Chapter 1
Urban Planning and Design Simulation to Develop Sustainable and Resilient Cities

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ABSTRACT

The demand for well-planned, sustainable, and resilient city infrastructure cannot be timelier, for the urban share of Globe's population continues to rise. Cities are complex systems with intricate dynamics, necessitating a thorough understanding of how different elements such as sewerage systems, culture centres, transport systems, energy consumption, and sewage management affect the success of an urban centre. Simulation tools offer a drawing board kind of set-up to urban planners where they experiment and compare various scenarios to select the best. The design of sustainable urban infrastructure and its resilience have also been discussed here. Urban planners may use simulation tools to model and evaluate various possible vulnerabilities and corresponding response options. Further, the chapter discusses technologies such as spatial databases, AI and machine learning models, and building information modeling in urban simulation environments, and also an international case study of urban growth simulation in Portland, Oregon, USA.

INTRODUCTION

The importance of urban planning and design in determining the future of cities has never been greater as the globe continues to experience unprecedented urbanisation (UN-Habitat, 2016). Given that urban regions are home to more than half of the world's population (United Nations, 2018), it is critical to embrace cutting-edge tactics that can result in the growth of resilient and sustainable cities. The crucial role that urban planning and design simulations play in accomplishing these goals while addressing the particular difficulties that urban regions face in the twenty-first century is explored in this chapter.

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Sustainable and Resilient Cities

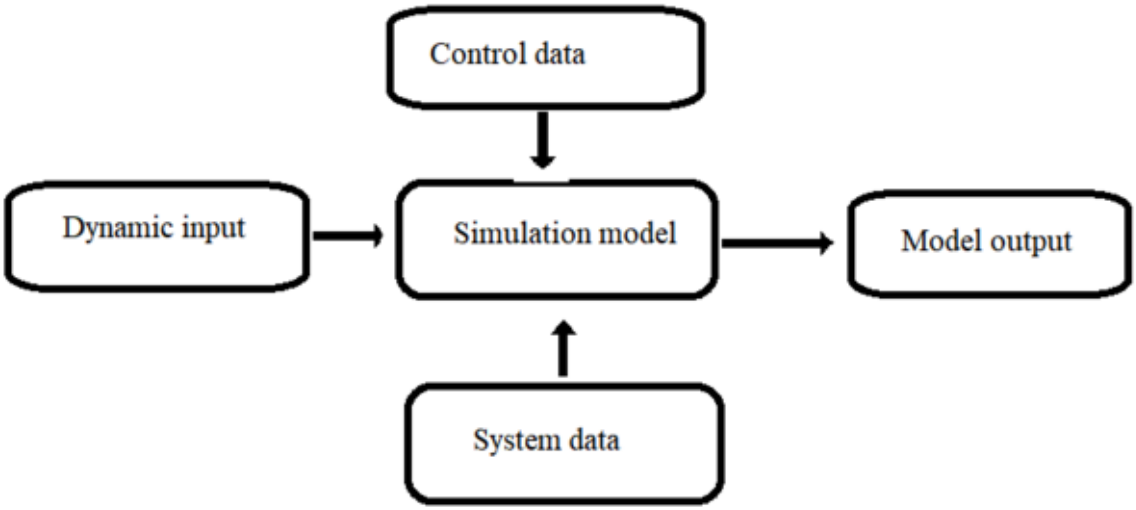
Urbanisation presents opportunities as well as difficulties. Cities serve as centres for innovation, economic development, and cross-cultural interaction. On the other side, rapid urban growth puts a burden on resources, exacerbates environmental problems, and exposes people to a range of dangers, such as socioeconomic inequality and climate change-related catastrophes (Seto et al., 2014; Angel et al., 2011). Cities need to work towards sustainability and resilience to navigate this complicated urban environment.

According to Alberti et al. (2003), sustainability in this context refers to the prudent use of resources, diminished environmental effect, and enhanced quality of life for locals. It includes factors like social fairness, energy conservation, environmentally friendly transportation, and efficient land usage (Echenique et al., 2012). The capacity of a city to endure, adapt to, and recover from shocks and pressures while sustaining key functions is referred to as resilience (Grimm et al., 2008; Berke et al., 2015). To achieve sustainability and resilience, one must take meticulous preparation and foresight.

The Role of Simulation in Urban Planning and Design

The dynamic and interrelated structure of contemporary urban systems may be difficult to handle using traditional urban planning methods, which frequently rely on static models and historical data (Batty, 2013). More adaptable and data-driven methods are also required due to the uncertainties surrounding future trends, particularly the effects of climate change and population expansion (Batty et al., 2012). Simulations of urban planning and design are useful in this situation. Fig. 1 depicts the general modeling and simulation process in abstract form.

Figure 1. A general simulation model



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