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PhD Thesis

Agent-based model and Geographic Information System (GIS): an integrated approach to test sustainable policies and urban transformation scenarios

By

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Abstract

When dealing with the city and the processes that characterize it, we face an extremely complex system, in which multi-dimensional aspects, multi-scalar, and multi-temporal perspectives are strongly relevant. Within this context, the increasing awareness of the fundamental role of sustainability issues and the necessity of long-term perspectives in urban transformation and planning urgently require the identification and evaluation of the environmental, economic, and social impacts of alternative policies and strategies.

The research aims to support decision-making processes for the development of sustainable policies and long-term strategies in urban contexts by proposing an integrated evaluation approach, strongly focused on individuals, stakeholders, and their decision-making processes. In this perspective, sustainability development is proposed as an inherently anthropocentric view around the success or failure of strategies, policies, and urban transformations in a long-term sustainable view. The analysis of alternative policies and urban transformation scenarios is conducted in a holistic way through the application of an integrated approach, able to consider the complexity of urban phenomena, their performances, and consequences over time in a real-world context, starting from the analysis of the system from a bottom-up approach. This implies that the evaluation is grounded in people (i.e., individuals and/or stakeholders), their behaviours, and interactions, capturing and analysing emergent phenomena over time.

The final objective is to identify the key drivers and key effects that guide these processes and connect them to the specificities of a place and its population.

To achieve the goal, the research integrates an agent-based model (ABM) with the potential of GIS, to combine the attitudes and behaviours of the stakeholders in a temporal and dynamic perspective with the consideration of the spatial dimension of the urban complex problems. Also, Multicriteria Analysis (Analytic Hierarchic Process and Best-worst Method), the Choice Experiment method, the Hedonic Price Model, and specific surveys are implemented to include in the model more intangible data related to the social attitudes of the population, their decision rules, and the level of importance of the aspects considered.