

Modeling Response to Urban Planning (MRUP): From GIS and ABM to Planning Support System

Abstract. PSS (Planning Support System) is a tool used to assist decision-making in urban planning¹. Because the decisions involved are closely related to geospatial, there has been significant research on integrating GIS (Geographic Information System) into PSS². However, in most cases, GIS analysis is descriptive and can only describe the environment. Actual policy formulation still needs to be considered by planners, making policy formulation rely on the cognition of individual responsible planners^{3,4}. This cannot achieve the original intention of PSS to change the traditional top-down black box model of urban planning⁵.

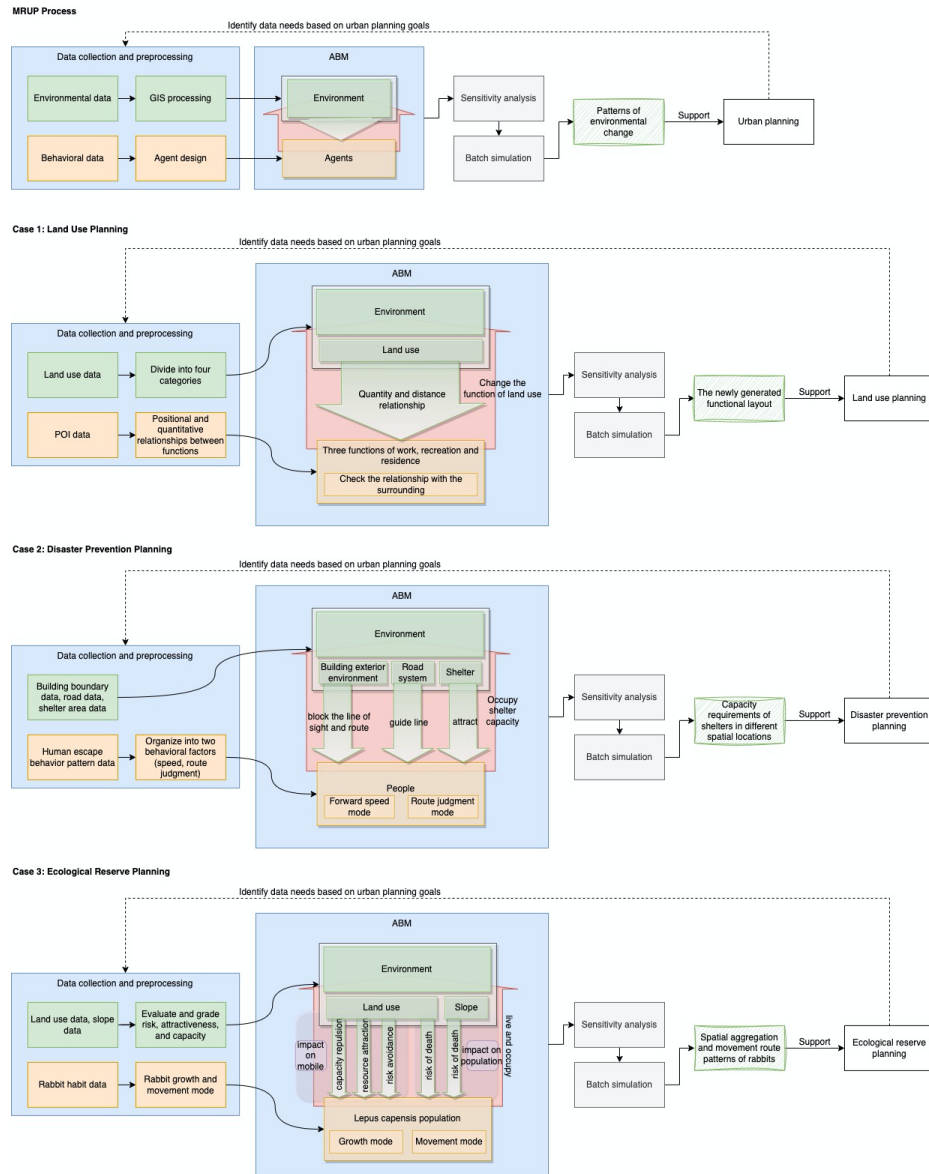
In this regard, ABM (Agent-Based Modeling) can give an effective complement. The dynamic nature of ABM fits well with the process-oriented dimension in the PSS science, and its characteristics are in line with the urban complex system that urban planning faces⁶. ABM can provide planners with possible scenario simulations with interpretability. Thus, planners can better grasp the characteristics of the environment and directly correspond to spatial locations, providing a more effective basis for urban planning decisions.

Currently, with the development of PSS and ABM, their intersection is increasing. Therefore, we recommend formally proposing a conceptual framework, Modeling Response to Urban Planning (MRUP), to integrate ABM into PSS science and improve its knowledge system. The MRUP framework specifically describes agent-based modeling geared towards urban planning decisions. This modeling process uses ABM to simulate the interaction between the environment and elements with spatial characteristics, and discovers the possible dynamics of environmental development to obtain the most adaptive strategy.

The MRUP process focuses on the external representation mode of the model, particularly the spatial distribution mode of given elements, to directly support the formulation of urban planning. In a specific urban planning target scenario, a targeted PSS is generated through the corresponding MRUP process. This article discusses the methodological relationship between PSS and ABM, introduces the concept of MRUP, and presents three practical cases based on this concept, involving land use planning, disaster prevention planning, and ecological reserve planning. These works combine GIS technology traditionally relied on by PSS with ABM to assist the formulation of urban planning policies. In this process, the modeler has become a bridge connecting researchers and planners to a certain extent, and ABM has become a powerful extension of PSS theory.

Keywords: PSS, ABM, Urban Planning, GIS.

Pictorial Abstract



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