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A Sociological Analysis of Urbanization, Climate Change and Sustainability Challenges in Mumbai

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Abstract

India's identity as a land of agriculture, farmers, and rural people is undergoing a radical transformation due to rapid urbanization. The rate of urbanization after Liberalization has increased rapidly, and cities are becoming more connected to globalization through trade, services, and technology. The nature of urbanization is changing, and the traditional understanding of urban areas is better than that of rural and tribal areas, which need introspection. However, certain urban areas are highly urbanized, centers of global business, and livelihood centers for people from different backgrounds. Urbanization and civilization are important developments in human history. These processes have brought progressive changes to human life and culture over time. Urban areas are always associated with changes in occupational patterns and in the quality of life, which are a source of developed human resources. Mumbai, as a metropolitan city known as India's economic capital, has a new identity on the world stage. It has become a new destination for businesses and commercial activities because of its location and public infrastructure. Mumbai has become a corporate hub for both the public and private sectors. The changing global economic landscape and environment have created risks in the process of urbanization, which may affect people and the environment in the future. An attempt is being made to understand the rapid urbanization, its impacts, and the risks of climate change arising from uncontrolled development in Mumbai city.

Keywords

Urbanization, Climate Change, Social Risk, Mumbai, Risk Society, Sustainable Development Goals (SDG 13), Urban Inequality.

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1. Introduction

The ideas of development, economic growth, and changing demographic patterns are closely linked to the emerging phenomenon of urbanization. Urbanization is often understood as a process that emphasizes the expansion of infrastructure and technological advancements aimed at improving human convenience and economic productivity. In this process, anthropogenic activities are prioritized, while other elements of the ecological landscape are often treated as secondary or less significant. However, this raises important questions: Is urbanization solely about human progress, or should it also consider the existence of other species and ecological systems that share the planet? The continuous modification of the environment to facilitate urban living has significantly transformed natural ecosystems. These transformations not only affect biodiversity but also increase social and environmental vulnerabilities. Even seemingly minor changes in the urban landscape can produce multiple consequences that extend beyond human populations, generating new forms of social risk. In this context, the present research seeks to examine how processes of urbanization contribute to the production of risk within society, particularly in relation to the growing global climate crisis. Climate change has intensified environmental uncertainties and has created multiple social risks, disproportionately affecting urban populations and ecological systems.

To better understand the climate change challenges facing Mumbai, it is important to examine its geographical setting in greater detail. Mumbai is a major urban hub in India and ranks among the largest and most densely populated cities in the world. It is situated along the western coast of the state of Maharashtra, adjoining the Arabian Sea. Geographically, the city occupies a narrow peninsula on the southwestern part of Salsette Island, bordered by the Arabian Sea to the west, Thane Creek to the east, and Vasai Creek to the north. However, a historical perspective on Mumbai's development reveals significant transformations in its physical landscape over time. Continuous urban planning and expansion, despite shifting environmental conditions, have propelled Mumbai into becoming one of India's leading and fastest-growing cities. At the same time, this relentless growth has contributed to a range of emerging challenges that the city now faces.

Mumbai's development timeline can be understood by examining the transition from a colonial port city to a global financial metropolis, shaped by successive phases of infrastructural and socio-economic transformation. Since we headed from the past, there has been a huge role in terms of changes that we

measure, largely driven by the colonial powers beginning of the land reclamation projects, building of the port, rise in the textile industries, leading to a large number of rural-urban migrations, and the coming up of the railways from 1853, spreading the major characteristics of urban living. Later on, after the colonial powers, the growth of Mumbai city didn't come to a halt, but it has undergone an intensive infrastructure boom in terms of the expansion of rails and roads, the increase of transportation, enhancing the connectivity, and moving towards easier and faster ways to build in the economy.

There are an endless number of projects that have helped make the city faster-paced, where we not only experience the expansion of the rails but also the coming of the metro and monorail. The Mumbai Trans Harbour Link project, coastal road development, and Navi Mumbai International Airport—what do all these projects highlight? It's none other than all aimed at enhancing connectivity and positioning the city within the global economy. These development and redevelopment projects align with Saskia Sassen's concept of the "Global City", where she put across how globalization reshapes urban life by as Mumbai exhibits features of global cities, which are increasing in financial hubs, infrastructure expansion, and integration into global markets, and simultaneously the urban life is also producing new forms of inequality, labor segmentation, and spatial restructuring.

Although Mumbai overall recorded average PM2.5 concentrations below the national safety threshold, several localized hotspots—including Deonar, Sion, Kandivali East, and Bandra Kurla Complex—exceeded permissible limits. This underscores the importance of implementing and strictly enforcing targeted, hotspot-specific interventions to effectively curb PM2.5 pollution, as emphasized in a recent national air quality report. Among coastal monitoring sites, Deonar emerges as one of the most severely polluted locations. In addition, areas such as Sion, Kandivali East, Bandra Kurla Complex, Borivali East, Worli, Mazgaon, Shivaji Nagar, Sewri, and Kurla have also reported PM2.5 concentrations at or above the National Ambient Air Quality Standards (NAAQS) threshold of 40 $\mu\text{g}/\text{m}^3$, as noted in a report published by The Times of India on July 17, 2025. There are new emerging risks that are getting developed by each passing day in the city, which is moving ahead in terms of development and fulfilling all the advanced infrastructure for the people but at the same time also forgetting the consequences that the people have to pay till the coming generation, which would be a huge cost.

Another *Times of India* report dated March 26, 2026, notes that former Supreme Court judge Justice Abhay Oka described the proposed clearing of 45,000 mangroves for the Versova–Bhayander coastal road as "staggering." He suggested that an independent evaluation of the project might have minimized ecological harm and argued that courts could have mandated more rigorous, impartial scrutiny before approving such extensive environmental diversion. Environmentalists further cautioned that global concerns over rising sea levels are being insufficiently addressed, even as local authorities acknowledge the submergence risks faced by several parts of Mumbai. They also invoked the devastating floods of July 26, 2005,

as a stark reminder of the city's vulnerability, noting that the lessons from that disaster have only been partially acted upon. Additionally, concerns were raised about earlier planning decisions, including the establishment of the Bandra-Kurla Complex on reclaimed land once rich in mangroves.

Besides the above issues, it must be emphasized that the nature of urbanization has changed radically worldwide since the Industrial Revolution in Europe. Industry and urban areas are interlinked, but traditional industries are no longer a lucrative option for the urban population because of their adverse impact on human life. Traditional industries depend on conventional energy sources and generate substantial waste in the production of final products. So the relationship between industry and urban development is contested. As a result, industrial areas are shifting from city centers to the peripheries (suburbs). However, Mumbai has become a new destination for businesses and activities because of its location and public infrastructure. Mumbai has become a corporate hub for both the public and private sectors, with Bandra Kurla Complex as a prime example. Real estate and the service industry are booming in Mumbai; Bollywood is one of the attractions, and it is now an industry. Mumbai has Asia's largest urban slum, Dharavi, which is rapidly transforming. Finally, it is expected that the quality of metropolitan life has to be at the highest level. The quality of life and life expectancy are also important goals of human development under the Sustainable Development Goals (SDGs). This paper critically examines the role of uncontrolled urbanization in identifying the social risks emerging day by day, and one of the major issues today is the risk of climate change. Urbanization is driven by rapid economic growth and continuous infrastructure expansion, which is transforming the socio-ecological landscape of contemporary cities. Since urbanization, with a continuously changing landscape, has enhanced connectivity and development, this progress is giving rise to new forms of man-made environmental change that are not natural, thereby increasing disasters, social risks, inequality, and life degradation.

This study examines the interrelationships among urbanization, climate change, and social risks in the context of Mumbai, India's most densely populated and rapidly developing metropolitan city. This paper will analyze how the increase in anthropogenic activities and the constant changing of landscapes and the environment have intensified climate vulnerabilities, including flooding, air pollution, and rising sea levels. Further, the sociological perspectives of Ulrich Beck's Risk Society and other development theories will highlight how modernization and capitalism-driven urban growth contribute to the unequal distribution of environmental risks. It further examines the role of Sustainable Development Goal 13 (Climate Action) in addressing urban climate challenges and evaluates existing policy measures and planning strategies. The findings emphasize the need for inclusive, sustainable, and resilient urban governance that integrates environmental concerns with social equity.

2. Research Objectives

The main objectives of this study are four-fold:

1. To examine the relationship between rapid urbanization and climate change in Mumbai.
2. To analyze how climate change exacerbates urban vulnerabilities and livelihood risks.
3. To assess the relevance of Sustainable Development Goal 13 in addressing climate challenges.
4. To explore policy measures and urban development strategies for climate resilience.

3. Research Methodology

This study adopts a qualitative analytical research design based on secondary data sources to examine the relationship between urbanization, climate change, and social risks in Mumbai. Data are drawn from a range of sources, including research articles, government and environmental reports, policy documents, newspaper articles, and documented case studies. Academic literature is used to trace the evolution and intensity of climate change concerns and urban development patterns, while environmental reports and policy frameworks provide insights into existing governance mechanisms and adaptation strategies. Newspaper articles and case studies supplement the analysis by offering recent empirical evidence on environmental degradation, emerging social vulnerabilities, and stakeholder responses. The collected data are systematically analyzed to identify patterns, trends, and interconnections between rapid urbanization, ecological stress, and socio-economic risks, thereby enabling a comprehensive assessment of sustainability challenges and policy responses.

4. Literature Review

Senapati's (2015) study of the *Socio-economic effects of climate change: A study of how vulnerable and effective coastal fishing is in Mumbai* (Doctoral dissertation, National Institute of Industrial Engineering, Mumbai) examines the socio-economic impacts of climate change, focusing on the vulnerability and effectiveness of coastal fishing communities in Mumbai. The study underscores that climate change has a big effect on individuals who depend on natural resources, making them more vulnerable to economic and environmental problems. The study employs both primary and secondary data to identify critical socio-economic and climatic variables-such as age, experience, family structure, and frequency of fishing trips-that influence fishermen's awareness, preparedness, and productivity. The study employs frameworks such as the Sustainable Livelihood Approach (SLA) and the Analytic Hierarchy Process (AHP) to develop vulnerability indicators, revealing differences in adaptive capacity across fishing villages. The results show that a lack of institutional support, experience, and

access to financial resources makes people more vulnerable. This research is significant for understanding the multifaceted societal risks posed by climate change in urban coastal regions. We need to examine how urbanization, environmental changes, and differences in wealth and income are interconnected.

Shinde's (2024) study on *Climate change, flooding, and urban development in Mumbai* (Unpublished Doctoral thesis, Indian Institute of Technology, Bombay). The paper examines the increasing incidence of urban floods in Mumbai within the context of climate change and rapid urbanization. It asserts that conventional flood control strategies, largely reliant on engineering solutions and temporary adaptation measures, are inadequate for addressing the complex, localized nature of urban flood risks. The paper proposes a transformation method that emphasizes systemic changes within socio-ecological and institutional settings. Employing the "three spheres of transformation" framework practical, political, and personal the research clarifies the significant incorporation of flood hazards into urban development processes, governance structures, and socio-political inequalities.

Shinde employed a mixed-methodology, integrating household surveys, interviews with policymakers and community people, and a case study examination of flood-prone areas, particularly Borivali-Dahisar. It discusses the primary factors that cause floods, including changing land use, the development of infrastructure in low-lying areas, inadequate drainage systems, and poor coordination among diverse groups. The findings indicate that community-based solutions and collaborations among local entities, governmental bodies, and civil society organizations are crucial for mitigating flood risks. Localized, participatory initiatives are more effective than centralized and technical approaches.

The study significantly advances the literature by shifting the discourse from adaptation to transformation and emphasizing the need for an inclusive, proactive, sustainability-centered urban governance. It stresses that urban flooding isn't just an environmental problem; it's also the result of many social, economic, and political factors. This perspective is particularly relevant for understanding how urbanization and climate change create diverse vulnerabilities in places like Mumbai.

Schiller *et al.* (2007) focus on the vulnerability of global cities to climate-related hazards. Schiller *et al.* in their article on "The Vulnerability of Global Cities to Climate Hazards" examine the susceptibility of global cities to climate-related hazards by analyzing three major coastal megacities: Mumbai, Rio de Janeiro, and Shanghai. The study employs a comprehensive vulnerability framework that integrates environmental and socio-economic dimensions, emphasizing that vulnerability is shaped not only by exposure to climatic hazards but also by the capacity of urban systems to withstand and recuperate from such challenges. The authors introduce the concept of "stress bundles", which refers to the interplay among several natural and socioeconomic pressures, such as rising sea levels, intense rainfall, population growth, and inadequate infrastructure, that intensify metropolitan vulnerability.

The findings indicate that cities are significantly more susceptible to climatic hazards when they experience rapid growth, unplanned land-use changes, and substantial wealth and income disparities. The study finds that in Mumbai, living close together, informal settlements in low-lying areas, insufficient drainage systems, and environmental damage all increase the risk of flooding. The study also reveals that global cities are economic centers, but because they are coastal and growing rapidly, they are more likely to be affected by climate change, which can cause flooding, cyclones, and rising sea levels.

The analysis of Schiller *et al.* (2007) underscores that vulnerability is not evenly spread, with underprivileged groups especially those living in informal settlements experiencing the greatest dangers. It also says that current solutions don't always work because they don't address the real social, political, and structural causes of vulnerability. The research significantly advances urban and environmental sociology by linking urbanization processes to the formation of climate risk and demonstrating that urban planning and climate adaptation must be conducted in an integrated, multi-scalar, and inclusive manner.

Kambekar *et al.* (2021) review of the last ten years of climate change and rising sea levels in light of the aims of the Paris Agreement examines the impact of climate change on rising sea levels along the Mumbai coastline and their implications for future flooding through 2050. The study uses sophisticated climate modeling techniques and the MIKE 21 hydrodynamic model to assess sea-level variations across several IPCC scenarios. The study offers a thorough scientific examination of rising sea levels and their possible effects by combining data from numerous national and international sources, including IPCC reports, NASA, and Indian meteorological institutes.

The findings indicate that the sea level will increase by approximately 0.395 meters by 2050 alone due to warming. When you add land subsidence and vertical land movement, this estimate rises to about 0.6 meters. This means that Mumbai is very likely to flood along the coast, especially in low-lying areas with many people. The study emphasizes the need to evaluate urban susceptibility to climate change using both meteorological and geomorphological factors.

The study is particularly pertinent in illustrating that the effects of climate change extend beyond natural processes, affecting infrastructure, urban growth, and disaster management on a broader scale. The study underscores the need for proactive, scientifically informed risk management by focusing on predictive modeling and scenario-based analysis.

The first chapter of Ulrich Beck's (1986) book on *Risk Society: Towards a New Modernity*, Part I - *Living on the Volcano of Civilization*, lays down the issues of wealth distribution and risk distribution. He wanted to emphasize that, with the rise of modernization and industrialization, societies face different issues not only in terms of risk factors but also in the distribution of wealth among people in a particular society. By the term "wealth distribution", he meant the commonwealth,

which is unequally distributed among the people, which can be anything such as education, income, property, opportunities, etc. The term risk distribution is which he has emphasis upon that how there are number of risks which the people are going through not only in a particular city or a country, but it has also put in the environment and other ecological entities and species, putting them at risk where the past loses the power to determine the present.

5. Theoretical Framework

5.1 Risk Society

Beck's Risk Society thesis posits that in post-industrial modernity, society is structured around the creation and regulation of novel, anthropogenic (produced) dangers. Advancements in industry provide both benefits and global dangers (such as pollution and climate change), and old institutions aren't good at dealing with these unknowns. Urbanization concentrates risk; cities create new dangers (such as heat islands and developments more likely to flood) as part of modernization. Beck's theory is shown by the uncontrolled rise of Mumbai: economic progress has caused environmental problems (extreme monsoon events, pollution) that make people less safe. Climate change is a major risk because it forces cities to deal with problems from around the world on a local level.

5.2 Sustainable Development Goals [SDGs]

The 2030 Agenda (UN 2015) establishes 17 Sustainable Development Goals [SDGs] as universal aims for global development. SDG11 wants to "make cities and human settlements inclusive, safe, resilient, and sustainable", while SDG13 wants to "take urgent action to combat climate change and its effects." The 17 Sustainable Development Goals, which all UN member states have agreed to, aim to make the world a better place for people and the planet by 2030. The issues of poverty and economic growth address many social needs, such as education, health, equality, and job opportunities. They also address the biggest issues, such as climate change, and work to protect and preserve the environment, including forests, oceans, and so on.

5.3 Environmental Justice

Environmental Justice (EJ) is the idea that everyone should have access to a healthy environment and that the benefits and costs of the environment should be shared fairly. The threats posed by climate change and by cities are very different. According to EJ theory, the poorest and most marginalized people in Mumbai, like slum dwellers and lower castes, are the ones who suffer the most from floods, heat, and pollution. It shifts the analysis from the average effect to the people most affected. EJ also stresses involvement, like if slum people were part of the planning that affects them (which is often not the case). In the case of Mumbai, EJ points out that the city's growth (new highways, reclaimed land, and industrial zones) often harms already weak groups.

5.4 Ecological Modernization Theory

This theory says that industrialized nations can use technology, new ideas, and changes to institutions to “reconcile the goals of economic development and environmental protection.” It asserts that capitalism and the state can be reconfigured to facilitate sustainable production (e.g., cleaner technologies, pollution control) as part of a progressive growth plan. EMT would say that Mumbai can reduce climatic and urban risks by using technology and sound government. Some ways to reduce pollution include modern drainage systems, waste-to-energy plants, green construction standards, and public transportation. If Mumbai were becoming more environmentally friendly, it would have robust green infrastructure (such as mangrove restoration and permeable pavements) and partnerships between businesses and the government to advance environmental technology. This method aligns with the SDGs in theory and offers hope for “clean growth” in cities.

6. Findings/Results

Mumbai is one of the most populous cities in India and ranks among the largest urban agglomerations in the world. The immense population concentration in Mumbai not only reflects its global urban prominence but also intensifies its exposure to climate hazards, as high-density settlements, informal housing, and stressed infrastructure exacerbate the impacts of flooding, extreme precipitation, and coastal risks. The review of empirical studies indicates that rapid urbanization in Mumbai has significantly heightened its vulnerability to climate hazards significantly through city’s exposure and sensitivity, particularly flooding and sea-level rise. The studies collectively show that unplanned expansion, land reclamation, loss of natural buffers, and the degradation of natural drainage systems have increased the frequency and severity of urban floods, while coastal communities—especially small-scale fishing households—face growing livelihood insecurity due to changing marine ecosystems and extreme weather events. Projections of sea-level rise and coastal inundation further suggest that critical infrastructure and densely populated low-lying areas are at heightened risk, reinforcing patterns of spatial and social vulnerability. These findings demonstrate that climate risks in Mumbai are not merely environmental but are deeply embedded in socio-economic structures, disproportionately affecting marginalized populations and subsequently are more dangerous for people and their livelihoods.

United Nations’s Sustainable Development Goal 13 (SDG 13) is designed to combat climate change and its impacts, and it can significantly help a city like Mumbai—especially with risks like flooding, heatwaves, and sea-level rise. SDG 13 plays a crucial role in addressing climate change impacts in Mumbai by promoting adaptation, resilience, and disaster risk reduction. However, given the city’s complex socio-economic and environmental challenges, its effectiveness depends on how well it is implemented and how it is combined with other development goals, particularly those related to urban development, infrastructure, and poverty reduction.

From a theoretical perspective, these patterns align with Ulrich Beck's notion of risk society, wherein processes of modernization generate "manufactured risks" that are unevenly distributed across social groups. At the same time, the findings partially support Ecological Modernization Theory by indicating that technological and policy interventions—such as improved flood management systems and coastal protection measures—have the potential to mitigate risks, though their effectiveness remains constrained by governance gaps and unequal access. The framework of Sustainable Development Goals, particularly climate action, emerges as relevant but insufficient on its own, as structural inequalities and issues of environmental justice continue to shape differential vulnerability. Overall, the findings highlight that the intersection of urbanization and climate change in Mumbai produces complex, layered risks that require integrated and socially inclusive responses.

7. Discussion

This analytical review demonstrates that rapid urbanization in Mumbai has intensified the interlinkages between climate change and socio-economic vulnerabilities, thereby producing uneven patterns of risk and resilience. The findings indicate that while urban growth contributes to economic development, it simultaneously exacerbates environmental degradation and heightens livelihood insecurities, particularly among marginalized populations. In this context, Ulrich Beck's concept of "manufactured risks" is useful in explaining how modern processes of development generate new and unevenly distributed environmental hazards.

The study further highlights the relevance of Sustainable Development Goals, particularly SDG 13, as an integrative framework for addressing climate challenges through the lens of sustainability and social equity. However, its implementation remains constrained by governance gaps, spatial inequalities, and growth-oriented development paradigms. While Ecological Modernization Theory offers an optimistic perspective on aligning technological innovation with sustainability, the analysis suggests that such approaches must be complemented by stronger commitments to environmental justice and inclusive policy frameworks.

Addressing the complex challenges of climate change in rapidly urbanizing contexts requires moving beyond fragmented policy responses toward a more integrated sociological approach that connects urbanization, risk, and inequality. Effective urban policy must prioritize climate resilience, equitable resource distribution, and participatory governance to ensure that future development pathways are not only sustainable but also socially just and inclusive.

8. Conclusion

This study concludes that rapid urbanization in Mumbai has significantly intensified the interaction between climate change and social vulnerability, thereby creating uneven patterns of risk and resilience across different social groups. The analysis highlights that while development processes contribute to economic

growth, they also deepen environmental stress and livelihood insecurities, particularly among marginalized populations. It must be remembered that more than 42% of residents in Mumbai live in slums and as such they are more exposed to climate risks (Kaneekar and Vaze, 2022). Prioritizing more vulnerable and marginalized communities and making them part of the planning process is vital. The relevance of Sustainable Development Goal 13 emerges as crucial in guiding sustainable and inclusive urban transitions, though its effectiveness depends on context-sensitive implementation and governance capacity. Overall, the study emphasizes that achieving sustainable urban futures requires integrating climate resilience, social equity, and participatory governance into the core of development planning, ensuring that growth is both environmentally sustainable and socially just.

9. Policy Measures and Urban Development Strategies for Climate Resilience

Findings/results of this study suggests that a coherent policy response to the intersecting challenges of urbanization, climate change and social risk in Mumbai. Urban development strategies for climate resilience require an integrated and equity-oriented approach that aligns urban planning with climate resilience, focus more on the integrating nature-based solutions (such as green roofs, urban forests, parks, wetlands, biodiversity enhancement etc.), upgradation of infrastructure so that it can handle extreme weather and also updating land-use planning that is required to restrict development in high-risk zones, implement buffer zones, control development on hazardous land as well as protect natural ecosystems

India-Specific government and non-government agencies like National Institute of Urban Affairs (NIUA), The Energy and Resources Institute (TERI), GIZ India, Coalition for Climate Resilient Investment (CCRI), Asian Development Bank (ADB), City planners and policymakers should prioritize climate-sensitive land-use regulation, strengthen coastal and flood management systems and, at the same time, invest in green and blue infrastructure to mitigate environmental risks.

In line with Sustainable Development Goal 13, there is an underlined need to embed climate adaptation and mitigation strategies within local governance frameworks, ensuring that development projects incorporate sustainability assessments and risk audits. Equally important is the inclusion of vulnerable communities in decision-making processes to address issues of environmental justice and uneven risk distribution. Institutional coordination across municipal bodies, improved data-driven planning, as well as the promotion of sustainable livelihoods can further enhance urban resilience. Overall, it must be stressed that the policy interventions must move beyond fragmented sectoral approaches toward a holistic model that integrates ecological sustainability, social equity, and economic development.

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