Chapter 5
The Role of AI in Urban Design and Planning in Responding to Extreme Flooding Events in Trinidad and Tobago

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ABSTRACT

Caribbean islands are some of the most vulnerable countries in the world to experience extreme flooding resulting from tropical cyclones, storm surges, and excessive rainfall. Persistent changes in the global climate have made countries like Trinidad and Tobago hot spots of climate change. As a result, the occurrence of extreme flooding events is likely to persist and is made worse by the barriers to adaptation and mitigation, such as having limited knowledge of climate change and how to plan for its impact at the individual level, as well as limited financial resources and technical know-how. Using a secondary research methodology, this chapter seeks to investigate the role that artificial intelligence (AI) plays in urban planning and design in responding to extreme flooding events in Trinidad and Tobago. This chapter discusses not only the historical occurrence of flooding events, and its causes, but also how the possible use and integration of AI in the planning and design of urban spaces in Trinidad and Tobago can assist in reducing the ill effects of such events.

INTRODUCTION

Climate Change is one of the most problematic issues facing the world today. In the face of extreme climate-related changes such as the growing intensity of extreme temperatures and metrological events, rising sea levels, and oceanic acidification, it is usually the poorer segments of populations within Small Island Developing States (SIDS) and Developing countries that Greenhouse Gases to suffer the most from the actions of more wealthy countries who are major emitters of Greenhouse Gases (GHG). Most of these emissions (60%) are produced by 10 countries, i.e., China, the United States (US), the

DOI: 10.4018/979-8-3693-1650-4.ch005

European Union (EU), India, Indonesia, Russia, Brazil, Japan, Iran, Canada, Japan, and Saudi Arabia (Climate Watch, 2022).

As these large fossil fuel-burning countries continue to grow their economies at the expense of smaller nations, it is, unfortunately, the poorer countries and regions around the world such as Bangladesh, Sub-Saharan Africa, Central America as well as the Caribbean, who will experience the grimmest of consequences through the frequent passage of tropical cyclones, heavier rainfall, intense flooding, greater incidence of water-borne diseases, droughts and poor harvests (Conner & Krogstad, 2018). As the climate crisis intensifies around the world, the most vulnerable in our society are the ones who will feel its disastrous aftereffects. This is indeed the case as the Caribbean region is expected to see its vulnerable population becoming increasingly displaced by natural disasters such as extreme flooding.

Considering such dislocation, diversity, equity, and inclusion have also been drivers behind the unequal implementation of mitigation and adaptation strategies for climate change. While some of the very same GHG-emitting countries, may be wealthy enough to fund the implementation of mitigation and adaptation strategies to reduce their GHG emissions, other countries like Trinidad and Tobago may not be able to do the same due to a lack of technical expertise, and financial resources, to build and strengthen the adaptive capacity needed to address climate change problems (Lemos et al., 2013). Notwithstanding this, the intensification of climate change events, like extreme flooding has a significant impact on the livelihoods of the most vulnerable communities in Trinidad and Tobago.

An examination of the climate change literature for Latin America and the Caribbean, reveals that while there is a wide range of studies which (1) examines climate change in coastal areas, and the impacts of floods occurring from extreme rainfall and snowmelt for Latin American Countries like Costa Rica, Ecuador, Chile and Argentina, and (2) studies that examine flood control mechanisms, flood insurance and management/analysis systems, flood risk mapping, and the impact of freshwater flooding on mangroves, there is a dearth of knowledge that examines the role of Artificial Intelligence (AI) in Urban Design and Planning in responding to extreme flooding events in Trinidad and Tobago.

Owing to this lack of knowledge, this chapter will aim to examine the role that AI plays in Urban Planning and Design in responding to flooding events in Trinidad and Tobago. To do this, using a conceptual research methodology, this study has several objectives, first to examine the historical flooding events in Trinidad and Tobago, second the primary causes of such flooding events, third explore the level of vulnerability to such natural hazards, fourth discuss the importance of urban design and planning in preventing urban flooding, fifth to examine the role that AI plays in urban design and planning in avoiding such events, and sixth to discuss the challenges that small island developing states like Trinidad and Tobago may encounter in integrating AI in its urban planning and design model, after which the study is concluded.

RESEARCH METHODOLOGY

This chapter takes a conceptual approach to investigating the role that AI plays in the Planning and Design of Urban areas in Trinidad and Tobago, as a response to extreme flooding events. This methodology was suitable for this chapter because it explores the existing literature on AI about Urban Planning and Design to develop a conceptual framework to understand better how AI-based strategies can be used to address severe flooding events in the Twin Island State. Further to this, given financial and time constraints, this approach was appropriate because it required fewer resources while allowing for