

GIS for Sustainable Urban Transformation in Countries With Emerging Economies: The Case of Piura in Peru

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ABSTRACT

In South America, the urban population has been growing rapidly over the last century, with a share of more than 80% expected by 2020. This trend has created new challenges for city planning because municipalities must address issues caused by horizontal urban expansion and the informal occupation of peripheral areas. Frequently, the latter are not designed or equipped for the basic needs of new inhabitants. This research is based on the work of MGI, an initiative for smart, sustainable development in Piura, an intermediate city with one of the highest rates of urban sprawl in Peru. This initiative promotes climate change adaptation and mitigation based on urban analysis embodied in a sustainability profile and an action-oriented roadmap with concrete, feasible, and replicable measures and projects. One such measure is a spatial analysis, prioritising small illegal dumpsites for recovery and converting these areas into a public space using digital planning tools. This study analyses the development of the intervention to be implemented against the city's opportunities and challenges.

KEYWORDS

Digital Planning, Emerging Economies, GIS, Sustainable Urban Planning Strategies

INTRODUCTION

Climate change, natural disasters, pandemics such as COVID-19 and social inequality present global challenges. Thus, people must consider how future cities and communities will look. Currently, the most urgent concerns for citizens include those related to living, environment, mobility, health and security. Cities represent economic progress, job opportunities, social action, innovation and technological development, providing more than 80% of the global GDP (Worldbank, 2020). In 2018, 55% of the world's population lived in cities, a percentage predicted to be 68% by 2050. Population growth in emerging economies has accelerated considerably, from 2 billion people in 2000 to a projected 5.5 billion by 2050, representing 95% of the world's urban population (UN, 2018b). With increasing wealth and economic opportunities, cities are expected to continue expanding, following a car-dependent expansion trend apparent in developed countries.

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The New Urban Agenda launched by the UN in 2017 states that cities must strengthen sustainable resource governance to facilitate the ecosystem's preservation, recovery, remediation and resilience against all new and emerging challenges associated with climate change and urban sprawl (UN, 2017). However, to reinforce such efforts, researchers must examine the urban ecosystem's social, economic, environmental and technological dynamics and its performance (D'Amico et al., 2022).

Strategic urban planning can prepare cities for future events, such as climate change, that affect urban infrastructure and urban life. A proper urban planning strategy supports both economic growth and sustainability by making cities more attractive for potential investors and citizens, ensuring high living standards (Carter et al., 2015).

Low-cost, high-impact, smart digital solutions are progressively being deployed in the Global South to tackle urban development challenges (Nagendra et al., 2018). However, despite these solutions' potential, many smart city projects have primarily focused on providing smart applications rather than data-driven city planning and management (Bibri, 2020). Consequently, the rollout of smart cities has revealed other challenges, namely a lack of competences and training opportunities for city professionals, a lack of digital skills among citizens, insufficient resources and inadequate city planning (OECD, 2019). Thus, to build smarter cities in emerging economies, cities must strengthen local government databases and exploit digital infrastructure within existing urban systems (Worldbank, 2021).

To accomplish this work, city planners need technical knowledge and tools facilitating swift, precise action in both the design and evaluation of urban plans. Along with technological advances in computing, many tools have been introduced to help planners, ranging from geo-referenced information systems (GIS) to complex urban system simulation models (Derix, 2012). Digital tools optimise and support the analysis and action of public policies to reach the sectors that need these services most, while creating capacities for urban project modelling and visualisation within the local administration (Kaluarachchi, 2022). Urban data can support cities and municipalities in decision-making; improving internal and external processes; and, most importantly, responding more efficiently to citizens' needs (GIZ, 2022). Introducing a system such as GIS should bring economic benefits, particularly for local authorities, through savings, reducing administrative costs, increasing efficiency, or improving effectiveness in management and operation (Obermeyer et al., 2016).

In 2020, Peru's Secretary of Digital Government of the Presidency of the Council of Ministers published the National Digital Transformation Policy to accelerate digital transformation at the national level and outline a digital agenda for the country. This document builds on the exponential growth of digital competences that emerged in public management and society from 2020 onwards due to the pandemic. Peru's government wishes to establish an active ecosystem, allowing public and private efforts to collectively facilitate digital inclusion and closing digital gaps at the national level. To this end, the country launched the Geo Peru Digital Platform, comprising more than 500 official publicly accessible digital maps, highlighting both progress and gaps in areas such as infrastructure, poverty, basic needs, education and security. This platform should strengthen local action strategies and support data-driven decision-making for the benefit of citizens (PCM, 2020). Peru's government has committed to promoting a digital transformation toward social equity, promoting a National Smart Cities Strategy to create sustainable, reliable cities. These efforts include offering technological solutions to facilitate digital governance and connecting decision-making with available data, accomplishing the country's Sustainable Development Goals (SDGs) set by the UN.

This research is based on the work of the Morgenstadt Global Smart Cities Initiative (MGI) in Piura, an intermediate city with one of the highest rates of urban sprawl in Peru. The MGI is funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) through the International Climate Initiative (IKI). This project supports innovative urban development in the cities Kochi (India), Saltillo (Mexico) and Piura (Peru), concentrating on climate change adaptation and mitigation measures and fostering environmental awareness in the cities while contributing to the SDGs. Additionally, MGI bases its work on the Fraunhofer Morgenstadt City Lab methodology. This approach has been applied in numerous cities worldwide, including Prague

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