

URBAN EXPANSION AND INFRASTRUCTURE STRAIN IN PAKISTAN:
NAVIGATING THE ROAD TO SUSTAINABLE DEVELOPMENT

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Abstract

Pakistan is undergoing rapid urbanization, driven by population growth, rural-to-urban migration, and economic transformation. While urban expansion offers opportunities for development and modernization, it also presents critical challenges, particularly in terms of infrastructure capacity, service delivery, environmental sustainability, and governance. This research examines the multifaceted relationship between urban growth and infrastructure development in Pakistan, highlighting how the current pace and pattern of urbanization are straining existing systems such as transportation, housing, water supply, and waste management. By analyzing national and city-level data, policy frameworks, and case studies from major urban centers like Karachi, Lahore, and Islamabad, the study assesses the gaps in planning and implementation. The research also explores sustainable urban planning models and best practices that could be adapted to the Pakistani context. Ultimately, the study aims to propose actionable strategies for balancing urban growth with sustainable infrastructure development, ensuring long-term resilience and improved quality of life for urban populations.

Keywords: Urbanization, Infrastructure Development, Sustainable Growth, Urban Planning, Pakistan

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INTRODUCTION

The Urbanization is a defining trend of the 21st century, with developing countries like Pakistan experiencing rapid growth in urban populations. According to the Pakistan Bureau of Statistics, over 36% of the country's population now resides in urban areas, and this figure is projected to rise significantly in the coming decades. While urbanization can serve as a catalyst for economic growth, innovation, and modernization, it also imposes considerable pressure on existing infrastructure and public services. In Pakistan, urban expansion has outpaced the capacity of city planning and infrastructure development. Major cities such as Karachi, Lahore, and Islamabad face persistent challenges related to housing shortages, inadequate public transportation, traffic congestion, poor waste management, and limited access to clean water and sanitation. The mismatch between urban growth and infrastructure investment has led to environmental degradation, growing socio-economic inequality, and declining quality of life in many urban areas (Abbas, 2024).

The complex relationship between urban expansion and infrastructure strain in Pakistan, with a focus on identifying sustainable solutions to these challenges. It seeks to assess current urban development patterns, evaluate infrastructure gaps, and examine policy approaches at both national and local levels. By drawing on case studies and comparative models, the study endeavors to propose practical strategies for achieving sustainable urban growth that is inclusive, resilient, and environmentally sound.

The Urbanization in Pakistan has accelerated over the past few decades, transforming the demographic and economic landscape of the country. Cities such as Karachi, Lahore, and Islamabad are expanding rapidly due to population growth, rural-to-urban migration, and economic opportunities concentrated in urban centers. However, this swift urban expansion has exposed serious weaknesses in the country's infrastructure systems. Basic services such as transportation, housing, water supply, sanitation, and waste management have not kept pace with demand, leading to overcrowding, pollution, traffic congestion, and declining quality of life in many urban areas. The growing disconnect between urban growth and infrastructure capacity presents a major challenge to sustainable development in Pakistan. Without comprehensive planning and effective policy implementation, urban environments risk becoming increasingly unsustainable, both socially and environmentally. The extent of infrastructure strain caused by urbanization in Pakistan, identifies key obstacles to sustainable development, and explores viable strategies to address these challenges. Through analysis of current trends and relevant case studies, the research aims to offer practical recommendations for building resilient and inclusive cities in Pakistan (Farooq, 2024).

Literature Review

Cities have undergone development due to globalization patterns which generate positive yet negative outcomes. Rapid urbanization in Pakistan stands as one of the most accelerated trends in the country despite the intense challenges that result from rapid urban center expansion (Farooq et al., 2024). The purpose of this literature review is to investigate critical urbanization together with infrastructure development aspects within Pakistan specifically regarding obstacles in achieving environmentally conscious urban expansion. The research evaluates components like urban planning and transportation alongside water supply and energy alongside environmental effects and housing developments which directly support the development of sustainable cities.

Rural-to-urban migration in Pakistan occurred mainly because people moved to urban areas for improved economic prospects together with better access to education and healthcare facilities. Rural-to-urban migration keeps accelerating because population growth along with agricultural productivity decrease and city-based economic prospects push people to move. An extensive wave of people leaving rural areas now sustains uncommon population expansion throughout Karachi and Islamabad alongside Lahore. The country experiences national progress through economic business activities concentrated in these urban centers (Liang et al., 2021).

The changing demographic structure now puts intense stress on city-based infrastructure systems. Cities extend in size more rapidly than their essential infrastructure can develop causing both more traffic congestion and insufficient housing alongside overstretched municipal services. The continuous expansion of urban populations requires effective planning and resource management to become more essential. Urban Pakistan faces a serious problem because its infrastructure has not been developed enough (Ahmed et al., 2021). Economic growth from urbanization creates excess demand which exceeds the availability of necessary supporting infrastructure. The impediments to successful infrastructure development stem mainly from bad urban planning combined with insufficient funding alongside inefficient resource management practices.

Different government levels at the federal and provincial and local levels have failed to work together which resulted in cities being built without proper coordination. Urban sprawl now represents a common urban pattern which results in wasteful land utilization and continues to increase inappropriate residential districts known as slums. The regions suffer from missing vital amenities including water and sewerage facilities besides electricity access and street infrastructure. Social inequality in urban areas has amplified because informal settlements expanded significantly when developers lacked proper infrastructure planning methods (Scheba et al., 2021).

The development of transportation infrastructure stands as a major issue for the cities of Pakistan. Rapid urbanization leads to traffic congestion as an obvious outcome that mainly affects Karachi and Lahore along with other large cities. Traffic congestion happens because inadequate public transport systems coexist with poor road maintenance and widespread reliance on private automobiles. This produces substantial commute delays along with jammed roads at intersections. The analysis demonstrates how traffic congestion simultaneously decreases productivity while making pollution worse and producing environmental changes.

Few urban areas lack proper public transportation infrastructure and most of the existing systems need upgrading. The implemented systems handle growing demand unsatisfactorily because of their ineffective management. People have limited ways to travel in such situations which increases their reliance on personal automobiles along with unregulated transport services. The necessity of building sustainable and efficient public transport networks has risen progressively because cities continue to expand. The development of urban Pakistan depends strongly on water supply and sanitary infrastructure systems (Hussain et al., 2024). The fast-paced rate of urban development has produced a major growth in the demand for water. Current water infrastructure in various cities fails to support population growth since their outdated systems are not sufficient for the rising populations. Quantities of accessible water have risen during recent times in dry regions because urban areas have difficulties sustaining their water delivery networks.

Water pollution occupies a primary position as a crucial urban issue because contaminant waste from industrial regions commonly causes damage to rivers and additional water sources. The pollutant contamination of water reserves leads to public health emergencies while simultaneously intensifying the lack of water access. Water scarcity worsens because cities lack proper sewage systems and insufficient waste management practices operate together with inadequate water treatment facilities. Water scarcity solutions together with better sanitation remain slow because poor infrastructure funding hinders progress (Ssekyanzi et al., 2024). The improper system of sewage waste disposal found throughout many urban zones causes diseases to spread while degrading the environment. The water-related challenges of urban Pakistan require immediate resolution through water management solutions including rainwater collection and wastewater purification and sustainable water practice development.

Great energy supply difficulties plague the urban regions throughout Pakistan. The energy crisis in the nation persists as regular power outages affect numerous areas across the country. Power outages together with load shedding are regular occurrences throughout urban

communities that affect domestic properties and industrial facilities. The present-day energy infrastructure operates below optimal standards and ineffective practices because power generation primarily depends on fossil fuels thus causing enhanced environmental degradation. Energy requirements of cities which grow at rapid pace create even greater challenges to the power sourcing infrastructure. Urban energy-intensive industries create excessive pressure that degrades the power distribution system in addition to residential energy demands. The energy sector in Pakistan requires a modern upgrade to integrate renewable energy sources that help supply sustainable power to expanding urban areas including solar, wind and hydroelectric power (Ahmad et al., 2022).

The rapid development of cities in Pakistan has brought substantial ecological problems to the nation. The fast-growing urban development process leads to the disappearance of natural areas and encroachment of farming territory and escalating pollution in air and water. Urbanization leads to substantial depletion of natural resources and extends its damage to worsen climate change implications in the environment. Cities remain highly susceptible to climate change because bad urban planning together with insufficient climate-resistant systems heightens the risks for incidents like floods and intense heatwaves and occasional droughts. Urban areas across Pakistan maintain poor air conditions because industrial contaminations combine with emissions from vehicles and the effects of construction activities. Research shows that urban air contamination has stimulated respiratory disease incidents along with various health complications (Grigorieva et al., 2021). The environment requires sustainable development practices including green building structures and waste reduction alongside clean energy technology advancement because of urbanization impacts.

The development of accessible housing stands as a fundamental problem that affects residents of urban Pakistan. Urban populations keep increasing so rapidly that the housing crisis expands which pushes people into living in unauthorized settlements. The facilities built through these settlements serve as housing for millions but they do not receive essential services or proper infrastructure. The poor living arrangements which combine overcrowded homes with nonexistent sanitation services create health risks that decrease both quality of life and personal well-being. The spread of urban expansion has created new slums together with unlawful residential areas near city boundaries (Henderson et al., 2021). The lack of official urban planning protects these areas from receiving basic utility services including electricity supply, water services and waste management resources. The provision of affordable housing remains restricted because of budget shortages together with political resistance and ineffective governmental policies.

The literature reveals different obstacles that result from the combination of urbanization with infrastructure development across Pakistan's territory. The fast-growing population of cities has brought tremendous challenges on national infrastructure which produces deficiencies in the delivery of basic service networks including transportation and water supply and sanitation and power distribution and housing. The challenges worsen because Pakistan suffers from poor urban planning and budget constraints alongside weak governmental leadership. The country needs to concentrate on sustainable urban development through advanced strategic planning and investments in strong infrastructure along with green innovation adoption. The nation needs constant collaboration between different organizations to develop cities which function economically while protecting the environment (Ren et al., 2021).

Infrastructure Strain in Pakistan

Pakistan's rapid urbanization has placed immense pressure on its infrastructure, exposing critical gaps in planning, investment, and governance. Major cities like Karachi, Lahore, and Peshawar are facing increasing difficulties in managing transportation, waste disposal, housing, and public utilities. According to the World Bank (2020), Pakistan's infrastructure investment has consistently lagged behind the rate of urban population growth, leading to congestion,

inefficiencies, and deteriorating service quality. These deficits not only impact daily life but also hinder economic productivity and long-term development prospects.

Transportation networks are one of the most visibly strained sectors. Urban centers often suffer from gridlock due to insufficient public transit options and poor road conditions (ADB, 2021). Similarly, the housing sector has failed to meet demand, resulting in the growth of informal settlements lacking access to clean water and sanitation (UN-Habitat, 2022). Energy infrastructure is also under stress, with frequent electricity outages disrupting urban economies and livelihoods. The cumulative effect of these issues highlights the urgent need for a coordinated, sustainable infrastructure development strategy that aligns with the realities of Pakistan's urban growth.

Water supply and sanitation systems in urban Pakistan are under severe stress. Many cities rely on outdated pipelines, irregular supply, and unregulated private water tankers. According to the Pakistan Council of Research in Water Resources (PCRWR, 2021), more than 70% of urban households do not have access to clean drinking water. Meanwhile, the lack of proper waste treatment facilities results in the discharge of untreated sewage into rivers and open drains, contributing to public health crises and environmental degradation (WWF-Pakistan, 2020). Solid waste management is another persistent issue. Urban areas generate thousands of tons of waste daily, but limited municipal capacity means a large proportion remains uncollected or is improperly disposed of. This not only pollutes the environment but also contributes to urban flooding, especially during monsoon seasons (JICA, 2018). Additionally, electricity and energy infrastructure are plagued by chronic shortfalls. Despite improvements through projects like the China-Pakistan Economic Corridor (CPEC), energy distribution networks are inefficient and often fail to meet urban demand, leading to frequent blackouts (Siddiqui, 2020).

Beyond the physical infrastructure, governance and institutional capacity remain key barriers to sustainable development. Fragmented authority between municipal and provincial governments, lack of funding, and poor enforcement of building and zoning regulations hinder the creation of integrated urban development plans. As noted by Hasan and Raza (2022), the absence of participatory planning and reliable data further limits the ability of local governments to respond to the evolving needs of rapidly growing urban populations. Without comprehensive reforms, infrastructure in Pakistan will continue to fall short of supporting sustainable urbanization.

Navigating the Road to Sustainable Development

Achieving sustainable development in the face of rapid urban expansion in Pakistan requires a holistic approach that integrates economic, environmental, and social dimensions. The country's urban growth has outpaced its infrastructure development, resulting in inefficiencies that hinder long-term urban sustainability. However, with the right strategies, Pakistan can navigate the challenges posed by urbanization and create cities that are both livable and resilient. This requires a focus on sustainable infrastructure, innovative urban planning, and effective governance.

First, sustainable infrastructure is the cornerstone of urban resilience. According to the United Nations (2021), sustainable infrastructure encompasses systems that support social equity, economic productivity, and environmental protection. For Pakistan, this means prioritizing investments in green infrastructure, such as energy-efficient buildings, renewable energy sources, and water-efficient systems. Additionally, improved waste management technologies, such as waste-to-energy initiatives can reduce the environmental impact of growing urban populations while contributing to energy generation. These infrastructure investments will need to be supported by policies that incentivize sustainability in both the private and public sectors.

Second, innovative urban planning that incorporates smart growth principles is essential for managing urban expansion. This includes promoting higher-density development, improving public transportation networks, and creating mixed-use zones that reduce the reliance on private

cars. The concept of "smart cities" is gaining traction globally and can be adapted to Pakistan's urban centers to enhance efficiency through technology, better resource management, and citizen participation. For example, integrating data-driven decision-making can improve traffic flow, reduce pollution, and enhance waste collection systems. Cities like Lahore and Karachi could benefit from more comprehensive urban mobility plans that integrate mass transit with non-motorized transportation options like cycling and walking.

Lastly, effective governance is critical to ensuring the success of sustainable urban development. Local governments in Pakistan often lack the resources, coordination, and expertise needed to manage urban growth. Strengthening institutional capacity at the municipal level, enhancing transparency, and ensuring greater public participation in urban planning are all key components of an effective governance framework. Furthermore, Pakistan must establish stronger inter-governmental partnerships between federal, provincial, and local authorities to streamline policy implementation and ensure urban development is aligned with sustainable principles. Navigating the road to sustainable development in Pakistan's urban centers will require a coordinated effort from the government, private sector, and civil society. Through focusing on sustainable infrastructure, adopting innovative urban planning models, and strengthening governance, Pakistan can transform its urban areas into sustainable, resilient, and inclusive spaces that can accommodate future generations. This will not only address current infrastructure strain but also contribute to broader social, economic, and environmental sustainability goals.

Achieving sustainable development amidst rapid urban expansion in Pakistan necessitates a comprehensive approach that balances economic, environmental, and social considerations. Pakistan's urbanization, particularly in cities like Karachi, Lahore, and Islamabad, has outpaced infrastructure development, resulting in strains that hinder long-term sustainability. However, with appropriate strategies, Pakistan can navigate the challenges posed by urbanization and pave the way for cities that are both resilient and inclusive. Key to this is the development of sustainable infrastructure, smart urban planning, and effective governance. Sustainable Infrastructure forms the foundation of resilient urban development. According to the United Nations (2021), sustainable infrastructure integrates social equity, economic productivity, and environmental protection. In the context of Pakistan, this includes prioritizing investments in green buildings, renewable energy sources, and water-efficient systems. Moreover, enhancing waste management technologies, such as waste-to-energy initiatives, can help reduce the environmental burden of growing urban populations while contributing to energy production (World Bank, 2020). To foster sustainability, government policies must support the adoption of these technologies and incentivize their use across urban sectors.

Innovative Urban Planning is also essential in managing the challenges of urban expansion. The principles of smart growth, which focus on higher-density development, efficient public transportation, and mixed-use zones, can help accommodate the increasing urban population without overburdening existing infrastructure (Siddiqui, 2020). The concept of "smart cities," driven by technological integration, is increasingly relevant to urban Pakistan. By adopting smart city concepts, cities can improve resource management, reduce traffic congestion, and enhance environmental sustainability through data-driven decision-making and innovative infrastructure (Hasan & Raza, 2022).

Finally, Effective Governance is crucial for the successful implementation of sustainable development strategies. Local governments in Pakistan often lack the resources and coordination necessary to address the demands of rapid urban growth. Strengthening municipal capacities, improving transparency, and promoting citizen participation in urban planning are vital for ensuring that cities are developed in an equitable and sustainable manner (Hasan & Raza, 2022). Moreover, inter-governmental coordination between federal, provincial, and local authorities is necessary to streamline policies and create a cohesive urban development strategy (JICA, 2018).

In conclusion, navigating the road to sustainable urban development in Pakistan will require a concerted effort from the government, private sector, and civil society. By focusing on sustainable infrastructure, smart urban planning, and strengthening governance, Pakistan can build resilient, livable cities that meet the needs of current and future generations. These efforts will not only address existing infrastructure strains but also contribute to broader social, economic, and environmental sustainability objectives.

Key Takeaways for Sustainable Development

- **Investment in Green Infrastructure:** Prioritizing energy-efficient and eco-friendly systems to reduce environmental impact.
- **Smart Urban Planning:** Creating mixed-use zones, expanding public transport, and enhancing green spaces to manage urban growth effectively.
- **Enhanced Governance and Coordination:** Strengthening local governments and fostering coordination between federal, provincial, and local authorities for more effective urban management.

Recommendations

Promote Integrated Urban Planning

Encourage holistic city planning that aligns land use, housing, transport, and green spaces. Implement urban growth boundaries to prevent unchecked sprawl and protect agricultural and natural lands.

Strengthen Public Transport and Mobility

Invest in efficient, affordable, and eco-friendly mass transit systems like BRTs and metro lines. Reduce dependence on private vehicles to ease congestion and lower emissions in major urban centers.

Upgrade and Decentralize Infrastructure

Modernize aging water, sewage, and power infrastructure, especially in rapidly growing urban areas. Promote decentralized systems like solar microgrids and community-based water solutions.

Empower Local Governments

Strengthen municipal governance by giving local authorities more financial and administrative autonomy. Enable better planning, resource allocation, and community engagement at the city level.

Strengthen Local Governance and Capacity

Empower local governments with greater autonomy, funding, and technical capacity to plan, implement, and monitor urban development projects effectively.

Conclusion

The Urban expansion in Pakistan, while a sign of economic ambition and demographic vitality, has placed an immense strain on the country's existing infrastructure. Rapid population growth in urban centers like Karachi, Lahore, and Islamabad has outpaced the capacity of roads, public transportation, water supply, sanitation, and housing systems. This imbalance between expansion and preparedness has resulted in increased congestion, environmental degradation, and a decline in the quality of urban life. Without deliberate planning, urban growth risks becoming a burden rather than a benefit. The strain on infrastructure also underscores the gaps in governance and planning mechanisms. Weak enforcement of zoning laws, limited investment in public utilities, and an overreliance on informal settlements have exacerbated the urban crisis. Moreover, the disconnect between federal and local authorities hampers efficient service delivery. These structural inefficiencies make it difficult to respond to the dynamic needs of a growing urban population and challenge the vision of inclusive, resilient cities.

Sustainable development in this context demands a multi-pronged approach that balances growth with livability. Embracing smart city solutions, investing in green infrastructure, promoting public-private partnerships, and enhancing urban resilience through data-driven planning are all essential strategies. Additionally, fostering community engagement and

empowering local governments can lead to more responsive and adaptive urban management. Long-term urban sustainability will only be achieved through proactive, integrated, and inclusive development models. The Pakistan's urban expansion presents both opportunities and challenges, the key to progress lies in a visionary approach to infrastructure and sustainability. By aligning policy, investment, and innovation with the realities of urban growth, the nation can transform its cities into engines of economic prosperity and social equity. The road to sustainable development is complex, but with commitment and collaboration, it is entirely within reach.

The rapid urbanization of Pakistan has exposed significant vulnerabilities in its urban infrastructure, highlighting the urgent need for comprehensive and forward-thinking policy reforms. As cities grow beyond their planned capacities, the resulting pressure on transport, housing, sanitation, and energy systems continues to undermine the quality of urban life and economic productivity. Without immediate interventions, these challenges will only escalate, further entrenching inequality and inefficiency. A major contributor to the current strain is the lack of coordination among planning authorities and the absence of long-term urban development frameworks. Many policies remain reactive rather than anticipatory, and infrastructural projects often fall victim to political instability or funding shortages. This reactive approach not only delays progress but also increases costs and reduces the resilience of urban systems. Lecturing these issues requires a shift in mindset from short-term crisis management to strategic urban governance. Strengthening institutions, fostering inter-agency collaboration, and improving transparency in urban planning processes are key steps. Investing in education and training for urban planners, engineers, and local administrators can build the capacity needed to implement smart, sustainable solutions.

The urban expansion in Pakistan must be matched by equally ambitious reforms in governance and policy. With careful planning, sustainable financing, and inclusive stakeholder engagement, Pakistan can turn its urban challenges into an opportunity for transformation. The future of its cities depends not just on how they grow, but on how they are governed.

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