Towards a Risk-Oriented Conceptual Model of Urban Environments

In the World Cities Report 2022, the UN states that the world will continue to urbanize over the next three decades - from 56% of the world's population in 2021 to 68% in 2050. Unsurprisingly, urban areas are emerging as risk hotspots, given the human, social, economic, and technological capital they represent. The range of impacts of natural, environmental, and anthropogenic risks on cities is broad. They include direct, physical damage to building structures and indirect effects on services and the socio-economic fabric. Cities and metropolitan areas can be considered adaptive complex systems, characterized by complex interactions between their inhabitants and the surrounding infrastructure. This explains the increasingly common comparison with living organisms. There are different approaches to modeling complex systems and different interpretations of what a model should be. Here, a model is defined as one of several possible representations of a particular part of the real world, determined by the model's scope. It can be observed that as the complexity of the domain increases, the comprehension and sharing of information may become more challenging. To solve these challenges, some models - called ontological models - use semantic modeling languages capable of capturing the shared semantics of a portion of the world to be represented to guarantee better comprehension and provide the sharing of distributed heterogeneous information. In this line, this paper proposes a risk-oriented ontological model of urban environments. For this, a method with six iterative steps was applied to build the proposed ontological models.: 1) requirements elicitation; 2) vocabulary building; 3) storyline design; 4) model design; 5) model validation; and 6) model review and release. The result is a preliminary ontological model (in OntoUML and OWL languages) to capture the semantics of the most relevant impacts and enable the assessment of associated risks consistently and sustainably, as well as a controlled vocabulary and a set of axioms.