Urban shape indicators in the Great Metropolitan Area of Porto – *clusters* analysis

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In the last decades, the rhythm of the number of people preferring to live in urbanized spaces has risen what means that actually more than 3,3 billion people – 51% of the total world population – try to accommodate in just 2,7% of the Planets' total area. Therefore, this *modus vivendi* growth rate, mainly in countries in development, continues to be very high (TÜV Rheinland Consulting GmbH 2009).

The extraordinary increase of the population density, economical activities and expectations in a confined space, puts decision makers a diversity of new problems associated to the both adequacy of the housing offer as well as of infrastructures, education, health, culture, accessibilities and environmental quality. The resolution of these problems undergoes through the precision with which will be possible to identify the fragilities, the potentialities and the available resources, in order to be able to conciliate them in the urban territory's planning in a balanced way. Therefore several exercises have arisen with the central objective of searching to evaluate effectively the urban form' characteristics while an opportunity to identify the status of urban development (Alberti 1999; Dunn et al. 1991; Wu et al. 2000, 2010). Consequently, it would be easier to distinguish the areas with high necessity for intervention from the less poor areas and, at the same time, point out the strategic axis for intervention (Schwarz 2010). The diagnosis goes through the discrimination in the territory

of compact or disperse areas, of higher or lower soil occupation, of more or less offer of goods and services, etc. This is due to the way that urban form is seen as the result of the interactions between the biogeophysic support (water lines, altimetric differentiation, soils, flora, fauna, etc) and as the result of the interventions with anthropic origin (built environment, streets, infra-structures, equipments, etc.), to which the flows of people, goods and services are overlapped. In other words, the urban form is the synthesis unique of the place and the geographical position with the society's history that is hosted there (Kevin 1981).

The urban form does also strongly reflect the relationship of the urban soil with its surrounding (Grimm 2008), which by itself illustrates, once more, its importance as a

sustainability indicator. Thereof its indispensability in the definition of any territory ordainment politics (Alberti 1999; Dunn et al. 1991; Wu et al., 2000, 2010).

Knowing the natural, socioeconomic, cultural and intrinsic historical diversity in the Great Metropolitan Area of Porto (GAMP), we propose, in this contribute, to appreciate the effectiveness of one of the numerous existing methodological procedures to define the urban form – the indicators of the landscape metrics and/or socioeconomic indicators (Herold et al. 2002; Huang et al. 2007; Hunsaker et al. 1994; Kasanko et al. 2007; Ritters et al. 1995; Seto and Fragkias 2005;Tratalos et al. 2007; Weng et al. 2007; Wu et al. 2000, 2010).

This challenge occurs in the sequence of other theoretic-methodological approaches which have been performed and that look forward to characterize the social and environmental (in)justices in GAMP, where in about 2% of the national territory reside 15,2% of the Portuguese population (Monteiro et al. 2011).

Between the possible indicators we focused our attention in a restricted group which could enable to distinguish, in GAMP, the existent differences in what concerns to the form, the extension, the complexity and the compactness of the urban areas of each one of the 16 counties.

For this, we applied, in a first phase, the methodology of Schwarz (2010), which is based in a multivariate statistical analysis (multivariable correlations, components analysis, *clusters* analysis and variance analysis) in order to choose the urban form's indicators main nucleus - landscape metrics and socioeconomic indicators.

In GMAP, the minimum group of urban shape indicators is constituted by seven indicators TB (*total number of building*) pop (*resident population number*), CILF (*compactness index of the largest urban fragment*) and NF (*number urban area fragments*), AT (*total area of the municipally*), FASD (*urban fragments area standard deviation of urban area*) and *diss* (*dissimilarity index in population distribution*).

From the clusters analysis applied to GAMP five counties emerge.

After defining the indicators and the groups of similar counties, we went to the evaluation of the methodology's effectiveness used to define, know and represent the dynamics and standards of soil occupation in GAMP.

The validation of these indicators can allow, if they prove to be effective, to regroup the GMAP counties according to its development status and its differentiated resilience, which from the optimization of the territory's ordainment point of view is absolutely essential.

Keywords: urban form, socioeconomic indicators, landscape metrics, *clusters* analysis, GAMP.

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