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Social imperatives in creating a flood resilient city: A Case Study of Ethekwini Municipality in South Africa

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Abstract

The case of the eThekwini Municipality, where the city of Durban is located, is a good example of challenges that accrue to the urban areas whenever the discourse turns to climate change and disaster risk management. The following reasons highlight why eThekwini stands out globally in terms of its geographical and socio-economic characteristics as it contends with the effects of urbanization. It is important to note that the population of the municipality is quite heterogeneous, and the area hosts both planned and unplanned urban settlements. The area suffers from flooding and potential future sea level rise effects along its coastline. The objective of this case study will be to identify the measures and difficulties regarding the process of developing a post-flood city based on the qualitative analysis of previous literature and policy evaluations.

Keywords: *Flood Resilience, Ethekwini Municipality, Urbanization, Disaster Risk Management, and Technological Innovations*

Introduction

Flooding in South Africa's eThekwini Municipality is an urgent crisis exacerbated by its floodplain location, rapid urbanization, and socio-economic challenges. In South Africa, out of all the areas, the eThekwini Municipality, which comprises the city of Durban, is especially prone to flooding because it is situated in a flood plain and is facing problems such as rapid urbanization and poor socio-economic indicators. The purpose of this paper is to discuss the measures that can be taken toward developing a post-disaster floodresistant city using a case study of eThekwini Municipality. With the theme of exploring the relationship between urbanization, disaster risk reduction, and post-disaster community resilience, the research makes an important contribution to the literature.

Background

The Context of Ethekwini Municipality

Ethekwini Municipality is mainly comprised of people from various socioeconomic backgrounds, whereby a significant number of its inhabitants reside in the slums with high risks of flooding. Study shows that these communities are highly prone to floods because the process of urbanization has accelerated here and the

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rate of building structures increased without considering the potential flooding in the future due to the urban mass (Lv et al., 2020). The transformation of permeable surfaces into impermeable ones, such as concrete and asphalt, has diminished the natural drainage capacity of the area, leading to increased surface runoff and flash floods.

Technical and Institutional Challenges

The evaluation of disaster management in eThekwini explicates some technical and institutional issues. Inconsistencies and gaps can be noticed in the current plans and frameworks regarding disaster management, and some of the core elements are missing, such as the Disaster Management Advisory Forum (Duze & Reddy, 2020). The Disaster Management Advisory Forum is missing which is most probably due to inadequate planning, resource constraints, lack of political will, or administrative oversight. This absence of institutions indicates the need for improved management and coordination of risks when disasters occur, incorporating several other departments and stakeholders in the municipality. Mashao et al. (2023) assert that to effectively address the impacts of flooding, one of the most severe natural disasters, flood risk management strategies must employ a comprehensive approach.

From the previous studies, one learns that there is a great need to undertake development planning that involves an assessment of disaster risks and prevention measures. Moreover, in light of this minimal coordination with the community as well as other departments, a study by Duze and Reddy (2020) highlights the necessity for integrated development planning, involving community coordination and sectoral connectivity, for effective municipal disaster risk reduction and preparedness. Disaster risk reduction activities are effective when they are incorporated into and complement legal, fiscal, and planning structures.

Vulnerability of Marginalized Communities

The high risk of females in the eThekwini Municipality to flooding is an essential issue concerning marginalized groups. Studies demonstrate that the adaptive capacity and the welfare of women in local informal settlements are limited, even though many development initiatives are targeted at the economic front (Michael, 2024). The occupation of hazardous areas characterized by the provision of poor and inadequate infrastructure and services raises the vulnerability of these informal settlements to hazards such as floods. To enhance the strategies for coping with flood incidences, gender vulnerabilities, and inequalities should be taken into consideration. Pre-flood mapping, effective drainage systems, flood-resistant materials, and protecting natural waterways are also crucial mitigation techniques (Han et al., 2022).

The Role of Urban Planning

It is worth noting here that urban planning has the central role of undertaking all the processes in order to develop flood-resistant cities. A study highlighted that proactive disaster risk reduction management within the framework of urban development is key to the improvement of community resiliency (Bongiwe & Mpuzu, 2023). This approach entails assessing the predispositions of the various groups of the population, especially those in the flood basins. Thus, flood resilience in urban planning means that municipalities are prepared to improve their adaptation to climate change and the progress of urbanization.

Technological Innovations

A study found that technologies associated with the use of IoT solutions for flood monitoring and early warning systems must form the foundation of improvements in flood preparedness and response (Pillay et al., 2023). They allow for data gathering and analyzing the data to give timely responses to flood incidences. IoT-based sensors can monitor the availability of water and weather conditions, among other parameters, that can be alarming to the authorities or the residing population as soon as they rise to a certain level. In addition, such systems can improve cooperation with the emergency services to maximize the utilization of resources and immediate response during emergencies. In areas prone to disasters, particularly in slum areas, it is possible to estimate the number of victims and losses through the application of efficient early warning systems.

Methodology

The type of research utilized for this study is a qualitative case study research design, and the type of data used is secondary data collected from the existing literature pertaining to disaster risk management and urban planning in the eThekwini Municipality. Analyzing various academic publications helps in outlining the possible consequences of flooding and the efficiency of modern measures aimed at reducing these threats. Understanding the dynamics of flood resilience in urban areas begins with a comprehensive review of existing literature.

Findings

Historical Lessons for Modern Urban Design: The study points to the importance of acquiring knowledge from the early urban practices, for instance dispersion pattern that was adopted by early urban settlements like Jenne- Jeno which had a decentralized dispersion pattern that was efficient in preventing flood occurrences (Tebboth, 2020). Subsequent studies should explore options for applying the above-mentioned historical strategies in current urban planning in Ethekwini Municipality, especially in terms of natural systems of water management and further inclusion of communities.

Need for Comprehensive Disaster Management Frameworks: Previous works reveal that Ethekwini Municipality still has no integrated disaster management policy and existing plans are characterized by gaps and seem more like short-term plans (Sibiya, 2022). This gap shows the need for analyzing disaster risks, coordinating with other actors, and investing in advanced disaster risk reduction for the purpose of increasing private households' flood resilience.

Impact of Informal Settlements on Flood Vulnerability: The research highlighted that the increasing population densities in the flood-prone areas increase vulnerability, especially among informal settlers, and minority groups (Udo & Naidu, 2023). Subsequent research should focus on the precise operations of these communities, evaluating how the absence of archival and supplier structures raises the susceptibility to floods and identifying ways to strengthen their protection.

Gendered Vulnerabilities in Flood Risk Management: The research highlights the need for knowledge regarding the flood experiences of the local black African women as their concerns remain insignificant in standard flood risk models (Udo & Naidu, 2024). Studies should focus on the integration of gender considerations

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into flood mitigation measures so that the special consideration and strengths of the female sex shall not be marginalized.

Ecosystem-Based Adaptation (EbA) Strategies: On the basis of the above literature, ecosystem-based adaptation was proposed to be an effective way of addressing flood risks in Ethekwini (Sakic Trogrlic et al., 2022). Yet, the effectiveness of EbA interventions and their implementation in the region has been addressed by limited research. It is recommended that further research examines actual examples of EbA and evaluates how they performed in terms of reducing flood risk as well as improving the quality of life of communities.

Community Engagement in Disaster Preparedness: The research has further revealed the significant importance of embracing an active engagement of the populace in disaster risk reduction measures and management (Sausi et al., 2023). Currently, there are significant knowledge deficits regarding the correct prescription on how to engage local communities in the mitigation of floods. More research should be focused on the type of intervention that engulfs the community with activities that involve them in disaster and disaster risk reduction education.

Long-Term Recovery and Resilience Building: The research points out that the time required for the recovery from floods is long implying that long-term approaches are important (Rasebechele, 2022). More research should also address the continuity of recovery in phases to look at the social, economic, and environmental factors that either support or adversely affect the processes for rebuilding reliability in the aftermath of a flood.

Discussion

The study also shows that eThekwini Municipality has experienced a rapid rate of urbanization, which has contributed to flooding exacerbated by infringement on floodprone zones and therefore degrading natural drainage systems hence increasing surface runoff. The lack of an efficient disaster management body, poor disaster management plans, the lack of an active Disaster Management Advisory Forum, and the lack of flood control mechanisms also reduce the ability of the municipality to manage flood crises efficiently. Furthermore, gender disparities make it even worse for minority women in the face of floods because women have social, economic, and cultural restrictions compared to their male counterparts when it comes to disaster management and response. Hence, gender mainstreaming is imperative in disaster risk management through improved resource accessibility and the enforcement of community education policies. Furthermore, it is crucial to incorporate disaster risk reduction strategies into urban development processes in order to build flood-proof cities. This entails pre-flood hazard mapping and mitigation techniques like efficient civil drainage systems, materials that are flood resistant, and protecting natural drainage systems like rivers. These integrated approaches not only focus on gender but also help foster community awareness and coping strategies when applied to technical, institutional, and social solutions to improve flood management in eThekwini.

Conclusion

1. Strengthening Institutional Frameworks: The Disaster Management Advisory Form, especially in Ethekwini Municipality, should be made more functional to foster improved coordination between the various stakeholders in the institution.
2. Enhancing Community Engagement: It is also important that local communities, especially those in vulnerable groups of society, should be involved in the planning and delivery of disaster risk reduction measures (Tebboth, 2020). This participatory approach is helpful for the inclusion of all stakeholder's viewpoints, specifically vulnerable persons.
3. Integrating Gender Perspectives: This calls for the integration of gender consideration in flood resilience measures for flood risk-affected areas because women are disadvantaged in such regions (Udo and Naidu, 2024). Specific strategies should therefore focus on the strengthening of women as well as increasing the capacity of vulnerable women who need to adapt to the situation.
4. Promoting Sustainable Urban Development: More initiatives need to be implemented in addressing urban planning to embrace sustainable development principles that can reduce flooding (Govender & Cloete, 2023). This ranges from planning and maintaining natural drainage basins, enhancing the use of green infrastructure, and improving permeable surface procedures in the design and layout of cities.
5. Investing in Early Warning Systems: IoT-based flood monitoring and early warning systems can be cost-effectively developed, which can improve the capability of the municipality to address the issue of flooding (Pillay et al., 2023). They should be incorporated into the established disaster management structures for effectiveness in disaster management.

References

1. Bongiwe, D., & Mpuzu, S. M. (2023). The Extent of Community-Level Initiatives in Addressing Natural Disasters in Informal Settlements: A Case Study of Fires in eThekwini Informal Settlements. Journal of Public Administration, 58(2), 269–283. https://doi.org/10.53973/jopa.2023.58.2.a3
2. Duze, M., & Reddy, P. S. (2020). Disaster Risk Management at the Local Level: The Case of Ethekwini City Council in South Africa. In P. S. Reddy & H. Wissink (Eds.), Reflections on African Cities in Transition: Selected Continental Experiences (pp. 247–271). Springer International Publishing. https://doi.org/10.1007/978-3-030-46115-7_12
3. Govender, V., & Cloete, M. C. (2023). Exploring the Role of Sustainability in PeriUrban Communities Using Innovative Urban Strategies: A Case Study of GibaGorge Precinct, eThekwini KZN. In Handbook of Research on Managing the Urban-Rural Divide Through an Inclusive Framework (pp. 226–245). IGI Global. https://doi.org/10.4018/978-1-6684-6258-4.ch013
4. Han, Y., Mao, L., Chen, X., Zhai, W., Peng, Z.-R., & Mozumder, P. (2022). Agentbased Modeling to Evaluate Human–Environment Interactions in Community Flood Risk Mitigation. Risk Analysis, 42(9), 2041–2061. https://doi.org/10.1111/risa.13854
5. Lv, H., Guan, X., & Meng, Y. (2020). Comprehensive evaluation of urban floodbearing risks based on

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DOI: 10.5281/zenodo.23970357

combined compound fuzzy matter-element and entropy weight model. Natural Hazards, 103(2), 1823–1841. https://doi.org/10.1007/s11069-020-04056-y

6. Mashao, F. M., Mothapo, M. C., Munyai, R. B., Letsoalo, J. M., Mbokodo, I. L., Muofhe, T. P., Matsane, W., & Chikoore, H. (2023). Extreme Rainfall and Flood Risk Prediction over the East Coast of South Africa. Water, 15(1), Article 1. https://doi.org/10.3390/w15010050
7. Michael, T. O. (2024). Adapting to climate change-induced flooding: Insights from women traders in the riverine areas of Nigeria—a qualitative study. Frontiers in Sustainability, 5. https://doi.org/10.3389/frsus.2024.1385513
8. Pillay, K. S., Shanmugam, K., & Rana, M. E. (2023). Recommendations for Developing an Affordable IoT-Based Flood Monitoring and Early Warning System. 2023 15th International Conference on Developments in eSystems Engineering (DeSE), 143–148. https://doi.org/10.1109/DeSE58274.2023.10099530
9. Rasebechele, P. M. J. (2022). Evaluating the impact of governance in mitigating climate change in the West Rand District Municipality, Gauteng, South Africa—University of Johannesburg. University of Johannesburg. https://ujcontent.uj.ac.za/esploro/outputs/graduate/Evaluating-the-impact-ofgovernance-in/9926808207691
10. Sakic Trogrlic, R., van den Homberg, M., Budimir, M., McQuistan, C., Sneddon, A., & Golding, B. (2022). Early Warning Systems and Their Role in Disaster Risk Reduction (B.Golding, Ed.; pp. 11–46). Springer. https://doi.org/10.1007/978-3- 030-98989-7_2
11. Sausi, K., Kanyane, M., Davids, Y. D., Gumede, N., Houston, G., Mchunu, N., Zondi, T., Ngqwala, N., Cosser, M., & Bohler-Muller, N. (2023). Evaluating the District Development Model: A review, with case studies: summary report. https://doi.org/10/19737
12. Sibiya, G. N. (2022). Information and communication technology in disaster preparedness by eThekwini Municipality [Thesis]. https://doi.org/10.51415/10321/5076
13. Tebboth (DEV), M. (2020). Foundations for climate resilient and sustainable growing settlements (U-RES) | Policy Commons. https://policycommons.net/artifacts/2283805/foundations-for-climate-resilientand-sustainable-growing-settlements-u-res/3043893/
14. Udo, F., & Naidu, M. (2023). Exploring Black African women's experiences of vulnerability and adaptation to flood impacts in the eThekwini metropolitan municipality, KwaZulu-Natal, South Africa. International Journal of Disaster Risk Reduction, 93, 103798. https://doi.org/10.1016/j.ijdrr.2023.103798
15. Udo, F., & Naidu, M. (2024). Assessing local government's response to black women's vulnerability and adaptation to the impacts of floods in the context of intersectionality: The case of eThekwini metropolitan municipality, South Africa. Environmental Policy and Governance, 34(1), 31–41.

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