

PERSPECTIVES ON ENVIRONMENTAL SUSTAINABILITY AND LAND USE DYNAMICS IN PERI-URBAN INTERFACE OF GLOBAL SOUTH

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Abstract

Peri-urban transition drives rapid spatial manifestations and environmental changes at the urban periphery on a global scale. The heterogeneous peripheral morphologies of the Global South depict land use changes, rapid real estate growth, and unplanned development. Peri-urban regions face the challenges of dynamic metropolitan growth and the pressures of globalization. Peri-urban areas differ globally; they differ in economic and social factors. The rural-urban frontier is a complex transition area in the Global South. Peri-urbanisation leads to population expansion, but often, these pressures compromise environmental qualities in the Global South. However, this transition process can be harnessed with the right strategies for positive change. Land use change is a major challenge to sustainability, leading to a decline in agriculture and environmental challenges. This paper addresses sustainable urbanisation as an alternative path for confronting these challenges and fostering sustainability in the Global South.

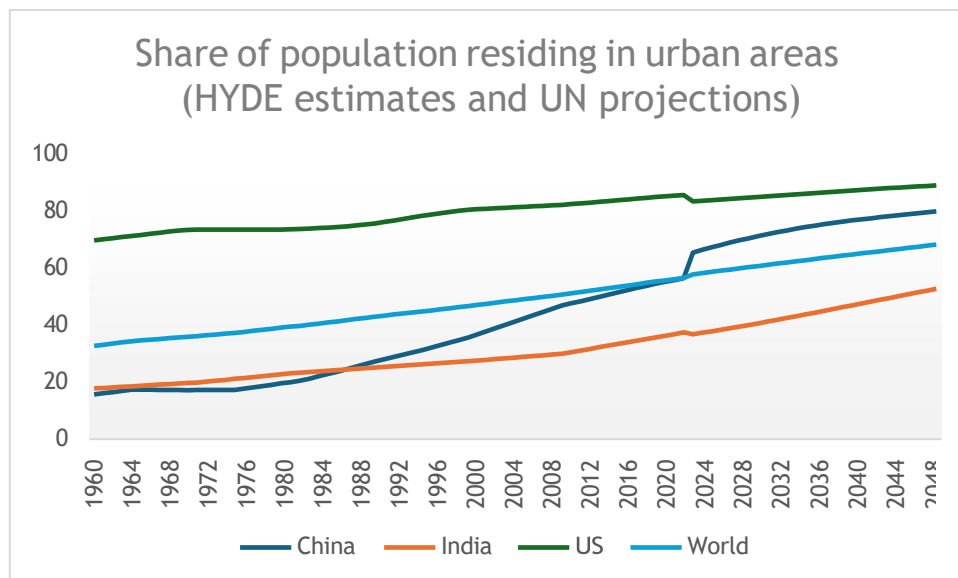
Keywords: Urbanization, Peri-urban, Land Use Changes, Environment, Sustainability, Global South

Introduction

Unprecedented urbanisation leads to innumerable changes in the peri-urban environment across the globe. Urban sprawl, a remarkable characteristic of global urban development (Varkey, 2023; Hutchings et al., 2022; Hatab et al., 2019; Muñoz, 2003), results in the dynamic nature of peri-urban zones, where present peri-urban could become urban landscape tomorrow, leading to serious threats to policymakers and planners in managing these sprawling spaces (Mauro, 2020; Li et al., 2017). The urban population has been advancing more rapidly than the rural populace in the peripheries of developing countries (Beltran, 2023; Cohen, 2004; Salem & Tsurusaki, 2024). From just one in 1950 (New York), the count of megacities with more than 10 million people increased to 17 by 2000, with the majority in developing countries (UNDP, 2000). In pursuing policy and debate, this paper raises two important questions. What are the consequences of land use changes and sustainability challenges in peri-urban areas in the Global South? How do the new planning and policies cope with the changing urbanisation scenario?

Urbanisation is steadily rising globally, surpassing the 50% mark during 2008-2010. As of 2024, 57.9 % of the world's population resides in urban areas. In India, 36.867 % of the population is urban, while in high-income countries, the urban population is 82.63%. The USA leads the global urbanisation trend, with 83.51 % of its population living in urban areas. India's urbanisation is rapid, with the urban population growing by 31.27 % by 2010 (Figure 1), and is projected to exceed 40 % in the near future. Developed countries like the US maintain a steady urban growth rate, in contrast to the rapid urbanisation in Asian countries like China and India.

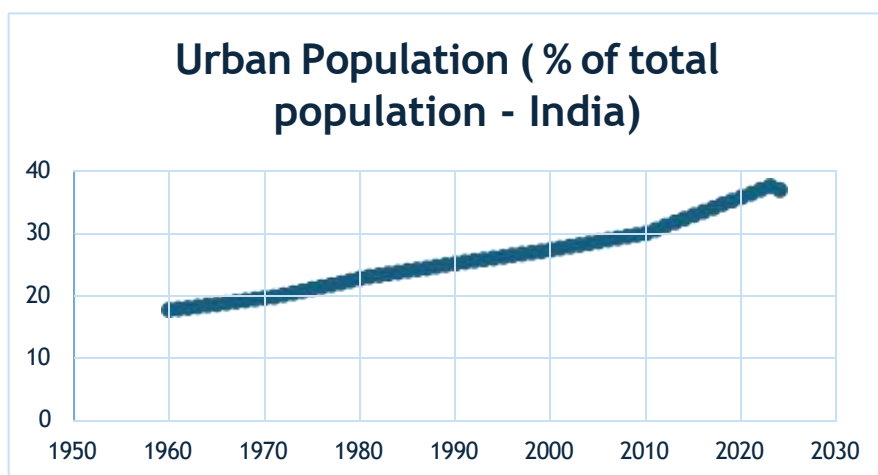
Figure 1: Urban Population Share in India (1960 - 2050)



Source: Author's compilation based on HYDE estimates and UN Projections

The expansion of the population (Liu et al., 2011; Mondal & Banerjee, 2021) has led to urban expansion, with the population set to increase from 1.35 billion (1970) to 6.3 billion (2050) (United Nations, 2012). As the urban population grows, constant structural changes are altering peri-urban landscapes. The adverse environmental effects of this peri-urbanisation process (Theodorou, 2022; Benis, 2017; Simon, 2008) are increasingly evident in the Global South's Peri-urban Interface (PUI). South Asia, representing 17.7% of the world population, is a prime example of this fragmentation due to development activities. This backdrop underscores the need to address the challenges of peri-urban land use changes and environmental sustainability.

Fig 2: Urban Population (% of total population India)



Source: Authors compilation using Data from World Urbanization Prospects: 2018

In 1960, the urban population in India was 17.92%, which increased to 25.54% in 1990, 35.39% in 2021, and 36.86% in 2024 (Figure 2). Urbanisation is rapid and manifests substantial land use changes in India. This fast growth has led to significant changes in cities, particularly in their environment and livelihood, with shifts from agriculture to industry and service sector-led development. However, urbanisation-led land use and land cover changes are important contributors to environmental deterioration, resulting in problems such as loss of land cover and biodiversity crisis (McKinney, 2002). Urban expansion frequently leads to land conversion (Pickett et al., 2001; Bürgi et al., 2004), and the spatiotemporal pattern of this expansion further contributes to environmental changes and land cover use alterations.

The peri-urbanisation phenomenon in the city and regional planning has become a significant aspect of urbanisation in the Global South. It has notably occurred in Asian countries like India and China, as well as in African countries such as Ghana and Lagos (Narain, 2009; Wu et al., 2013; Lawanson et al., 2012; Appiah et al., 2014). The world's fast urbanisation process is visible in cities in Asia and Africa (Angel et al., 2016). While peri-urbanisation brings about economic expansion and employment opportunities, it also challenges environmental sustainability. Land use changes affect sustainability, particularly in sprawling cities in the Global South (Follmann, 2021; Paul, 2021; Drescher, 2021). Such challenges are understood from examples like the Yangtze and Pearl River Deltas of China, where there are immense development challenges with fast urbanisation (Liu et al., 2004). Addressing the existing gap in peri-urban literature on the Global South, this paper offers a perspective on the issues related to sustainability and land use changes.

Substantial research has addressed sprawling and land use changes; however, scant attention has been paid to formulating methodologies quantifying sprawl (Hasse, 2004). The peri-urban growth pattern varies significantly across geographical regions and cannot be understood in isolation from the larger metropolitan context. While existing literature mainly discusses land use from a GIS-based geographic perspective, it lacks adequate discussion on the Global South perspective of peri-urban areas, particularly concerning specific examples of industrial development. The land use changes affect biophysical activities, leading to climate change, biodiversity decline, and changes in environmental quality (Ríos-Sánchez et al., 2024; Mahmood et al., 2006). While land conversion processes lead to urbanisation (Quan et al., 2006; Wang et al., 2005), they result in biophysical changes that require planning attention (Gottero, Larcher, & Cassatella (2023). Global South, in particular, suffers from haphazard sprawling patterns, leading to biodiversity loss and environmental degradation due to unplanned constructions and lack of efficient land use planning.

2. Peri-urbanisation as an Exemplar of the Global South

The pace of transition of cities in the Global South is rapid, and the increase in population is one of the primary reasons for the fast development. South Asia's fastest urban sprawl is visible due to its high population growth and industrial development. Several factors affecting urbanisation in South Asian cities like Bangalore are the growth of the IT Corridor, IT-led real estate developments, and industrial developments (Varkey, 2023). Bangalore is known for speedy transitions and loss of land cover, unlike world-class cities like London or Paris, where a frequent inflow of people and resources is managed effectively.

Land use changes lead to problems such as climate variability, land degradation, water problems, unplanned developments, and the haphazard growth of urban areas in the peripheries. Fast urbanisation is responsible for the unplanned development of the Global South.

Spatial transition is a global phenomenon; it varies in different geographic regions. The Global South cities are transitioning, with a distinct pattern of an influx of migrants from villages to cities. Studies show that the urbanization pattern of the West refers to a massive migration of the rural population into the cities (Gottmann, 1961). Bangalore attracts businesses and investments to their peripheries, seeking affordable land with the possibility of expanding. Fringe areas have been experiencing economic and structural changes, leading to a service-led economy in Bangalore. The dynamic transition of the periphery is associated with environmental problems and a lack of planning (Dijst et al., 2005).

Bangalore is an example of a distinct pattern of urban sprawl in the Global South based on (1) per-urban clusters and (2) a reputation for rapid industrial growth, yet with differences in the development pattern and land administration. Globally, land use changes are continually altering the environment at an unprecedented rate, driven by both natural and human processes. The relations between biophysical and human aspects propel these changes (Meyfroidt et al., 2013). Land use changes lead to farmland deterioration, and fallow land becomes unsuitable for cultivation with excessive human activities (Liu, 2018). The rapid environmental changes resulted in socioeconomic and ecological transitions in the rural-urban continuum (Marshall & Dolley, 2019).

3. Discussion

Land use changes affect the sustainability of the peri-urban system (Varkey & Manasi, 2019). The densification of metropolitan areas directly influences the quality of life by diminishing the greenery and hindering environmental services (Westerink & Aalbers, 2013; Westerink et al., 2013). The peri-urban areas are often more evolving than a planned development zone. This creates significant spatial management problems related to environmental management. The adverse effects include loss of agriculture, changes in the land covers, and environmental degradation in the growing peripheries of the global south. Fringe areas have adequate scope for expansion in the global south; industries are located near a growing periphery in the growing metropolitan areas of Bangalore, Chennai, and Delhi as they offer employment opportunities in emerging tech jobs and businesses. Accessibility to the market, expansion of services, and commerce are reasons people choose the periphery (Mandere et al., 2010; Tuyen, 2014). Peri-urban areas attract people due to their proximity to the city and access to urban facilities (Sridharan, 2011), and people enjoy rural-urban amenities. The peri-urban areas are the best living places (Mahavir, 2011), but economic and environmental factors trigger dynamic changes at the periphery. Moreover, the demarcation of the periphery is always in question, as the administration is challenging to decide since the transition is dynamic and volatile.

Fast urbanisation is typical in the Global South, and the pattern of urban growth refers to a sprawling nature (Leichenko & Solecki, 2005). The deterioration of agricultural lands co-occurs with various urban land uses. Human activities significantly affect the landscape in the emerging cities of South Asia. Unlike European countries such as Sweden, Denmark, or Germany, developing countries lack facilities for the planned development of their land. This affects the region's Land Use/Land Cover, sustainability, and climate (Mahmood et al., 2006).

Evolving industrial clusters of the Global South agglomerate many polluting industries from the urban core. Dupont (2005) explained the scenario in the case of Delhi, a very dense location in the Global South. A similar example of peri-urban growth is found in Rajiv Gandhi Technology Park in the case of Chandigarh (Narain et al., 2013) and Hitec City at the periphery

of Hyderabad City (Kennedy, 2007). Due to the lack of planned management of peripheries, the peri-urban urban environment is degraded with exorbitant amounts of pollution led by human activities. Issues of peri-urbanisation include increasing land and water conflicts, negative environmental consequences, and a reduction in farmlands and the source of livelihoods of people (Kwangwama et al., 2021). The narrative delves into the historical shifts in landscapes and their ramifications on the environmental dynamics intertwined with urbanization across diverse nations, as elucidated by Acemoglu et al. (2005), Hassan and Nazem (2016), Suribabu et al. (2012), Yagoub and Kolan (2006), Batisani and Yarnal (2009), Liu (2018), Giupponi et al. (2006), and Tianhong et al. (2010). The lack of better policy management has led to increased exclusion and failure in achieving sustainable urban development goals, and there is a dire need for a policy to tackle the various issues related to managing the sustainable peri-urban environment.

Precise land use and land cover data is critical for efficient land use planning (Pabi, 2007). Landscape simulations (Aspinall, 2004; Parker, Manson, et al., 2003; Turner, 1987; Gutzler, 2015; Cao, S., 2009 et al., Kamusoko et al., 2009) show continuous vegetation degradation. Land use changes petulantly affect urban sustainability in the scenario of a lack of good governance. Urban authorities are concerned about the issues and try to ensure planned developments; however, the extent of peri-urban transition is uncontrollable and unpredictable in the metropolitan cities of the Global South.

Broad policy implications are derived from the above discussion on peri-urban land use changes and sustainability. First, PUI is to be included in the city's urban planning through integrated planning. This will significantly reduce uncontrolled expansion and prevent environmental damage. Second, cities of the Global South demand more flexibility in planning mechanisms and institutions because of their speedy transition. Planning authorities make a conscious effort; however, more development control is needed for a sustainable future for the city. Third, fast-growing urban areas in many poor countries in the Global South are characterized by land fragmentation, litigation, and property conflicts. The technological integration of land management can play a significant role in countries like India. Fourth, effective planning for peri-urban areas will require the attention of the appropriate local authority levels. GIS and remote sensing tools are critical in analyzing spatial dynamics (Varkey, 2023) and mapping Land Use and Land Cover changes (Hathout, 2002; Lambin et al., 2003; Zhang & Jia, 2013). These techniques are essential for future research, enabling the identification of spatial changes and development challenges. The long-term evaluation of these changes provides farmers, policymakers, and planners with a solution.

4. Recommendations

4.1 Technological Investment

Sustainable urban waste management is a concern for the cities of India and much of the global South (Cheela et al., 2021; Millington & Lawhon, 2019), which face a serious challenge regarding sustainable waste management and disposal for the global south. In China, technology and innovation are well advanced, particularly in city planning and waste management; biogas from food waste is a sustainable waste management method (Chen et al., 2010; Huang et al., 2018; Xiao et al., 2023). Chinese companies invest in different sectors in other global south countries, such as waste management and biogas, which can bring sustainable growth to these regions.

India, while facing significant challenges in green technology innovation, particularly in city planning, has a promising future. In this globalized world, investment from Chinese companies in Indian city planning could lead to mutual growth for both countries. India has many opportunities to achieve economic growth under these circumstances. However, peri-urban development is a concern in sustainability due to the lack of technological innovation. A gap in India's city planning and innovation can be filled through foreign direct investment (FDI) from other countries (Sahoo, 2006), including China, with potential opportunities for city planning investment. Technological investment will improve sustainable urban planning in India's newly emerging developing cities.

4.2 Innovation and Green Finance

The Global South faces governance and innovation challenges due to a lack of investment and government projects. This situation can be improved through green finance provided by various financial institutions. Green finance can eventually reduce the lack of green technology innovation (Zhang et al., 2022). The government should support private entities by offering tax reductions for innovative projects in green technology. Subsidies can foster innovations in urban development.

4.3 Environmental Education for Urban Development

Environmental education is essential for environmentally friendly lifestyles and achieving long-term goals to create sustainable city transitions (Wu et al., 2019; Debrah et al., 2021). An educated society can address human-made environmental problems and attract green investment opportunities for urban development.

4.4 Growth of sustainable cities in the Global South

The backwardness of the Global South in green finance and innovation, can only be overcome through cooperation among Global South countries. Sustainable urban planning requires excellent investment opportunities for global south nations. China has significant financial and technological capabilities in city planning (Jiang et al., 2024), a unique opportunity for Global South.

This collaboration helps the Global South embrace green technology and innovation through joint venture investments (Cheung, 2021). Joint ventures create equal opportunities for all countries. Political decisions are important for sustainability investment through joint ventures to improve peri-urban city modelling.

4.5 Political Decisions and Sustainability

Political decisions are critical and pivotal for sustainability (Feiock & Kim, 2021). The primary focus of Global South is to address the fundamental issues of lack of education, poverty, food crises, and healthcare; environmental protection often becomes a secondary objective (Abubakar et al., 2022). Addressing these challenges requires government action and environmental protection measures to mitigate the negative effects of environmental damage.

Political administrations have a significant opportunity to foster bilateral cooperation with various countries to enhance the basic infrastructure of peri-urban development, but this can only be achieved through visionary political leadership. With the government initiatives, China strives to achieve its environmental goals in the Global South (Islam & Wang, 2023). The

Global South can adopt the lessons from China to promote environmentally friendly peri-urban development. Indian administration should take the initiative to collaborate with China to mitigate the challenges of city planning and urban innovations.

Conclusion

A strategically planned research agenda is essential to address the spatial changes of megacities for sustainable urbanisation. While this paper addresses some of the challenges, city development transition and global environmental changes are affecting the peri-urban areas of developing countries and require sustainable urbanisation for environment-friendly city development transitions to overcome global climate change difficulties.

This research provides insights into the impacts of locations in peri-urban areas, explains the challenges associated with land use, agriculture, and environmental impact changes, and offers opportunities for future policy recommendations. The results confirm that the biological effects of land use change vary across geographic regions. Spatial analysis provides statistics for formulating land-based mitigation strategies, encouraging the grouping of different land use types to address environmental challenges.

This research underscores the need for an action plan to overcome environmental challenges through diligent planning by local governments. Future research on peri-urban land use changes and sustainability must prioritize sustainable urbanization. It is crucial to adopt countermeasures that promote sustainability. Future research has to focus on revitalizing rural decline, enhancing land use and sustainability to achieve sustainable development, and promoting sustainable urbanisation.

Countries in the Global South often lack access to new green technologies and sustainable methods for building infrastructure during peri-urban transitions due to a shortage of innovation and limitations in economic and human resources. Countries in the Global West possess advanced environmental technologies, but these are expensive for the Global South. This gap can only be filled through free technology exchange at an affordable rate. Such measures would benefit the Global South during peri-urban transitions by enabling the development of zero-carbon or low-emission cities without imposing a financial burden, thereby preventing environmental green finance colonialism. The important aspect of the peri-urban research envisaged is to develop an efficient land use policy for administering fast-moving cities and urban locales. Future empirical research in the global south's industrialized regions will capture the peri-urban's dynamic nature. Since peri-urban locales differ across developing and developed regions, the discussion of sustainability challenges in the developing country setting deserves special mention.

Conflict of Interest

The authors declare that there is no conflict of interest.

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