

Urban metabolism and the form of cities

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Research on the form of cities and on urban metabolism has been mainly developed back-to-back. On the one hand, the field of urban morphology has been focusing on the physical stocks – and on the processes and actors shaping them – somehow ignoring the urban flows. On the other hand, research on urban metabolism has not been able to deal with the spatial dimension of cities and with low scales of analysis – such as the parish, the neighborhood, and the urban block. This is mainly due to the scarcity of data, but also, to the absence of specific techniques to deal with the available data.

The research project Sustainable Urban Metabolism for Europe (SUME) is founded by the 7th Framework Programme and gathers ten research centres in Europe and Asia. One of its fundamental goals is to link these two fields of knowledge, contributing as such to the creation of more sustainable cities. One key product of SUME is the Metabolic Impact Assessment (MIA) methodology, developed at CITTA, and already applied in four European cities: Porto, Vienna, Newcastle and Stockholm. MIA intends to be an operational instrument for the physical planning of a city (or city-region), allowing the evaluation of the impact of a project or plan to the metabolic performance of that city. This methodology considers four metabolic components: energy (in the sub-components of transports and buildings), land use, water and materials.

The Metabolic Impact Assessment is framed by six generic principles: it evaluates the urban development process, from a metabolic perspective; it focuses on plans and projects as fundamental drivers of the urban development process; it assesses the wide metabolic impact in the city of the proposals included in plans and projects; it explores the spatial dimension of alternative development processes, focusing on particular plans and projects; it may address different temporal scales but is better suited to short-term assessments; and finally, it deals with the environment in an integrated way.

The procedure of this methodology is structured in six sequential stages: the definition of the scope, and the establishment of the study area (the urban system), and of the intervention area (an area that is large enough to enable the analysis of the direct interaction between the planning proposal and the wider study area); the metabolic characterization of the study area; the metabolic description of the planning proposal; the identification and characterization of its impacts; the

assessment of the proposal and of alternative scenarios; and finally, the potentiating of the metabolic efficiency.

Due to the nature of the conference, this paper focuses on the application of the methodology to the city of Oporto, and to the particular case of the *Plano de Pormenor das Antas* (PPA), assessing the components of energy and land use.

The application of the Metabolic Impact Assessment to the PPA, and to the city of Oporto, provided some promising results: a 'spatial dimension' was successfully introduced into an urban metabolism model, an aspect that is crucial to planning, and is seldom seen in urban metabolism literature; the impact of PPA on the metabolic performance of a city was defined, identifying the key metabolic issues and the characteristics of the plan and of the city that are critical to the overall impact; and finally, some alternative planning solutions were generated, to better fit the specific characteristics of the city metabolism.

Keywords: Urban form, urban metabolism, physical planning, energy, land use.