Sustainable development at the regional level: the case of the Porto Metropolitan Area

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1. Introduction

The main objective of this paper is to present the research methodology of a PhD thesis presently being started at Instituto Superior Técnico (IST), Technical University of Lisbon so that discussion on the topic can provide an incentive for better focusing of the proposed research. Hopefully, new ideas and knowledge will emerge out of the participation on this PhD Workshop.

The aim of the thesis is to develop a conceptual approach on sustainable development. The innovation lies in the attempt to tackle the issue at regional level. The topic is further developed in the next section.

The importance of the chosen research area is described in section 3. The quality of the urban environment is increasingly important to the global sustainability of the planet. At present, several international projects and reports address this issue, such as the Local Agenda 21 and Habitat, while in the European Union the Sustainable Cities and Towns Campaign has paved the way for an improved action. This has culminated in the release of a thematic strategy about the topic.

International literature has been devoting a strong attention to the problems of environmental sustainability at the urban level, mainly through the calculation of the ecological footprint, city metabolism and the development of indicators. Nevertheless, while the urban dimension has been the main focus of research, the regional dimension is still poorly understood and needs further research. This is so much relevant as this level is being pointed out as the most adequate to tackle sustainability issues.

The methodological approach being used in this thesis is presented in sections 4 and 5 of this paper. A selection of key-issues, indicators and parameters is listed. Advantages and disadvantages of their adoption as well as their current use at the regional level is discussed. The validity of using GIS and multi-criteria analysis in dealing quantitatively with the conceptual approach is introduced and explained.

Finally, in section 6, some conclusions regarding the theoretical framework and the proposed methodology being addressed at present are put forward. It is highlighted that the conceptual approach is still being worked out. Nevertheless, it can be regarded as a relevant tool to monitor development at the regional level.

2. Objectives of the PhD thesis

The PhD thesis aims at further developing the concept of sustainable development, applying it to the regional level. This is the level at which important economic and social developments are occurring. As Brenner (2003: 298) explains, “major political-economic actors throughout western Europe have embraced the assumption that

metropolitan regions, rather than localities or national economies, represent the natural economic zones in which economic development must be promoted". Thus, it seems correct to presume that a complementary focus on sustainable development, rather than economic development by its own, is necessary. Broadly speaking, the thesis pretends to enlighten the sustainability concept, avoiding the lack of accuracy that it is frequently accused through the use of a range of indicators and criteria capable of being quantified and applied in practice.

More specifically, the PhD thesis will:

- develop a theoretical approach of territorial planning at the regional level based on the concept of sustainable development. This approach is expected to promote the quality of life of citizens and at the same time reduce the consumption of resources such as soil, energy and water;
- define a pack of sustainability criteria and indicators relevant at the regional level and that may be used in practice;
- analyze sub-processes dealing with rehabilitation, urban regeneration and expansion, as well as ecological and transportation networks, linking them with the sustainable development of the city-region;
- test and validate the proposed theoretical approach in the Porto Metropolitan Area, in Portugal, which shall be used as a case study.

A series of complementary steps will be necessary in order to achieve a useful result. It is important, for instance, to understand clearly which are the sustainability issues at stake at the regional level (and not at the national or local level). This distinction is far from clear-cut, since they are often interrelated. Also, it will be crucial to establish priorities between those issues so that the leverage points can be identified and the greatest attention is paid to the most important ones. The thesis will probably concentrate deeper in these. The building blocks of a theoretical model must also be considered. For instance, Finco and Nijkamp (2001: 295) suggest three main factors that determine the success of sustainable development urban policies: institutional, behaviour of citizens and urban structure and morphology. Even sustainability is classified according to three angles: weak or strong; (de)coupling (or (de)linking); and local versus supra-local. Similarly, four typical sustainable urban development models were analysed by Haughton (1997): self-reliant cities; redesigning cities and their regions; externally dependent cities; and fair shares cities. Rotmans *et al.* (2000: 268) specify different functions derived from an integrated city planning instrument: organizational, policy, monitoring and evaluative. As can be seen, there coexist several different but complementary approaches to urban sustainability. They can be divided into five categories:

- a classification of the kind or degree of sustainability;
- a theoretical framework defining the main domains that sustainability encompasses, namely social, economical, environmental and territorial; the relevant issues to be considered in each of these domains; horizontal factors that affect the success of the model as a whole;
- policy formulation: principles, policies/objectives and targets;
- quantitative criteria: parameters and indicators;
- the geographic level being analysed.

There remain some uncertainties about the perspective of analysis. Ideally this thesis will privilege action and strategy to the detriment of a sustainability assessment, although this assessment will obviously play a fundamental role. Environmental and ecological economic scientists have been investigating these kind of tools, which are developing fast and becoming more accurate as a consequence. Studies about the metabolism of cities, ecological footprint and multi-criteria analysis are some examples.

Case studies from other European metropolitan areas such as Valencia in Spain or Milan in Italy are being considered as references for cross-comparative analysis.

In short, this thesis aims to establish bridges between land-use and transportation planning, but mainly the first topic, with environmental issues that although ideally united in the concept of sustainable development, applied research shows that it has not been the case.

3. Planning for sustainability at the regional level

The vision of Patrick Geddes, considered the "father" of regional planning, became partially true with Abercrombie's Plan for the Region of London (1944), but a number of factors, mostly related with political ideologies, interrupted the development of regional planning theory and practice in the United Kingdom. This assumption is not valid for a few other countries namely the Netherlands where spatial policies have since long incorporated the regional level, especially after World War II. The emergence of the new regionalism in the

nineties has brought and stimulated the debate about it, with regional governance structures being created again as a consequence. The region is considered today as the adequate level to foster efficiency, to protect the environment and to promote equity (Pastor, 2000: 8), surpassing the concept of "spaces of economic competitiveness".

Meanwhile, the theory of designing cities evolved: Howard's Garden City was radically hampered with the rising of the modern movement, although some similarities concerning the provision of generous public space remained. Jane Jacobs initiated a strong opposition against both theories, accusing them of neglecting fundamental social factors such as experiencing of streets by the people, usage of mass transit and the sense of security (Jacobs, 2000).

Sustainability considerations have traditionally been left out of the planning theory, and only marginally or by coincidence mentioned. Recently, however, it has responded to the environmental demands with the so called "new urbanism", which envisages the creation of truly city-regions structured around an environmental backbone of parks and ecological corridors, where suburbia would be revitalized and urban expansion strictly controlled. In the United States this theory has been put in place through "smart growth" initiatives, though urban densities never reach those Europe is used to. In any case, the need to counteract urban expansion and the urgency of better regional coordination, especially in the West Coast, is finally coming through politicians' minds. In "The Regional City", probably one of the most influential books about new urbanism, Peter Calthorpe and William Fulton (2001) propose a truly city-region comprised by four main unites:

- centres: the prime destiny of the neighbourhood, city or region;
- districts: areas with special vocations and dominated by a specific function;
- reserves: open spaces and green areas which shall be connected by corridors shaping a network;
- corridors: the elements linking natural areas and the transit infrastructures such as avenues and rail tracks.

Apart from the planning theory, a number of projects and documents were developed, most of them by countries and by international institutions. Table I summarizes some of the most important. A special focus has been given to the local level through Local Agenda 21 initiatives, which aim at translating sustainability principles endorsed in the Rio's Agenda 21 in municipalities. Although regional Agenda 21 are also known (in Spain, for instance, in Barcelona and Soria), municipal approaches are largely the majority.

Table I: Relevant documents and projects concerning urban sustainability.

Title	Category	Author, reference and year
European Urban Charter	Charter of principles	Council of Europe (in 1992)
Ålborg Charter	Charter of principles	International Council for Local Environmental Initiatives (in 1994)
Try this way	Action guidance	European Council of Town Planners, 2002
European sustainable cities	Action guidance and diagnosis	EC, 1998 (in 1996)
Guiding Principles for Sustainable Spatial Development of the European Continent	Action guidance and diagnosis	Council of Europe (in 2000)
Sustainable urban design: an environmental approach	Action guidance and diagnosis	Thomas, 2003
Urban Exchange Initiative II	Action guidance and diagnosis	Urban Exchange Initiative, 1999
Local Agenda 21	Ongoing project	International Council for Local Environmental Initiatives
Healthy Cities	Ongoing project	World Health Organization
ECOLUP - Guidance: environmental management for communal urban land use planning	Ongoing project	Lake Constance Foundation, 2004
European common indicators: towards a local sustainability profile	Ongoing project	Ambiente Italia, 2003
Urban audit	Ongoing project	http://www.urbanaudit.org

Note: a comprehensive list is given by EEA (2002:18-21).

The PhD thesis shall embrace the important contributions described, establishing the important link between the theory of urban planning and the concept of sustainable development.

3.1. Key-issues, indicators and parameters

Sustainability must involve practical criteria and indicators that can, in a scientific and objective manner, assess the compliance with the formulated principles. This is a major but possible task. Quantitative approaches have been gaining acceptance, such as calculations of city metabolism (Rotmans *et al*., 2000; Newman, 1999) and of ecological footprints (Holden, 2004; Folke *et al*., 1994). Ravetz (2000) presents a tool which accesses the sustainability of a region, city or plan. These methods shall be complemented with indicators (see, for instance, the compilation of Alberti (1996).

As a first attempt to tackle key-issues, a selection of these is presented in Table II with the key elements dealing with urban sustainability having as a basis the topics chosen by the Thematic Strategy on the Urban Environment of the European Commission (see also Quental *et al.*, 2004).

Table II: Fundamental elements of urban sustainability to be promoted.

Theme	Key-elements of urban sustainability
Sustainable urban conception	
Urban structure and land use	• Polycentrism of urban centres • Higher urban densities near public transit corridors and area with high public transit accessibility • Strict control of urban expansion • Conditioning the percentage of artificial surfaces and urbanized areas • Mix of uses • Urban rehabilitation and regeneration • Block size, implantation of buildings and street orientation • Location of commercial centres, services, health and educational equipments, etc. • Heritage protection • Protection of landscapes and scenic views
Green spaces	• Primary and secondary green structures • Green corridors • Natural, agriculture and forest areas • Grooves and tree planting • Protection of floodable surfaces
Sustainable urban transportation	
Mobility	• Intermodality • Frequency and speed of public transit • Bus lanes, and rail, light-rail and tram networks • Bicycle lanes, pedestrian streets and large sidewalks • Parking and localization of “park and ride” • Traffic calming measures
Air	• Air quality • Emission reduction • Restrictions to the circulation of cars • Environment friendly transportation
Sustainable construction	

Theme	Key-elements of urban sustainability
Ecological construction	• Systems that promote the collection, recycling, screening and treatment of water • Composting toilets • Insulation and passive solar systems • Heating technology • Thermal and acoustic comfort • Ventilation and air renovation • Renewable energies • Environmental friendly materials • Waste screening • Simpler transformation of uses in buildings • Permeability of the pavements
Energy	• (see "ecological construction" and "mobility")

Sustainable urban management	
Water	• Sewage and pluvial water networks • Wastewater treatment • Water quality of rivers • River bank protection
Waste	• Selective collection of waste and recycling • *In situ* composting
Noise	• Noise reduction
Public participation and transparency	• Public participation mechanisms • Access to information and its disclosure • Transparency in the decision making process

A set of indicators and of parameters ought to be defined comprising all of the key-issues. The European Environmental Agency has just released a technical report explaining their core set of 30 indicators, which is based on the DPSIR model (EEA, 2005). The idea behind establishing parameters is an attempt to materialize sustainable urban development and assure that planning embodies its principles through the fulfilment of specific conditions. Possible examples are conditioning minimum urban densities according to transit accessibility, the imposition of a maximum allowable provision of car parking and the creation of public spaces. These efforts are not new: several documents and even plans already mention them, but a more systematic way of addressing this issue is necessary. Refer to GLA (2004a:177), English Partnerships (2000:74), Thomas (2003:22 and 38), Lake Constance Foundation (2004:38), Costa Lobo *et al.* (1995:246 and 247), Magalhães (1992:24), Pardal *et al.* (1998:58) and Carvalho (2003:226) for specific examples.

The assumption is that although planning is case dependent, there are basic rules that should be followed in all cases in order to be sustainable. If a comparison is possible, the same is to say that although each country has its own values and culture, the Universal Declaration of Human Rights represents an ethical minimum not questionable.

3.2. GIS and multi-criteria analysis

The impact of urban plans on sustainable development is seldom analysed, and even when it happens it usually is restricted to specific issues such as economic or demographic changes. New tools can be used as a way of improving this process. The so called "multicriteria" or "multi-assessment" methods pretend, in Finco and Nijkamp words, "investigate simultaneously the impacts of policy strategies in a multitude of relevant criteria, partly monetary, partly non-monetary (…). Such methods offer a great potential for the development of a balanced multidimensional policy for a sustainable city" (Finco and Nijkamp, 2001: 296). The model they propose consist of a triangular framework that includes: (a) strong versus weak (un)sustainable development; (b) local versus supra-local sustainability; and (c) absolute versus relative (de)coupling or (de)linking. The PhD thesis shall incorporate a theoretical approach based on multicriteria analysis.

The SPARTACUS project, whose goal was to develop and pilot the use of a comprehensive analytical framework for building and evaluating long term strategies for sustainable urban development, employed modelling tools based on data from three urban areas: Helsinki Metropolitan Area, Bilbao and Naples. By the

end of the study, in 1998, some conclusions could be drawn. It was found that pricing policies were the best to reduce car dependence and that some strategies with this objective had, in fact, the opposite effect (though it is not clear if there is a direct cause-effect relationship). When car operating costs were increased by 50% the total private car mileage was reduced by 16% in Helsinki and Naples, while regulation policy (car speeds lowered on main roads) only reduced it by 4%. The use of combined policies yielded the best results: 21%, with simultaneous positive effects on emissions, noise, accidents, total travel times and modal split (Lautso, 1998).

GIS technologies are also being increasingly incorporated in the development and monitoring of territorial plans, since they offer an extraordinary capability of visualizing, querying and calculating spatial data, though the core information base is always crucial and the most difficult to obtain. In Germany, an ArcInfo database of land-use patterns to model the physical compactness of 116 regional cities was created (Thinh *et al.*, 2002). There are an enormous amount of examples, since nowadays most municipalities already rely on some kind of spatial database, even if many of them still lack the mastering of full GIS power.

4. Conclusions

Embodying sustainability in urban planning is making important advances and has been object of much research work. A number of tools are being improved so that they can better measure the degree of sustainability and predict future trends or implications to the territory. This quantitative approach, however, cannot cope with the complexity of the decision-making process. Therefore engineering tools need to be complemented by robust theoretical approaches capable of adapting to the reality and helping society to improve its sustainability. The PhD thesis may become a helpful insight to this end.

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Abstract

The quality of the urban environment is increasingly important to the global sustainability of the planet. At present, several international projects and reports address this issue, such as the Local Agenda 21 and Habitat, while in the European Union the Sustainable Cities and Towns Campaign has paved the way for an improved action. This has culminated in the release of a thematic strategy about the topic.

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The PhD presently being carried on aims at:

- developing a theoretical framework of territorial planning at the regional level based on the concept of sustainable development. This approach is expected to promote the quality of life of citizens and at the same time reduce the consumption of resources such as soil, energy and water;
- defining a pack of sustainability criteria and indicators relevant at the regional level and that may be used in practice;
- analyzing sub-processes dealing with rehabilitation, urban regeneration and expansion, as well as ecological and transportation networks;
- testing and validating the proposed theoretical approach on the Porto Metropolitan Area in Portugal, which shall be used as a case study.

Case studies from other European metropolitan areas such as Valencia in Spain or Milan in Italy are being considered as references for cross-comparative analysis.