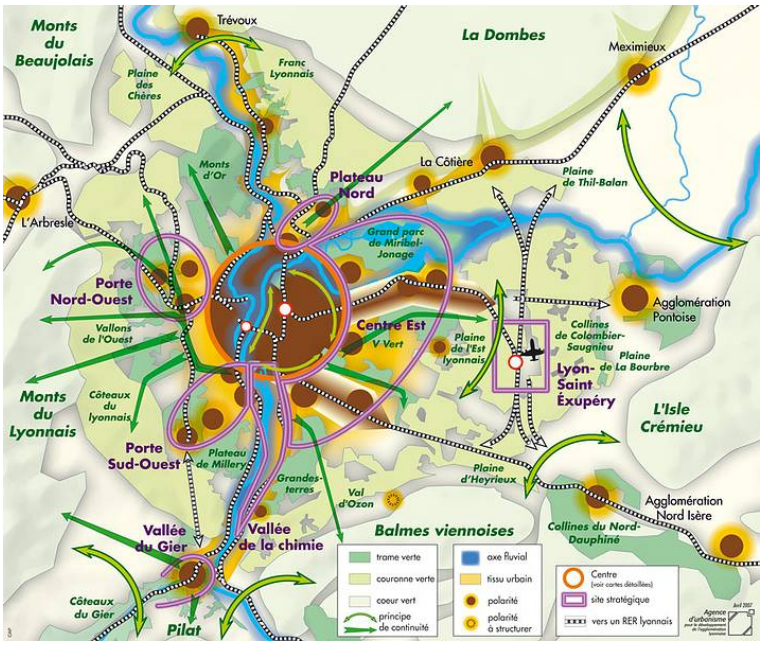

Figure 9. *(Agence d'urbanisme pour le développement de l'agglomération lyonnaise, 2007)*

Avec ce dernier schéma, le Plan d'Aménagement et de Développement Durable (PADD) du ScoT du Grand Lyon propose un réseau urbain multipolaire, qui s'apparente au modèle du réseau de villes, reliés entre elles par un réseau de transport en commun, ici un Réseau Express Régional en projet.

9 Conclusion

Ces quelques extraits issus des PDU et Scot de trois aires urbaines françaises, celle de Lyon, 1 700 000 habitants, celles de Rennes, 550 000 habitants, celle de Tours, 380 000 habitants, montrent que toutes visent à renforcer la présence des réseaux de transport en commun et pour les

plus grandes, leur développement au niveau de l'aire urbaine. L'interconnexion entre le chemin de fer, le tramway ou le métro, les réseaux de bus, sont très fortement préconisés.
La place de la voiture est toujours prise en compte avec le développement des parkings relais qui délimitent la ville 1 de la ville 2.

Pour autant, les lieux d'interconnexions entre la ville 1 et la ville 2, mais également entre l'aire urbaine et les autres aires urbaines ne sont pris encore pris en compte comme les nouvelles polarités qui doivent réorganisées la spatialité des agglomérations, du moins pas suffisamment. C'est avec et autour de ces lieux qu'il convient de redéployer le projet urbain. Lorsque l'on étudie le développement de l'agglomération de Lyon par exemple, les lieux d'interconnexions nouveaux situées en périphéries, sont l'objet d'opérations de renouvellement urbain (Lyon Vaise, La Soie). Elles s'ajoutent à l'existant sans pour autant le renouveler. Ces opérations participent encore de l'extension urbaine et pas suffisamment d'un remodelage en profondeur de l'existant pour gérer les incertitudes en matière de transport pour les quelques décennies futures. L'accessibilité plus que la mobilité doit être l'agent de la conception de la ville. Ce principe nous conduit à réinterroger le contenu de la centralité.

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Porto – an urban area on the way to happiness

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All available information indicates that the urban areas will continue to be the most preferred areas to live by human beings for decades to come. And why are they preferred? At a time when all the descriptions insist in the dark side of this gloomy urban modus vivendi, it is relevant to ask whether there is any masochism or if it is in fact a rational and logical option. Using the example of Porto, we intend to illustrate how this preference is a logical and rational strategy for finding happiness. Despite the multiple dimensions of happiness - health, basic needs' satisfaction, feelings, freedom, safety, time, culture, entertainment, etc. - are more likely to be met in an urban area, it is not easy to offer/plan a product that accomplish the desire of all. Happiness is a complex formula of several objective and subjective dimensions. Planners may ensure provision of employment, security, environmental quality, leisure and recreation spaces, and facilities for education, health or sports, which meet the objective dimension. However, in the field of feelings or cultural/historical skeleton or attitudes towards life, the interference of the planners is more induced than offered. We will try to validate, using Porto's case study, some of the positive and negative impacts created by the presence or absence of a certain blend of happiness inductor factors (i.e. neighbourhoods' size, green spaces, transports, health, climate, etc.).

Keywords: urbanization, environmental (in)justice, medium-size cities, Happiness Index, Porto

1 Introduction

1.1 The world and urban population projections

All population's projections show that human beings will continue to prefer living in urban areas than in rural ones. This will be particularly evident in less developed countries which may mean an enormous imbalance increase between the size and location of the available space, resources and people needs (Fig.1 e 2).

Since 2003 till 2030 (UNPD, 2007) the urban population in the world is expected to rise from 3 billion to 5 billion while the rural population is expected to decrease, in the same lag of time, from 3.3 billion to 3.2 billion (Fig.1 e 2).

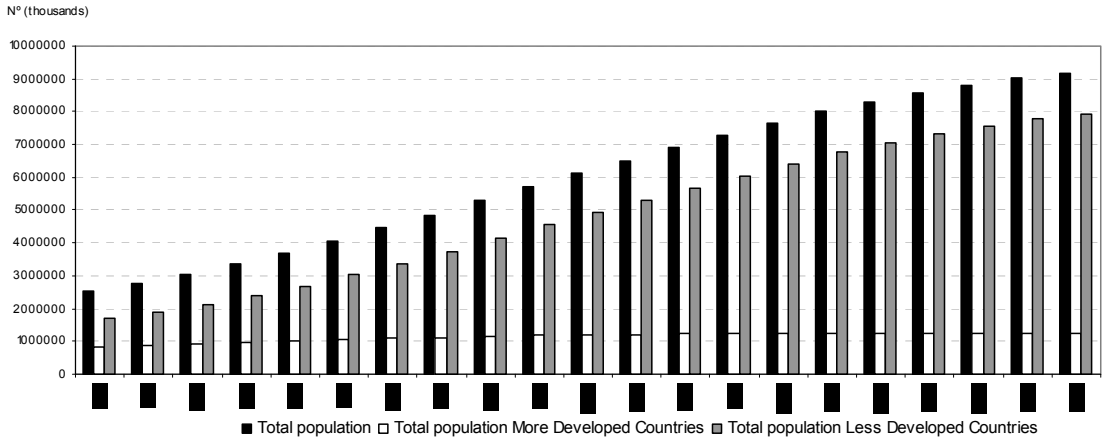

Figure 1a. World population 1950-2050 (United Nations Population Division, 2007)

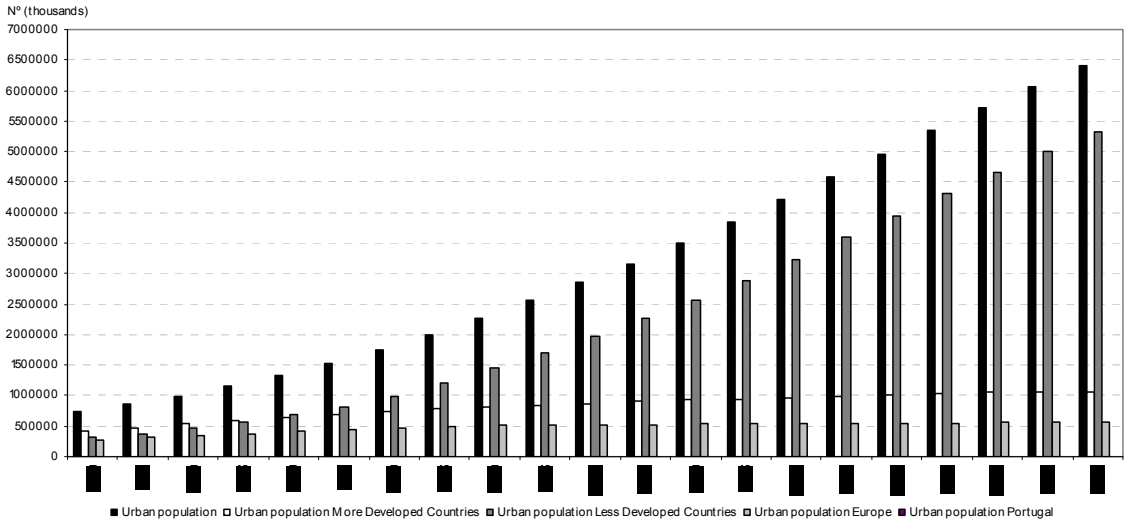

Figure 1b. World, European and Portuguese urban population 1950-2050 (United Nations Population Division, 2007)

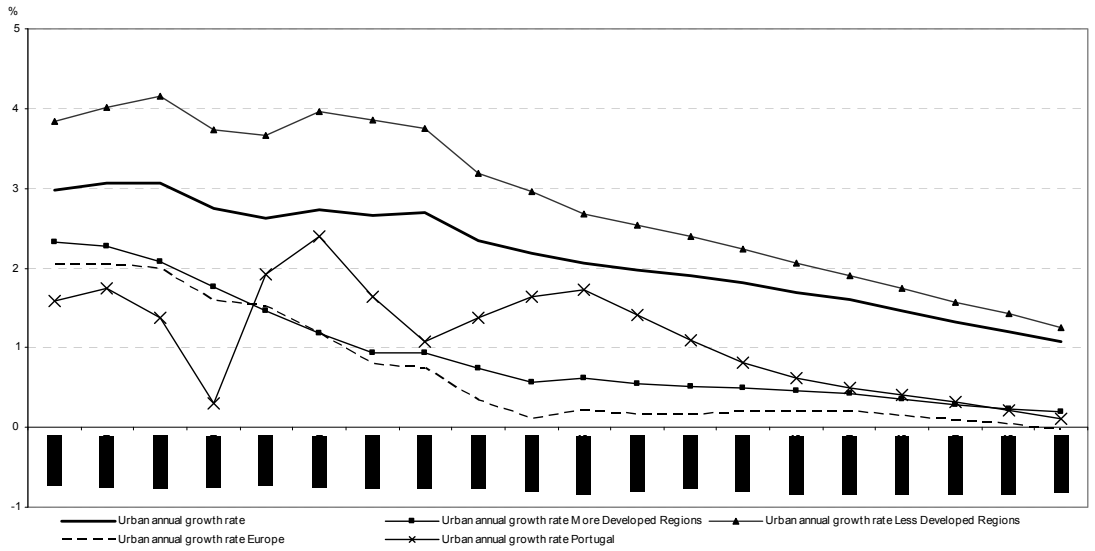

Figure 2. Urban growth rate of the more and less developed regions from 1950-2050 (United Nations Population Division, 2007)

Besides being very recent in our Planet history, the urbanization process since the hunter-gatherer societies, through the agricultural revolution till the creation of villages has been one of the most severe and powerful actions of man upon earth surface.

Till 1800 the urban/rural balance was always negative. The ratio started to modify just after the Industrial Revolution especially in UK where, along the 19th century, the cities with more than 100000 increased from 10% to 40%. Meanwhile, in Europe only 2,2% of the population lived in cities with more than 100000 inhabitants UNPD, 2007).

Since 2007, the world had, for the first time in history, more urban than rural inhabitants and according to UNPD projections the annual rate will raise 1.8% what means an expected doubling in a 40 years period.

For the time being one of the major apprehensions comes precisely from the manner this way of life have spread at an extremely high rate in developing countries. In developing countries the growth of urbanization started in 1970 with a population increase rate that was the double of the rural. In Africa, for instance, the rate overpasses the 4.5% per year - a doubling in an interval of 15 years.

This urban growth process changed completely the social, economic and man-environment relationships. The complexity and intensity of the territorial and social multidimensional sculpture created by this way of life generated an imbalance between people needs and available natural resources that carried entirely new faces on earth.

2 Cities as unique milieus

2.1. Impact Assessment

At the same time that it attracts more and more people, cities became the supreme and preferred laboratories to implement technological innovation. This unique combination – people amount and diversity motivated by a strong scientific knowledge nest dynamic - provoked huge changes in the role of man on earth and in the type of performance of each individual in family, in demography, in education and cultural needs, in the nature of work, in labour relationships, in social classes and cultural interactions, in consumption behaviour, in diet, in health, in well being expectations, in happiness patterns, etc.

The powerful appeal to man's manipulation ability of this new lifestyle exerts a redefinition of a lot of previous concepts like: freedom, family, social responsibility, job, health, wellbeing or happiness. At the same time nourished a more distant and highly sectioned relationship with ecosystem and an ever-increasing consumption desire.

The advantages of urban *modus vivendi* are clear and undeniable. The size makes possible a greater and more diversified offer as well as it allows more individual freedom and less society monitoring and control. Wealth and material comfort were, with opportunities, the advantages that suffered a major unprecedented augmentation.

Besides being a very recent phenomenon, cities are one of the most impressive types of artificial spatial organization. The fact of containing approximately half of the world's population but occupying only 2,8% of planet land area, generate a lot of opportunities but also many threats.

2.2. The bright and the gloomy side of the urban *modus vivendi*

As the territory skills and the natural and financial resources are not infinite combined with the urban areas need of accommodate in a small space several facilities may diminished the initial attractiveness because sometimes doesn't match all people' desires and especially do not answer equally to every citizen. The great investments in public infrastructures like sewage, waste disposal, accessibility, housing, schools, public water supply, etc., and the huge food and energy inputs produce severe inequalities and injustices among very close areas.

More, the combination in a quite small area of a complex mixture of people of diverse nature, with different tastes and expectations, hinder the chances of a bid that might meet all. Furthermore,

the speed rate of wellbeing patterns' change nowadays increase so much that planners do not have an easy task when they try to (re)define sustainable development in urban areas.

This difficulty in suiting everybody's needs is social and spatially translated in a double faced picture - the dark and the bright side of the urban *modus vivendi* - that may be seen either in demography, or social-economic performance, or housing, or health, or even in environmental quality.

The higher fertility rates among poor and deprived ones than in privileged social classes, the easier milieu to spread contagious diseases, the high costs to maintain an health service answer, the needs of sewage, waste disposals and water supply networks everywhere, the natural resources depletion due to the soil impermeabilization required to built infrastructures, the deforestation, the destruction and split of natural fauna and flora, the greater water and energy consumption, the air, soil and water pollution rise, the greater food demand, the housing shortage, the segregated arrangement of social classes, the loss of vicinity relationships, the loneliness, the family node structure weakness, the absence of time, the violence and crime increase, etc., generate some gloomy patterns inside almost all cities.

That's why it is important, during the planning process, to analyze the positive and the negative picture of each city. Health and happiness are two effective indicators of these both sides of an urban area: front and backyard.

3 Porto case study

3.1. Location and size

Porto is the second most important town in Portugal and is situated inside a metropolitan area (GAMP - Porto Metropolitan Area) with 1 281 424 inhabitants, located in the NW coast of Iberian Peninsula (Fig. 3 e 4). In 2005, Porto had 233 465 inhabitants. Porto is a city with a daily flux of more than 500 000 persons. It concentrates mainly services – administrative, educational and cultural – and offers more than 218 000 jobs. 50% of the employees come from nearby municipalities.

Porto's population evolution was, until the 80's, very similar to the rhythm of its metropolitan areas (GAMP). After this decade, while Porto's population decreases, its metropolitan area experienced a population increment (Fig. 5). The demographic regression of Porto along the last decade of the 20th century happened mainly because of the huge housing decentralization, as well as it was due to an enormous fall on the birth rates (Fig. 6).

Porto's population drainage process, mostly towards the nearby municipalities of AMP, and the births drop was accompanied by structural changes in family type and in the age pyramid distribution. The average family size diminished and the number of single parent families augmented as well as the number of lonely elderly people increased.

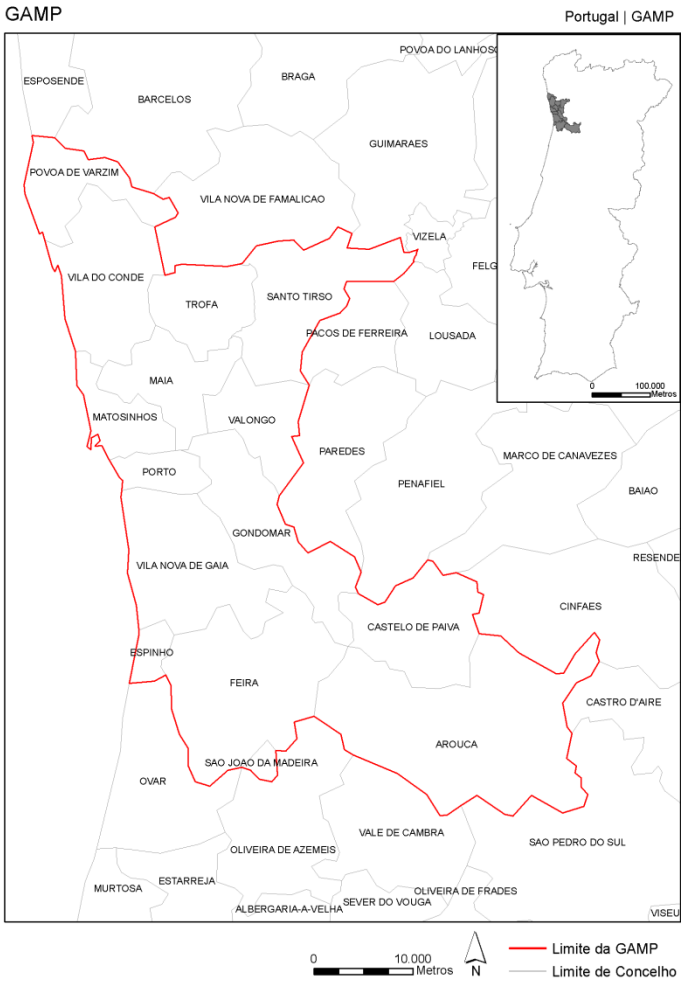

Figure 3. Geographical location of Porto Metropolitan Area (GAMP).

Figure 4. Geographical location of Porto

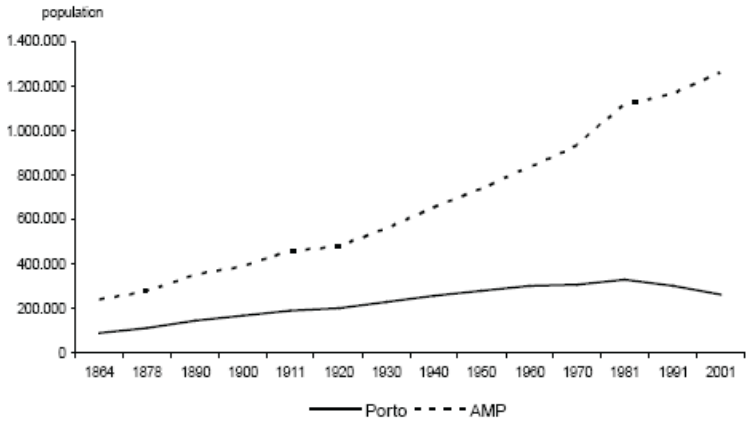

Figure 5. Porto inhabitants (INE, 1884-2001).

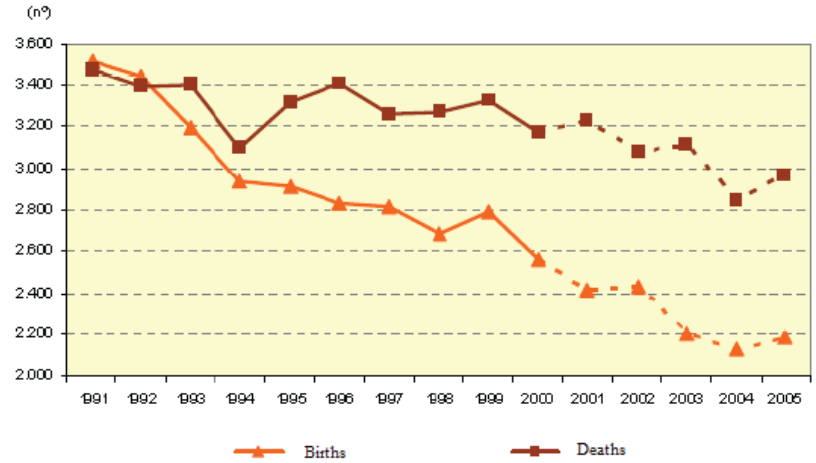

Figure 6. Birth and death rates at Porto (INE, 2007).

3.2. Accommodation of people in space

When we look either through the Porto's population distribution or young and elderly dependence index or family dimension or (il)literacy indexes or unemployment rate, we come to the same broad image of the city – a dark and a bright one, a dream and a nightmare, a full of vitality and a dying one (Fig. 7 to Fig 13).

Moreover, it would be enough to recover the image of the development of green spaces in the city and mix it with buildings age and housing estate distribution, to understand quite well the city's development options in recent years and to understand: why some people remained while others fled; who cannot leave the site where they still are; those who have no choice at all; and the preferred places of those that have a chance to decide where they want to live (Fig. 14 a Fig. 17).

This medium size city that overlays more than 8 centuries of history whose built environment had remarkably increase especially after 1960 (Fig.14 a Fig. 15), show already some serious symptoms of the well known threats typical of greater urban environments.

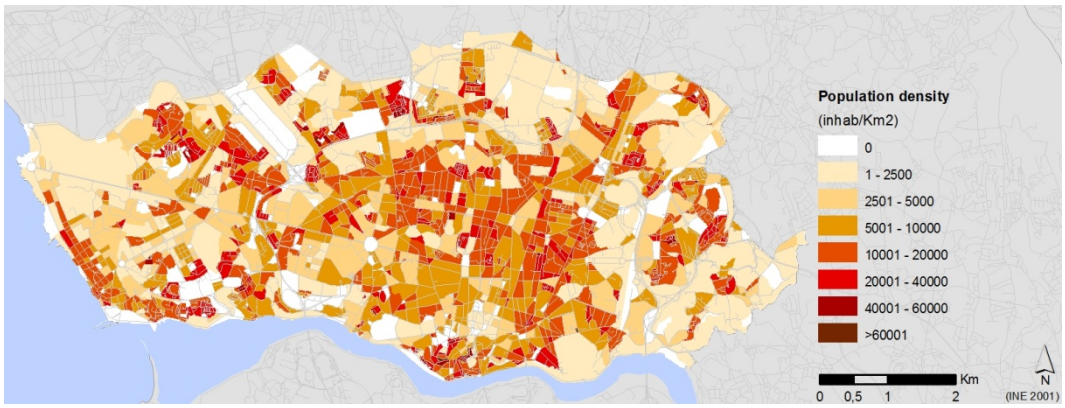

Figure 7. Porto's population density (INE, 2001; PTDC/SAU-ESA/73016/2006, 2009).

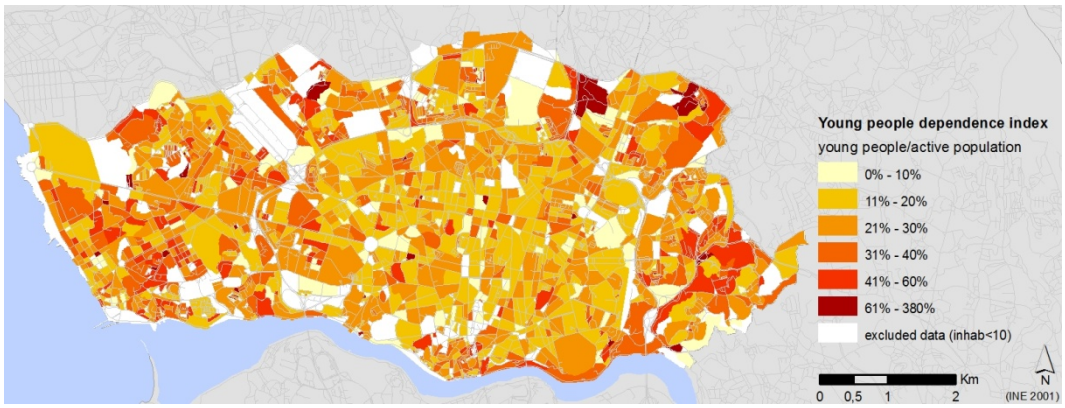

Figure 8. Porto's young people dependence index (INE, 2001; PTDC/SAU-ESA/73016/2006, 2009).

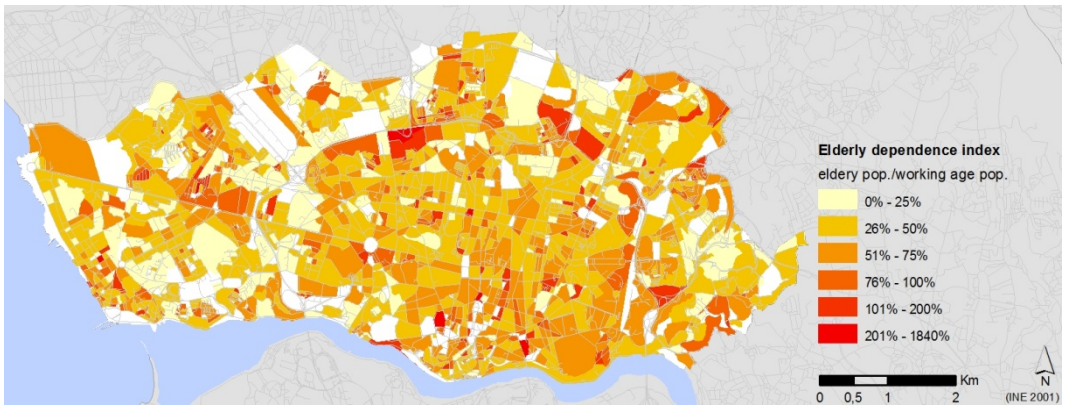

Figure 9. Porto's elderly dependence index (INE, 2001; PTDC/SAU-ESA/73016/2006, 2009).

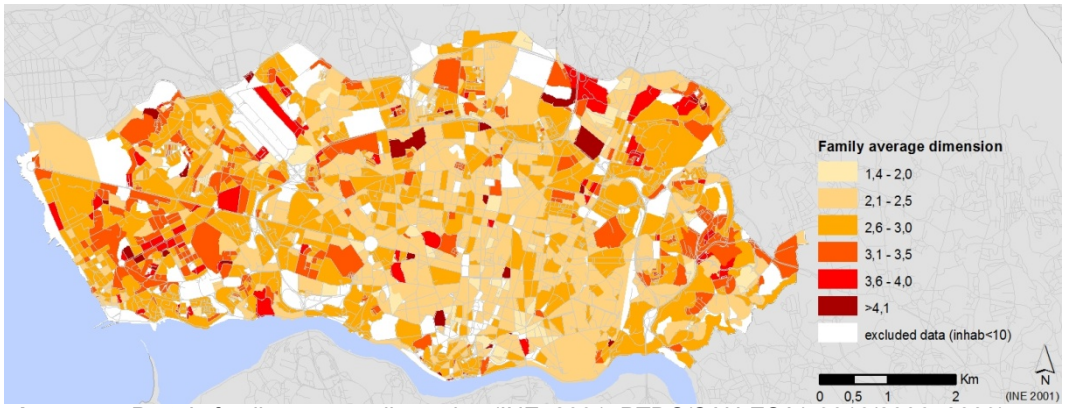

Figure 10. Porto's family average dimension (INE, 2001; PTDC/SAU-ESA/73016/2006, 2009).

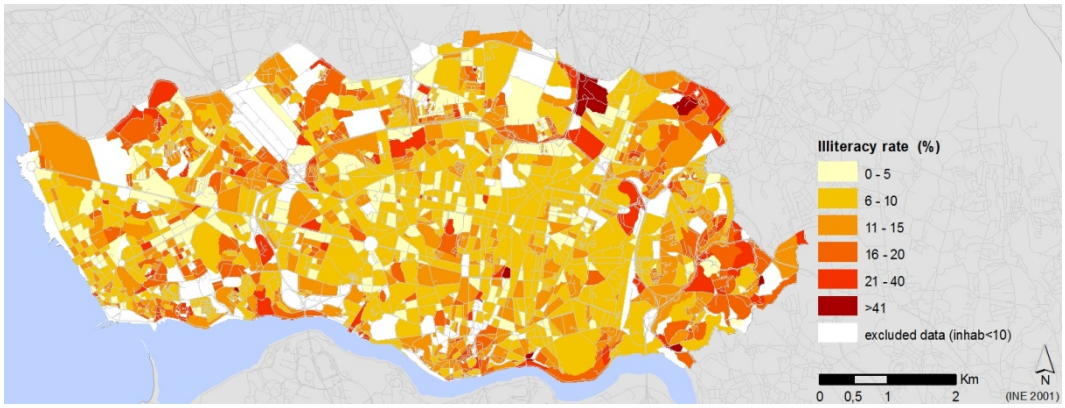

Figure 11. Porto's illiteracy rate (INE, 2001; PTDC/SAU-ESA/73016/2006, 2009).

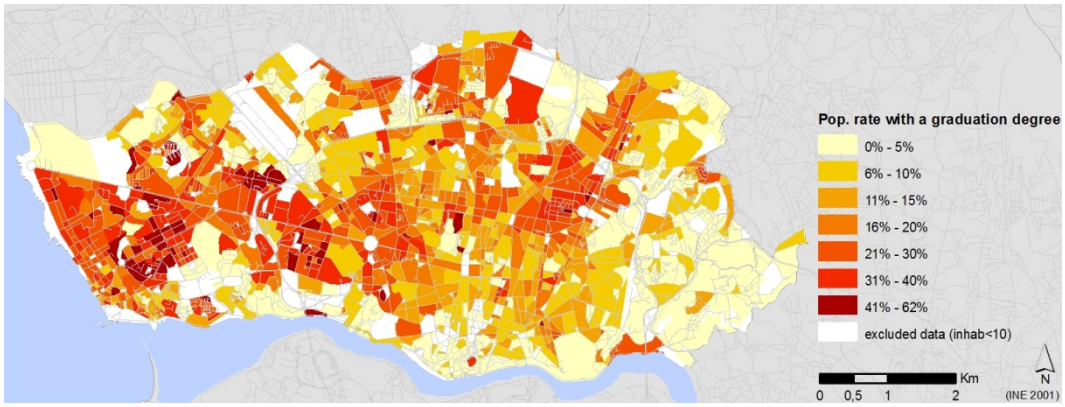

Figure 12. Porto's population rate with a graduation degree (INE, 2001; PTDC/SAUESA/73016/2006, 2009)

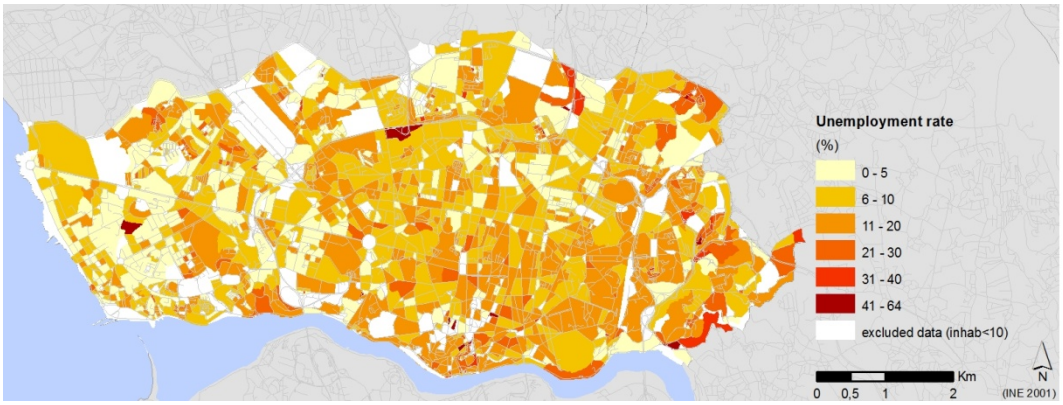

Figure13. Porto's unemployment rate (INE, 2001; PTDC/SAU-ESA/73016/2006, 2009).

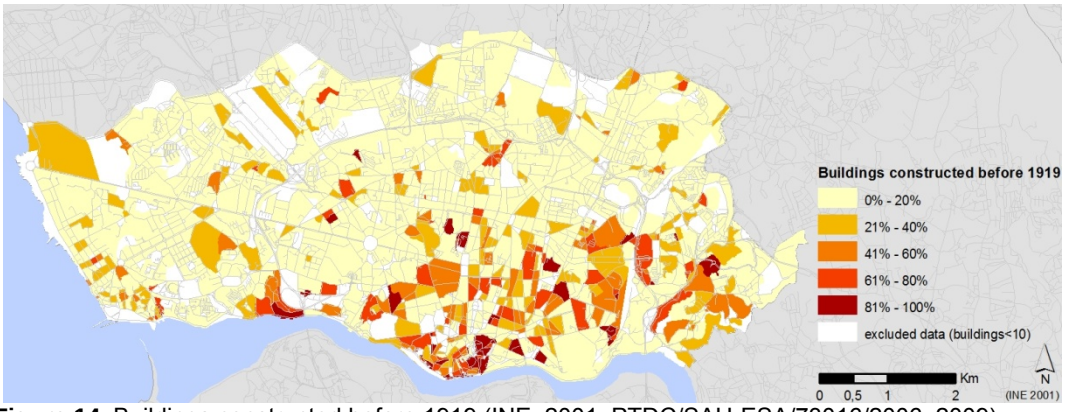

Figure 14. Buildings constructed before 1919 (INE, 2001; PTDC/SAU-ESA/73016/2006, 2009)

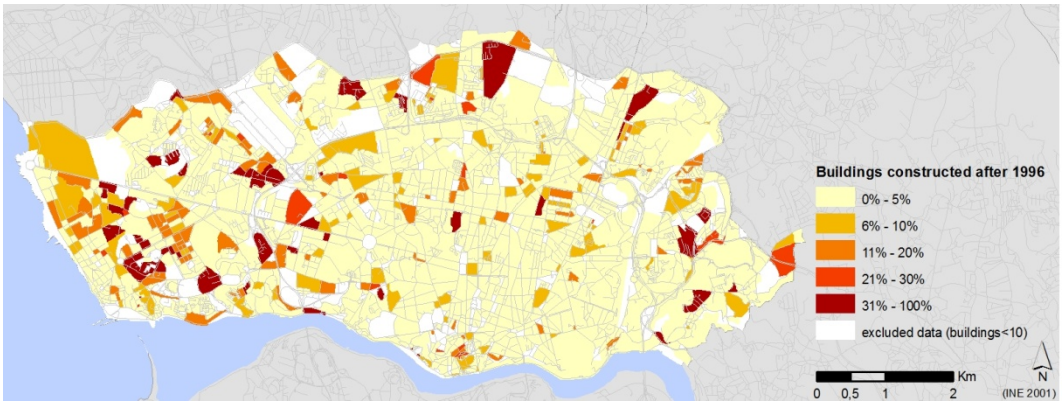

Figure 15. Buildings constructed after 1996 (INE, 2001; PTDC/SAU-ESA/73016/2006, 2009).

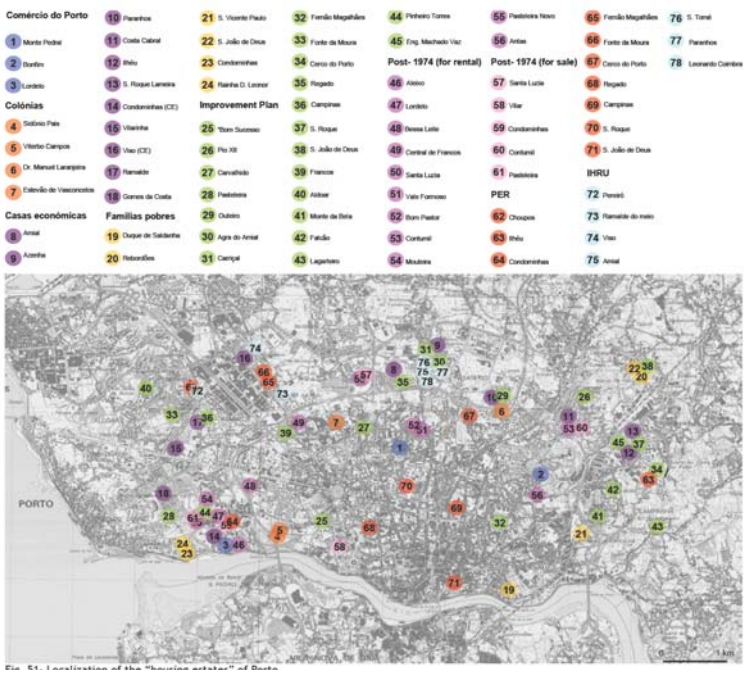

Figure 16. Porto's housing estates (Monteiro et al, 2009).

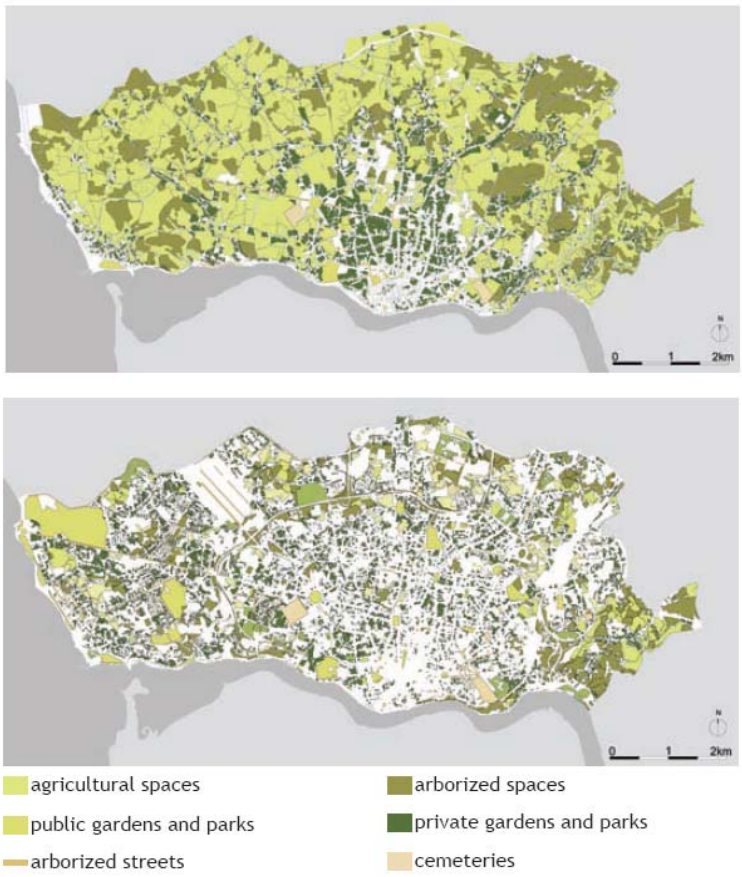

Figure 17. Porto's green areas in 1890 and 2000 (Madureira, 2001).

3.3. - Porto's health data as a consequence of genetics and environment

When we analyze the more recent health data at Porto, by parish, we conclude that the residents in the old city center are those who went more and stay admitted in one of the 4 hospitals of the city (Fig.18). This happens either when we analyze the total amount of admissions or only those suffering from respiratory or circulatory diseases (Fig.19 and 20).

If we compare the flux of people drainage with aggravated disease to the main hospitals (Fig. 17 to 20) with the elderly dependence index (Fig. 9) or with illiteracy index (Fig. 11) or with the unemployment rate (Fig. 13) or even with the family dimension (Fig. 10) or with the buildings age (Fig. 14 and Fig. 15) or with the green areas density (Fig. 17), we conclude that the health vulnerability seems to have a close relationship with the individual environmental condition as well as with the socio-economic and demographic context.

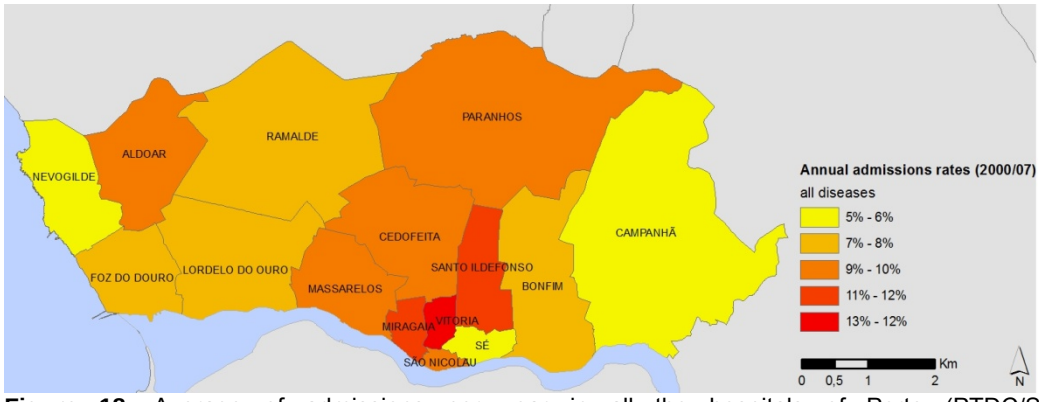

Figure 18. Average of admissions per year in all the hospitals of Porto (PTDC/SAU-ESA/73016/2006, 2009).

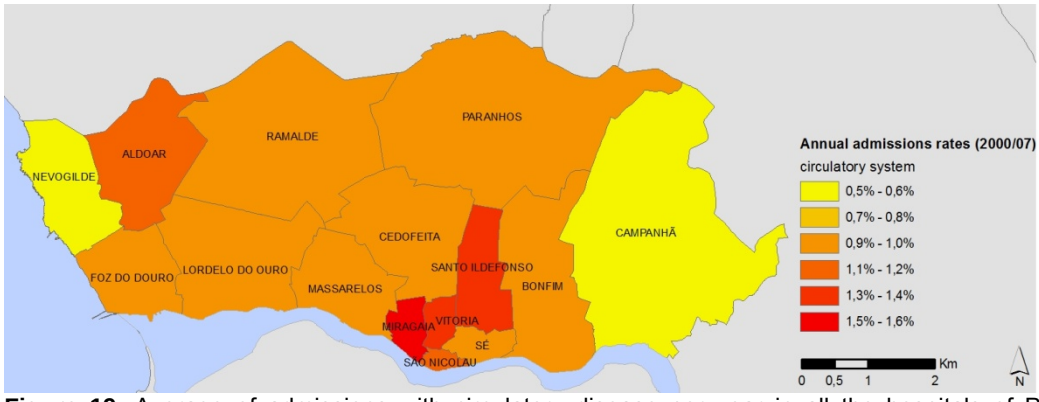

Figure 19. Average of admissions with circulatory disease per year in all the hospitals of Porto (PTDC/SAU-ESA/73016/2006, 2009).

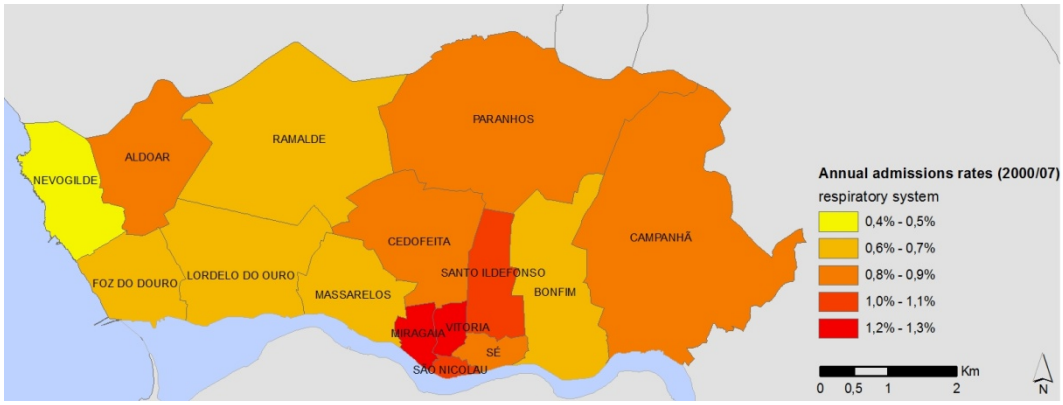

Figure 20. Average of admissions with respiratory disease per year in all the hospitals of Porto (PTDC/SAU-ESA/73016/2006, 2009).

3.4. The health stress geographical distribution during heat wave episodes – a symptom of (un)sustainability

When we look to the Porto's health vulnerability behavior during extreme events like heat waves (Fig. 21 to Fig 23), and we remind the average *urban heat island* magnitude and shape (Fig.24), it seems quite clear that the geographical context – human and physical – may contribute a lot to provoke many of the more acute disease situations.

In the last decades Porto's residents lived under several heat waves. The 2003 and 2006 events are recent examples of this persistent climatic impulsivity. The heat wave definition is not consensual among scientific experts. Its definition depends very much upon the purpose of the research. Anyhow, the WMO consider that a heat wave is a sequence of five days with a daily maximum 5ºC above the average maximum temperature of, at least, thirty years.

Having WMO criteria in consideration, the daily maximum temperatures of July/August of 2003 and 2006 had been quite high, above the thirty years' average, and lasted for several days throughout all the country (Fig.21 to Fig. 23).

At Porto, despite the close proximity to the Atlantic Ocean, the records show an extraordinary sequence of very high values in maximum but also in minimum temperatures. This thermal environment together with the absence of wind, created the needed conditions to affect the most vulnerable population groups especially in terms of respiratory and circulatory system - children and elderly (Fig. 25 to Fig.30).

The majority of the admissions – total, respiratory and circulatory diseases – came from the historical city center and adjacent areas, where the climatic comfort context combined with the demographic and the socio-economic character promote an health vulnerability increase. The fact of being older, living in houses with bad bioclimatic indoor without income capacity to support the use of artificial heating or cooling, are some reasons that may led people to health stress (Fig. 25 to Fig. 30).

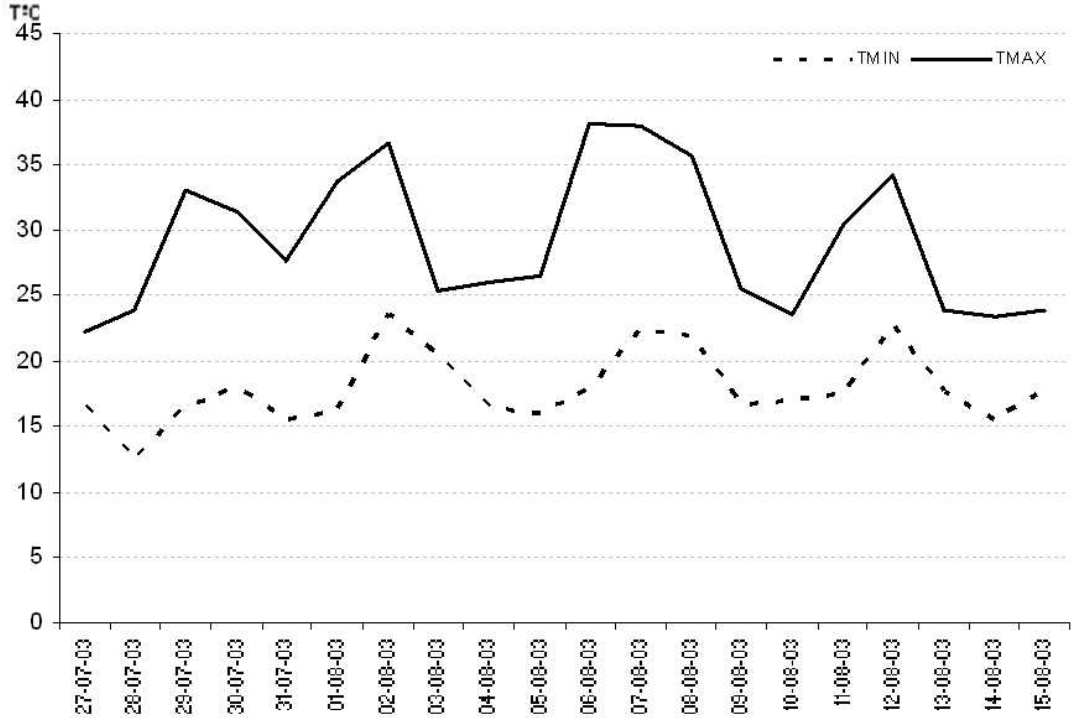

Figure 21. Porto's heat wave of July and August 2003 (Porto-Pedras Rubras).

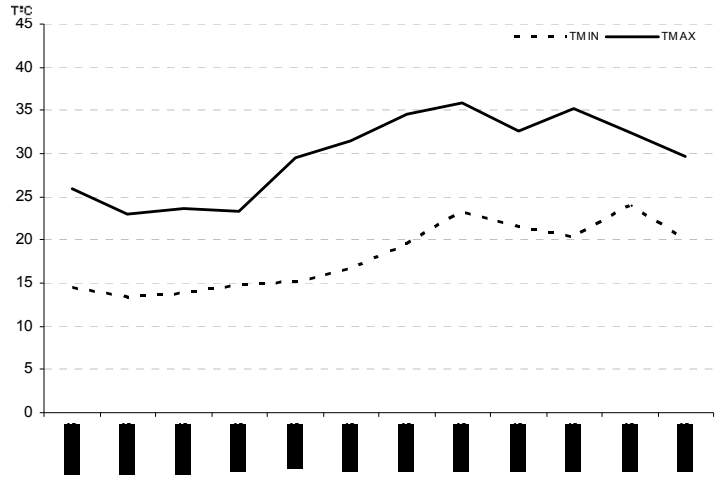

Figure 22. Porto's heat wave of July 2006 (Porto-Pedras Rubras).

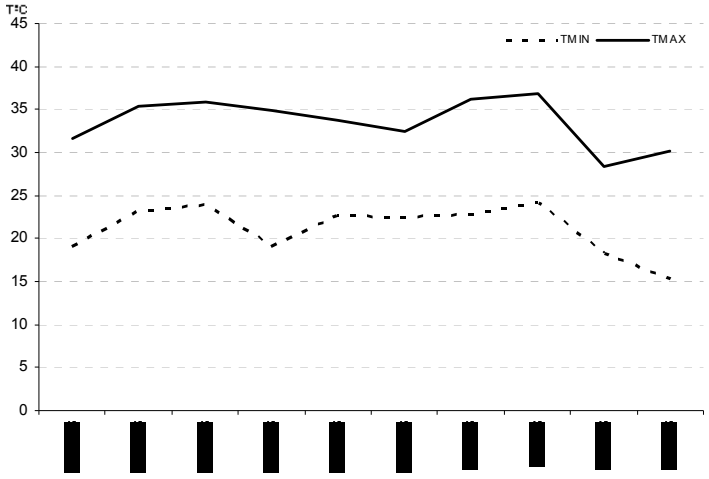

Figure 23. Porto's heat wave of August 2006 (Porto-Pedras Rubras)

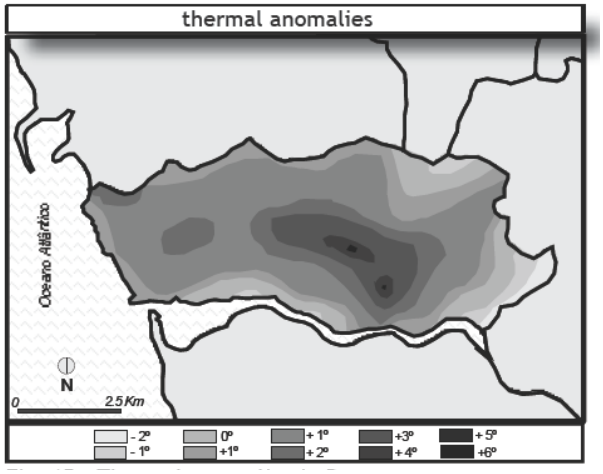

Figure 24. Average urban heat island at Porto (Monteiro, 1997).

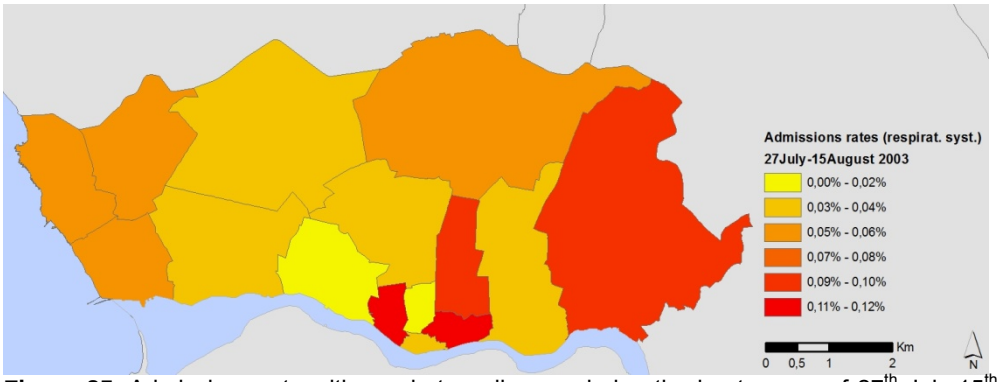

Figure 25. Admissions rate with respiratory disease during the heat wave of 27th July-15th August 2003

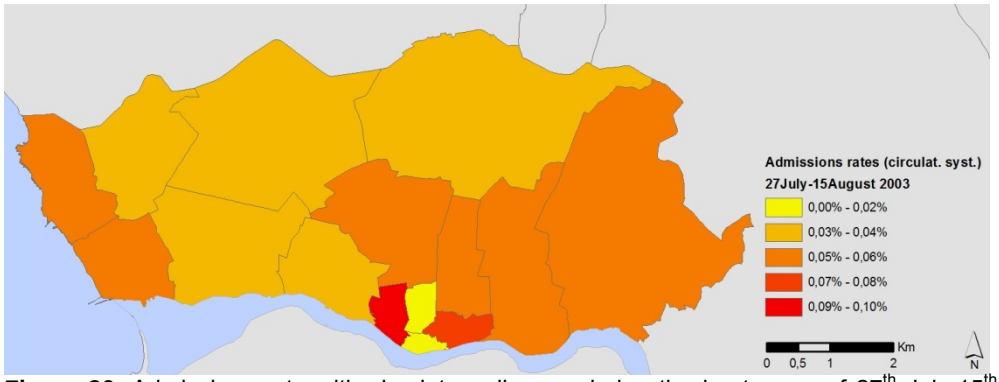

Figure 26. Admissions rate with circulatory disease during the heat wave of 27th July-15th August 2003

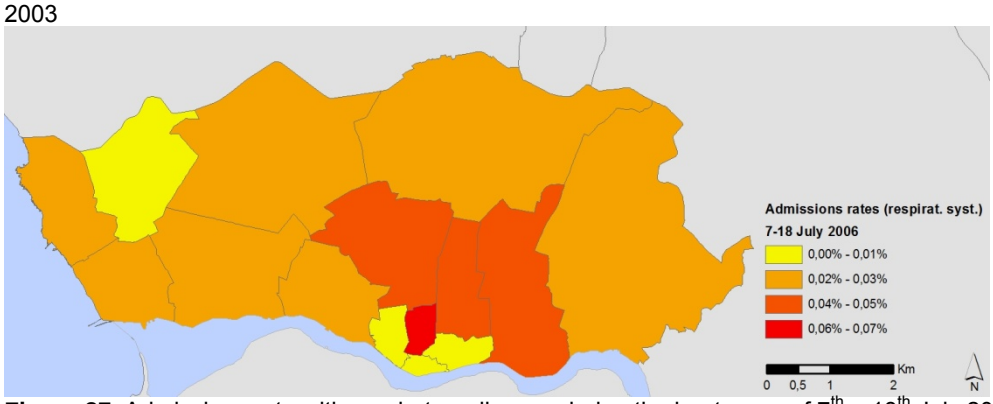

Figure 27. Admissions rate with respiratory disease during the heat wave of 7th – 18th July 2006

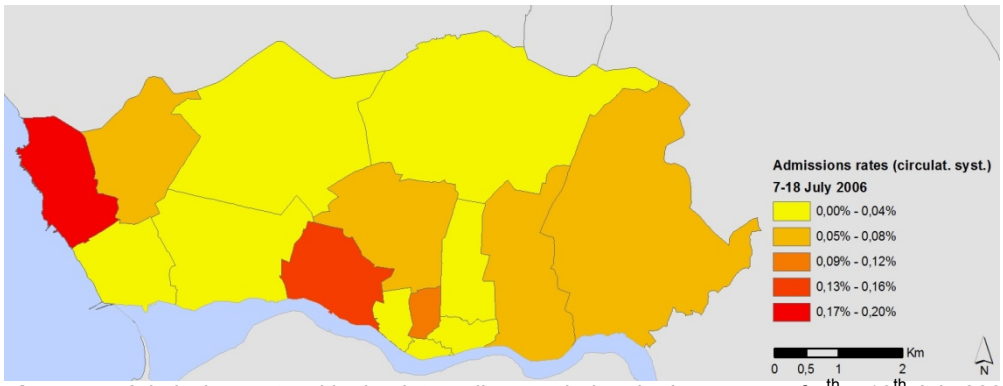

Figure 28. Admissions rate with circulatory disease during the heat wave of 7th – 18th July 2006

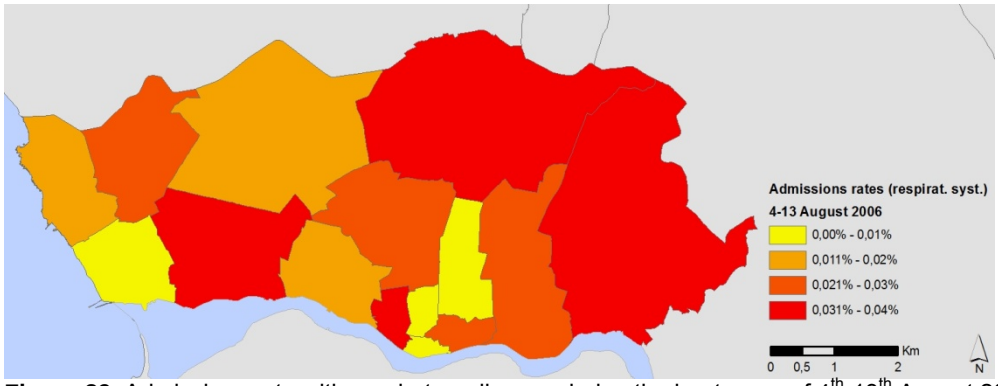

Figure 29. Admissions rate with respiratory disease during the heat wave of 4th-13th August 2006

When we see, anytime but in particular during extreme climatic events, the increment of admissions of people that live in the old city center and in the poorest parishes of Porto where the indoor bioclimatic comfort and atmospheric pollution live side by side with the lower levels of family incomes, we understand that a sustainable urban planning should have in mind that the city is a particularly sensible and complex milieu where an effective intervention is the one that is able to touch the multidimensional value of each piece of the global material and immaterial puzzle.

However, the most serious problems' diagnosis is a much easier task. We can choose whatever look we prefer because the social, the economic and the environmental injustice coincide in urban space.

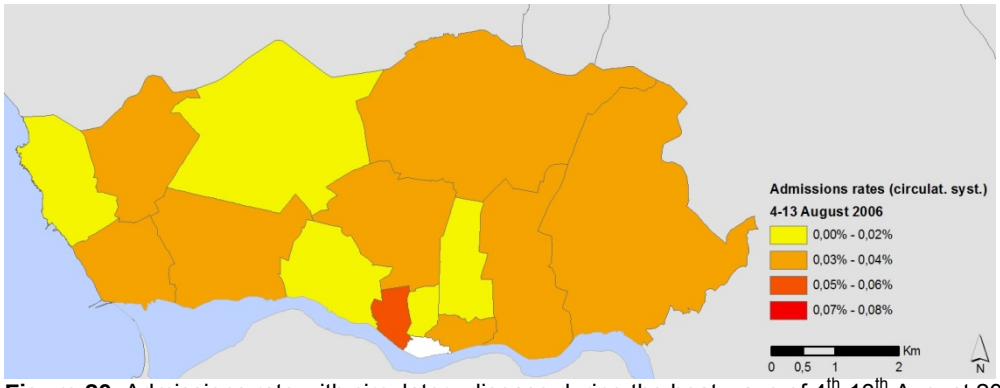

Figure 30. Admissions rate with circulatory disease during the heat wave of 4th-13th August 2006

4 Health and happiness – an alternative perspective to do urban planning

Being so, one possible alternative look to have a systemic approach in sustainable urban planning may be choosing happiness as target during the planning process.

In this context, happiness should be understood as an effective way of transforming resources through activities/technology in better wellbeing patterns to human and other ecosystem elements.

Being true that the multiple dimensions of happiness and wellbeing - health, basic needs' satisfaction, feelings, freedom, safety, time, culture, entertainment, etc. - are more likely to be meet in an urban area, the fact is that it is not easy to offer/plan a product or an idea that accomplish the desire of all (Fig. 31).

Citizen's wellbeing and happiness is a state and a process. It is a condition that results from a complex subjective assessment and a set of individual objective condition evaluation. This feeling emerges from a process in which a person held an objective assess of its mental and physical condition at the moment, compares his/her state with the other's and concludes subjectively about his/her feelings.

Health, cognitive and sensorial condition, character, individual expectations, attitude, faith and emotional relationships compete to shape our subjective assessment at a certain moment (Fig. 31).

The employment, income, education, housing, health, culture, family, security, governance and environmental quality embodies the essential ingredients to the objective conditions formatting that drives us to feel more or less happy (Fig. 32).

Urban planners are supposed to ensure the better conditions to provide employment, security, environmental quality, leisure and recreation spaces, facilities for education and health which assemble the needed ingredients of happiness objective dimension. Nevertheless, in the field of the subjective dimension the planners' interference is more induced than offered. Neighbourhoods' size and aesthetic, green areas, accessibility, health facilities or climate comfort are examples of happiness inductor factors that should be taken into account.

The subjective component of wellbeing and happiness is much a personal issue although in urban areas the people density makes easy a kind of patterns replication by contagious effect.

Figure 31. The determinants of health and wellbeing (Barton and Grant 2006).

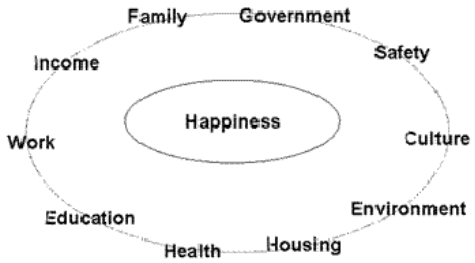

Figure 32. Objective conditions of happiness.

5 The Porto's front and the backyard

Mixing some objective and subjective dimensions of happiness in a GIS, after looking through a correlation matrix and a principal component analysis, and having always in mind the previous considerations of what we understand as the main components of happiness and wellbeing, we try to estimate the shape and size of what may be identified as the bright and the gloomy city of Porto (Fig. 33 and Fig. 34).

The bright and happy city was sketch combining data from graduation degree rate (>31%), unemployment rate (<2,5%) and buildings constructed after 1996 (> 21%)

The gloomy and unhappy city was considered overlaying data of elderly dependence (> 76%), illiteracy rate (> 16%), unemployment rate (> 21%), respiratory disease (> 1%).

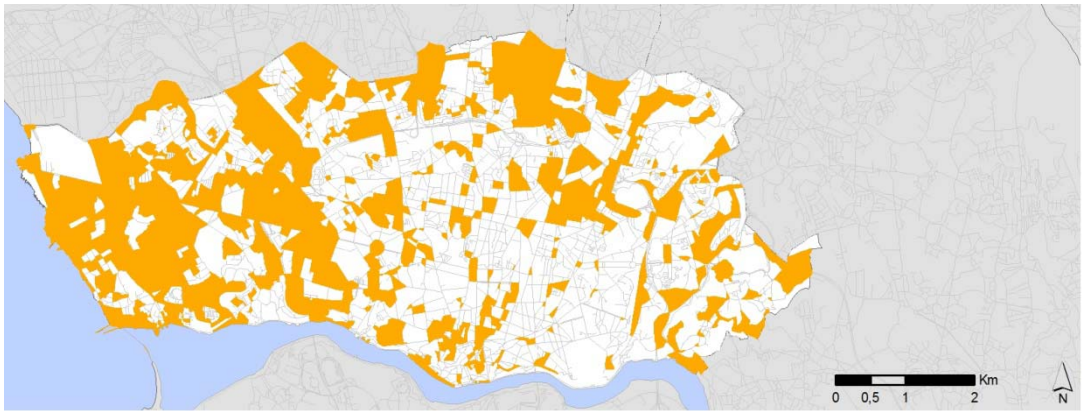

Figure 33. The bright and happy city

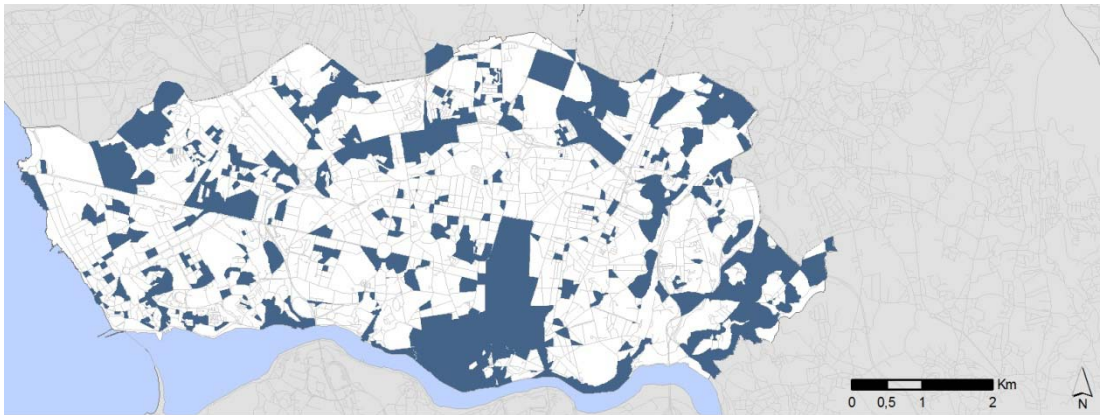

Figure 34. The gloomy city

We believe that both visual expressions (Fig. 33 and Fig. 34) illustrates, with great accuracy, the mental map of social and environmental (in)justice that those who live, investigate or help decision-makers of Porto carries in their mind.

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The Portuguese National Transport Model as a Decision Tool

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The Portuguese National Transport Model (PoNTraM) represents the supply and demand of medium and long distance travel within the country. After initial development between 2006 and 2007, follow up research has recently got under way to significantly upgrade the demand model. The scope of the Portuguese National Transport Model is to evaluate transport measures that have a regional or national impact, such as the construction of a new national airport or a high-speed rail link. It considers five transport modes relevant to long distance travel: car, bus, rail, taxi and high-speed, and the demand models are estimated on a large-scale household survey. The model supports the decision making of transport network investments by providing passenger forecasts or highway link flow projections. By doing so it can be used to prioritize network development investments, which is increasingly important with the current pressure on available funds. The paper presents some case studies and focus on the model as a decision tool to evaluate major transport investments.

Keywords: transport models, decision, national models

1 Introduction

In 2006, the Faculty of Engineering of University of Porto (FEUP) developed a Demand and Supply Model of the National Transport System for the Instituto da Mobilidade e dos Transportes Terrestres (IMTT) (Portuguese National Road Transport Agency). This model, was called the Portuguese National Transport Model, and includes the transport modes car, bus, taxi, rail, air and high-speed rail. The model assigns the long distance travel demand to the transportation networks through the supply, simulating the travel choices of passengers. In this work, the Software used to simulate and evaluate the transportation system was EMME, an INRO transport modeling package.

The current version of the model was built between 2006 and 2007. After this initial development, follow up research has recently got under way to update and operationalize this model.

This paper describes the scope of PoNTraM and outlines its structure. To illustrate its potential to support decision making on transport investments it discusses two case studies of transport planning alternatives. In the following chapter the main features of the model are described in three sections: Supply, Demand and Mode Choice Model. Chapter 3 discusses two case studies that were implemented in the model: the introduction of High Speed Rail and the regulation of public road services. The last chapter discusses the conclusions of present work and outlines planned updates and improvements to the model.

2 Scope and structure of the Portuguese National Transport Model

Understanding the effects of transport planning alternatives is a complex task. Large scale simulation tools, such as the Portuguese National Transport Model, can help decision making by making better predictions of effects of planning alternatives. Developing such modelling tools is a complicated

stepwise process of identifying the problem, defining a set of objectives and criteria, collecting data for the study area, calibrating the parameters in the model, and validating the outcomes.

A National Model, like PoNTraM, has large data requirements and that may be one of the reasons why they remain fairly scarce in spite of their potential role in managing and planning national transport infrastructure. Building up good databases of existing transport supply and demand is therefore an important first step in getting such a model off the ground. In this task, IMTT and INE (Portuguese National Statistics Agency) had an essential role providing the needed input data.

Now the first version of the model is operational a number of case studies have been performed. In the decision making process, the model is used in the following way to support decision making:

- Develop alternatives and scenarios
- Predict future travel behaviours
- Evaluate the alternatives / scenarios
- Select the best scenario
- Strategy implementation in view of the TIPs (Transport Improvement Projects) and land use studies

The model is used to fill in the first three steps: it helps in generating planning alternatives, and it predicts the behaviour of travellers in these scenarios. These outcomes can then be used to evaluate each alternatives in terms of passenger numbers, modal shift or highway intensities.

2.1 Supply

The input data on the supply of transport infrastructures for PoNTraM was provided by IMTT, who maintains an up-to-date online database of all medium and long distance public transport services in the country (TRANSPOR).

The network includes the road and rail network topology. Information about road network was extracted from Navteq´s GIS street database that includes a network hierarchy attribute named “Functional Class” and was built using mostly roads belonging to Functional Classes 1, 2 and 3. In areas with poor road coverage some roads belonging to classes 4 and 5 were also included. The rail network was available in a shapefile format too and includes stations position and link properties.

Volume-delay functions (vdf) express the travel time (or cost) on a road link as a function of the traffic volume v. Usually, these functions are expressed as the product of the free flow time multiplied by a normalized congestion function $f(x)$

$$t(v) = t_0 * f\left(\frac{v}{c}\right).$$

Where the argument of the delay function is the v/c ratio and c is a measure of the road capacity. Many different types of volume-delay functions have been proposed but the most widely used are the BPR functions, which are defined as:

$$t^{BPR}(v) = t_0 * \left(1 + a * \left(\frac{v}{c}\right)^b\right),$$

where $t_0 = \frac{length}{free\ flow\ speed}$. In PoNTraM, parameters a, b, c are adapted from the High Capacity Manual by road type.

In what concerns to the transit time functions, they are defined according the transit type. In our model, there are ten different transit time functions, one for bus and the other for rail. Bus transit time function is based on the car speed in the network, which is evaluated by the volume-delay functions during assignment. Based on a calibration against published travel times it was assumed that bus speed reaches 80% of car speed: $bus\ speed = 0.8 * auto\ speed$.

The rail transit time functions depend on average speeds, distinct by rail service type, calculated for the whole rail network and coded in respective links. After define the model network and transit time functions, the next step was coding the Public Transport Services: Bus lines and Rail lines (Alfa Pendular, Intercidades, Suburbanos and Metro (Lisboa and Porto)). This task consists of identifying stops, routes, headways and velocities for each line.

Summarizing, PoNTraM represents the modes: Car, Bus (coach), Rail and HSR (high-speed rail, forecasting only). In addition to these principal modes, the following access modes are included: taxi, metro and suburban rail services. When modelling long distances travel, these auxiliary modes of transport are necessary for modelling access to infrastructure networks from any location in the country.

2.2 Demand

The demand side of a national transport model consist of the choices that long distance travellers make in travelling from their origin to a specific destination. These choices can include a destination choice, a mode choice, a route choice and a time of day choice.

2.2.1 Demand data

The demand data were obtained from different agencies. The IMTT commissioned a national medium and long distance household travel survey in 2001 (Inquérito à Mobilidade de Média e Longa Distância – IMMLD, INE, 2001) which was the base for the input data. EP (Estradas de Portugal, S.A.) also made available their 2005 traffic count data (Estimated Daily Traffic) and INE provided information on commuting from the 2001 Census.

The first step in defining demand was the spatial disaggregation (zoning). The country (mainland only, about 10 million inhabitants) was divided into 440 zones. Roughly, this zoning corresponds to the municipalities but cities with a larger population were disaggregated in two or three zones more, always respecting the limits of smallest statistics division.

The demand matrices estimation was based on the results of IMMLD, on demographic, economic and socio-economic data collected and on times and costs matrices obtained from network assignments in EMME. The demand matrices are segmented to Time Periods (for example, Week AM peak, Week PM peak, Monday AM, Friday PM, Week off-peak, Saturday AM, Sunday PM

periods), Car Availability (captive and non Captive Demand Matrices), Trip Purpose (for example, H-Work, Business, Health, Shopping, Leisure, Holidays, Family/Friends or work related (H-Work + Business) versus non-work related), Income Level (by 3, 4 or more income levels) and Trip Distance (Inter versus Intra-Distrital trips).

Although the objective of this model is the medium and long travel distance analysis, it is necessary to take into account short distance travel matrices to simulate road congestion correctly. Since there is no intention in estimating the modal choice for short distance travels, it was decided to consider a static matrix for short distance trips. This short distance matrix was calculated based in table 6.40 from Census 2001 (commuting trips Home-Work and Home-Study), considering only the movements in individual transport and ignoring the intra-municipal movements. Although this methodology allows obtaining only a rough estimative of short distance travels, the input of this information enabled the substantially improve of calculation of delays in urban areas.

2.2.2 Mode Choice Model

Transportation forecasts traditionally follow the sequential four-step model: trip generation, trip distribution, mode choice and route assignment. The mode choice analysis is the third step and allows the modeller to determine what mode of transport will be used.

According to the simple multinomial logit model, the choice of transport mode to be used in a given trip is organized in a single level. The individual chooses, in a unique level, what kind of transport is used (eg, air, car, rail or BUS) (see Figure 1).

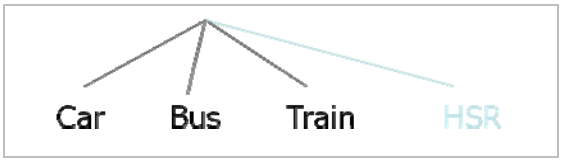

Figure 1. Simple Multinomial Logit Model Structure

In this case, the probability of choosing a given mode, e.g. HSR, is given by:

$$P_{HSR} = \frac{e^{V_{HSR}}}{e^{V_{auto}} + e^{V_{rail}} + e^{V_{bus}} + e^{V_{HSR}}}$$

The variable V_{HSR} represents the generalized cost or the utility of HSR mode. The following expression allows obtaining the utilities for a given transport mode:

$$V_m = \alpha \cdot t + \beta \cdot c + ASC_m$$

where t is the travel time spent from a given origin to a given destination by mode m; c is the respective travel cost; α and β are time and cost coefficients that need to be estimated and ASC_m is the Alternative Specific Constant associated to the m mode that expresses the travellers attitude towards this mode.

The time t and cost c variables consist of different parts. For example, the car costs consist of fuel costs ($COST_{auto\_GAS}$) and tolls ($COST_{auto\_TOLL}$).

2.3 Demand supply interaction

The demand for long distance travel and supply of transport infrastructures are co dependent. If travellers choose a car alternative, highway intensities increase and thus congestion and travel times can increase. This influences the supply side of transport infrastructures. Vice versa this change in supply can affect the choices on the demand size: some car travellers might decide to take another mode of transport due to the increased travel times. There for the demand and supply models in PoNTraM are run iteratively.

Given a set of travel matrices, the supply models determine travel time and travel costs. These travel times and costs are input to the demand models that calculate the generalised costs (and utilities), the probabilities that a mode and destination is chosen, and the resulting demand. This new set of demand matrices are then again input to the supply models and the process is repeated. The following figure illustrates how one iteration step is implemented in EMME.

Table 10. EMME implementation

1. Disaggregate demand by Car Availability (captive and non-captive)
2. Carry out initial set of assignments • Car (time, gas, toll) • Bus (InVehicleTime, WaitingTime, aux; distance; aux_distance) • Rail (InVehicleTime, WaitingTime, aux; distance; aux_distance)
For each demand segment, separately:
3. Calculate utilities
4. Calculate choice probabilities
5. Calculate demand
6. Aggregate demand
7. Carry out new assignment (back to step 2)

3 Case Studies

The model allows the creation and evaluation of transport planning scenarios, in which the actual base case scenario corresponds to the Transport System in May 2007. To illustrate the use of the model two case studies are presented: the Introduction of High Speed Rail and the Regulation of actual Road Public Transport System. The next two sections explain the parameters and results for these scenarios.

3.1 Introduction of High Speed Rail

In the first case study, the model was used to analyze the impact of introducing a high-speed rail service between Lisbon and Porto on accessibility and territorial modal split. This test scenario includes two distinct services: direct service without stops between Lisbon and Porto and a service stopping at Lisbon, Ota, Leiria, Coimbra, Aveiro and Porto. Both services were established with hourly frequency.

For the direct service, the average speed was estimated at 220 km/h (1h20m to connect Lisbon to Porto) and, for the second service an average speed of 190 km/h (1h35m to connect Lisbon to Porto). Based on documents provided by the Government, the fare was set at a price of € 0.13 per kilometre, which corresponds to a fare of about € 40 on Porto-Lisbon connection.

Table 2 shows of the estimated modal split in the base scenario and the scenario with HSR (AM peak hour). The results show that the HSR can capture 4.3% of the demand for long distance travel. This market share comes for 1.3% from car, 1.4% from conventional rail and 1.6% from the bus alternative.

Table 2. With and without HSR modal split (Week AM Peak)

	CAR	RAIL	BUS	HSR
Base Scenario	78.5%	10.0%	11.5%	-
HSR Scenario	77.2%	8.6%	9.9%	4.3%
HSR - Base	-1.3%	-1.4%	-1.6%	+4.3%

Table 3 shows the estimated revenue by transport mode in the HSR scenario. It reveals that although its modal share is less than a half of value for conventional rail and bus modes, the revenue generated exceeds both competitors public transport modes. As will be shown, this is due to the high average HSR travel distance.

Table 3. Incomings by mode transport with HSR (morning peak time)

	Toll	RAIL	BUS	HSR
Incomings (€)	272 273	43 920	70 223	76 643

Figure 2 shows the HSR Modal Split by origin zone. As expected, the HSR effect is mainly felt in the caption area of their stations, with extensions in Lisbon and Porto along the suburban rail corridors. The high speed rail can capture a market share of 17% of all long distance trips in origin zones like Valongo and along the Minho line.

Figure 3 shows the passengers flow on the HSR network (AM peak hour) and figures 4 and 5 show the number of passengers (AM peak hour) in the HSR stop in all stations service in Porto-Lisbon and Lisbon-Porto direction, respectively. Each train vehicle has a capacity of approximately 250 passengers. The demand exceeds by about 100% the supply along the HSR line. This can be explained by the fact that HSR reduces the travel time and the price is relative low compared to the gained travel times. The model does not take into account overcrowding in the mode choice model

(overcrowding is likely to reduce demand) but in the calculations it is assumed that the high speed rail operator (RAVE) would increase the capacity of the trains to facilitate all demand. So, the estimated passenger number can also provide input to the planning trains and wagons for this new type of infrastructure.

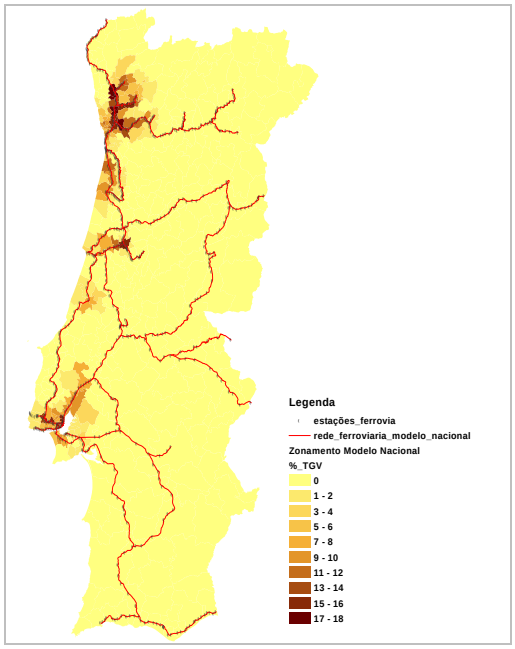

Figure 2. HSR Modal Split (% trips) by origin zone

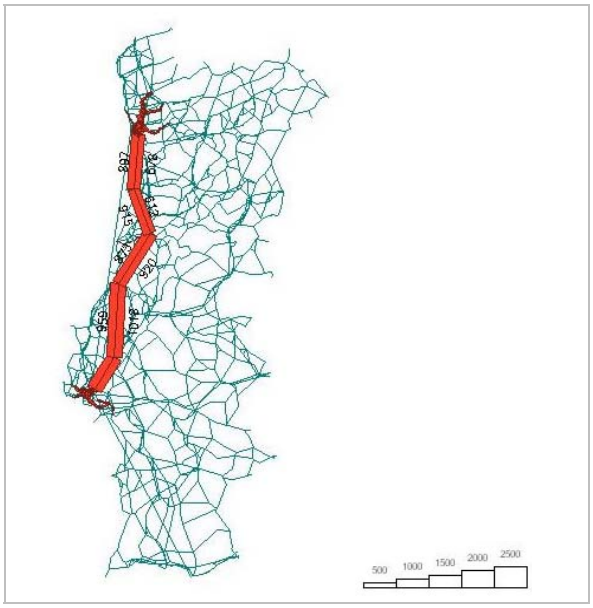

Figure 3. Passengers flow on the HSR network

Figures 6 and 7 show the number of boardings by station in Lisbon – Porto service and Porto – Lisbon service, respectively. On Lisbon to Porto service, most of the boardings occur in Lisbon, with a small number of passengers boarding in Aveiro. In the other direction, most boardings occur in

Porto, with a small number of passengers boarding in Aveiro, Coimbra and Leiria. The Ota station has practically no demand, since this analysis was performed to the pattern of current demand. Although the model can be used to analyze the modal split of trips planned for the future, with destination/origin in Ota, the estimate of this demand sub-matrix would have to be carried out exogenously.

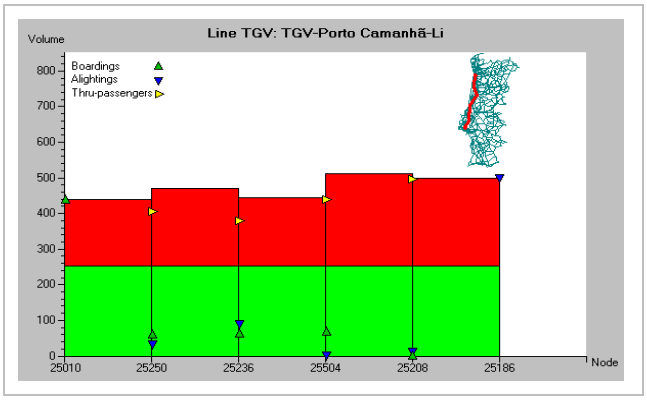

Figure 4. Number of HSR passengers, Porto - Lisbon

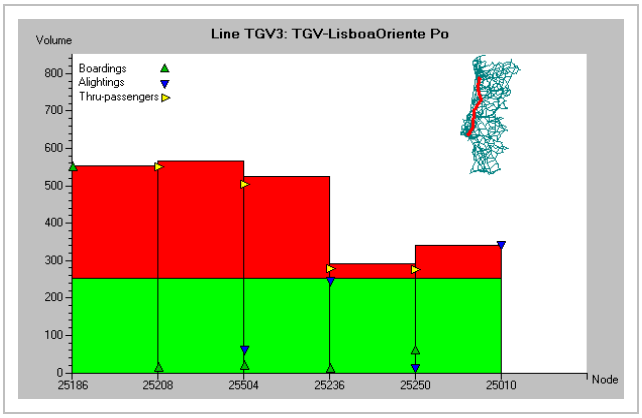

Figure 5. Number of HSR passengers, Lisbon - Porto

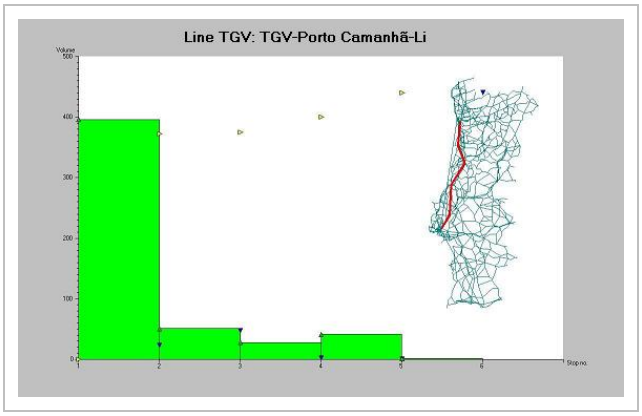

Figure 6. Number of boardings by HSR station, direction Porto-Lisbon

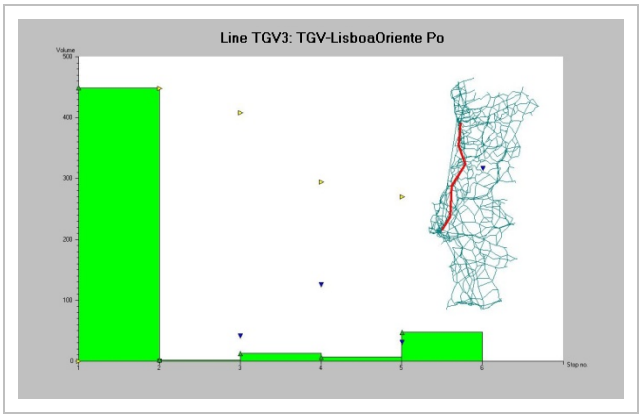

Figure 7. Number of boardings by HSR station, direction Lisbon-Porto

Next figure, Figure 8, shows the change on roads traffic flows resulting from HSR introduction. There is a substantial reduction on traffic along the A1 between Lisbon and Porto, which justifies the results in Table 1. This traffic reduction (and congestion reduction) is responsible for the increase of road accessibility, as shown in Figure 9. Gains between 5 and 10 minutes in average travel times occur in the areas like Vila Franca de Xira, Leiria (centre), Coimbra (centre), Porto (Centre) and the east zone of Porto. However, it's interesting to note, that there are also accessibility gains in areas far-away from the HSR line. This is due to the fact that the congestion reduction in areas such as Lisbon and Porto, which attract many trips from other parts of the country, benefiting individuals that moving from this areas by car.

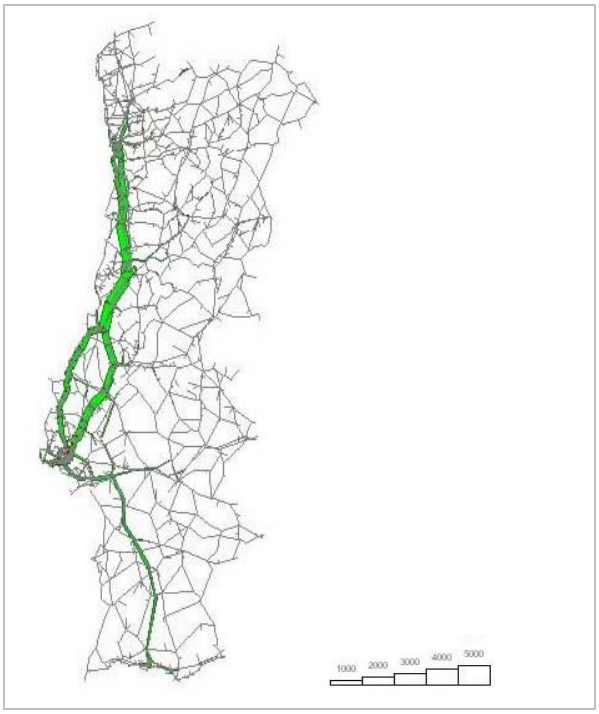

Figure 8. Change on road traffic flows resulting from HSR introduction (Week Am Peak) – Green represents the traffic reduction and red the traffic increase

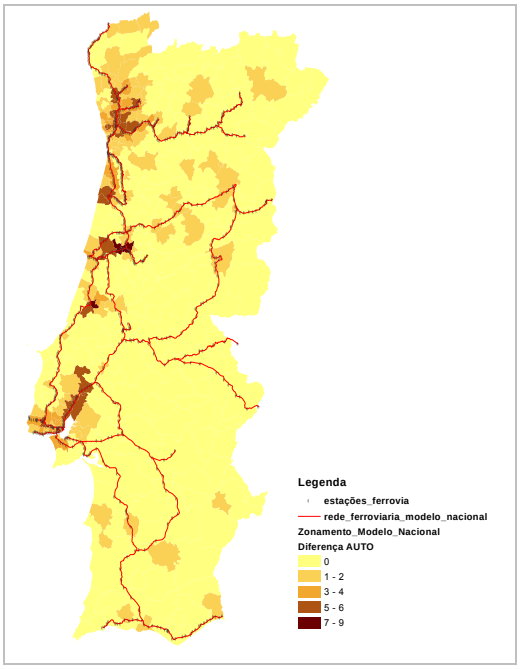

Figure 9. Average Gains in car accessibility (minutes), resulting from HSR introduction

This brief review of the HSR introduction illustrates the kind of results that can be obtained from the model. It is easy to conclude that such results can be used as a useful tool for decision support, for example, the socio-economic benefits calculation associated with a particular investment.

3.2 Regulation of the current bus time schedules

In a second case study, the model was used to test the impact of a regulation scenario for the bus time schedules, in which the optimal headway for each bus line is calculated based on its demand. This scenario was implemented for the morning peak period, and the following variables were calculated:

$$veh-km = total\ number\ of\ vehicles - km$$
$$Pax-km_i = Passengers - km\ number\ in\ line\ i$$
$$L_i = length\ of\ line\ i$$

The optimal headway (F_i, circulations per hour) for line i is calculated with the following equation:

$$F_i = \left(\frac{Pax-km_i}{\sum_i Pax-km_i}.veh-km\right).\frac{1}{L_i}$$

The term in brackets represents the number of $veh-km$ to a given line i. Dividing this value by the i line length, a new headway is obtained. This must be an iterative calculation that stops when the changes in frequency, between iterations, are below a pre-defined value.

This approach allows to re-allocate resources in favour of services between OD pairs with high density flows and where the bus is relatively attractive. By reducing the average passenger waiting times, it reduces the generalized cost of travel and attracts more passengers to this mode of

transport. This is shown in Figure 10, which represents the difference of bus passengers between the scenario and the Regulatory scenario basis. There is a significant increase of passengers in all roads, except for a small reduction in the corridor Faro-Lisbon.

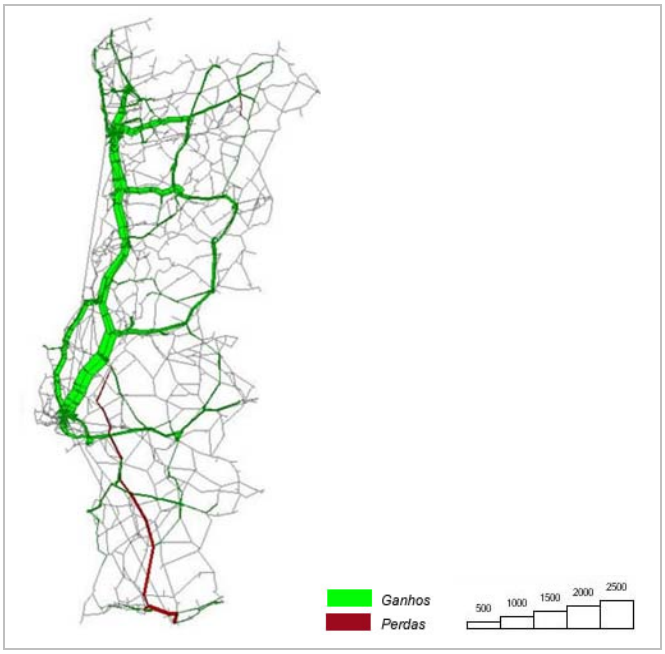

Figure 10. Change of passengers flows on bus network, resulting from introduction of new headways calculated in Regulatory Scenario (morning peak period)

It is perhaps surprising that in low demand corridors there is no reduction of passengers. This can be explained by the assumption that the maximum waiting time in generalized cost calculation, is 30 minutes. This means that passengers know the timetable of services with low frequency and go to the stop no more than 30 minutes before the departure. This is the reason why corridors where the headway is reduced and had a initial low frequencies, when the number of circulations by hour is reduced doesn't produces an increase in the waiting time or in the generalized cost.

Table 4 shows that the implementation of Regulation Scenario has a positive effect on the market share for bus. The aggregates values are difficult to interpret, since in some parts of the country there have been an increase in demand, and in others there have been a decrease. However, it's possible to say that on aggregate, the increase in bus demand comes from the rail alternative. The increase of car is explained by reduction on road congestion, as a result of better bus services on some O-D pairs. In these circumstances, the car alternative becomes more competitive than rail, explaining the increase in car demand.

Table 4. Modal Split: Base Scenario VS Regulatory Scenario (morning peak hour)

	CAR	RAIL	BUS
Base Scenario	78.5%	10.0%	11.5%
Regulation Scenario	80.4%	6.2%	13.4%
Difference	+1.9%	-3.8%	+1.9%

This analysis shows that there is potential to increase the number of bus passengers (although this includes a loss of services in some areas with lower demand) and this measure may have an indirect, but significant, impact on the competitive relationship between the car and rail modes.

4 Conclusions

This paper discussed the development of the Portuguese National Transport Model (PoNTraM) and illustrated its use as a decision support tool with two case studies. First it was shown how PoNTraM can be used to generate passenger forecasts for different planning alternatives for a new High Speed Rail between Lisbon and Porto. The results can be used to forecast revenues, support vehicle planning, or to analyse effects on competing modes (for instance reduction of congestion on highways).

The second case study illustrated how the model can be used to optimise the bus time tables, and show its secondary effects on the competing modes. The results show that an optimisation scenario can increase the market share of the bus, and even reduce the highway intensities on some parts of the road network. This can help in improving the revenue for bus companies, optimising their operational costs and as a side effect reducing congestion on the car network.

Currently, IMTT has initiated the 2nd development phase of PoNTraM, with the purpose to improve the current model. The purpose of this project is to update the supply data in the model (networks and services) and it will review the construction of demand matrices and the calibration of parameters, which implies also a new model calibration.

This new tool can be used to analyse territorial accessibility at the regional level of the existing transport system and allows an impact assessment of new transport infrastructure projects.

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