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Challenges of Urban Governance in Heatwave Mitigation and Adaptation: A Study on Rajshahi City Corporation

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Abstract

Urban areas in developing countries like Bangladesh are becoming increasingly vulnerable to extreme heatwaves due to rapid urbanization, climate change, and inadequate governance mechanisms. This study explores the challenges of urban governance in mitigating the effects of heatwaves in selected city corporations of Bangladesh, with a particular focus on Rajshahi City Corporation (RCC), which has frequently recorded some of the highest temperatures in the country. Drawing on both primary data collected from 300 residents and key informant interviews with relevant city officials, the research identifies institutional, infrastructural, and financial barriers to effective heatwave governance. Findings reveal a significant gap between policy formulation and implementation, lack of coordination among relevant departments, limited public awareness campaigns, and inadequate early warning and emergency response systems. Furthermore, poor urban planning, insufficient green spaces, and inefficient resource allocation exacerbate heatwave vulnerabilities, particularly among low-income populations. The study highlights the limited engagement of local communities and the absence of data-driven forecasting and response strategies. Based on the findings, the paper suggests strengthening inter-agency collaboration, enhancing institutional capacity, incorporating heat-resilient infrastructure, and promoting forecast-based financing (FbF) to improve preparedness and adaptive capacity. The research contributes to the growing body of literature on climate resilience and urban governance in the Global South and offers practical policy recommendations to build heat-resilient cities in Bangladesh and similar contexts.

Keywords: Urban Governance; Heatwave Mitigation; Climate Resilience; Rajshahi City Corporation; Forecast-Based Financing (FbF)

1. Introduction

The frequency, severity, and length of heat waves have greatly changed globally in recent years, endangering public health, urban infrastructure, and ecosystem sustainability (Marcotullio et al., 2022; Masson et al., 2021; Depietri et al., 2012). Among the most impacted areas is South Asia, especially Bangladesh, whose dense population, fast urbanization, and poor adaptive capability have made it a hotspot of climatic vulnerability (Uddin, 2024; Tucker et al., 2015). Already subjected to the urban heat island (UHI) effect, urban areas are disproportionately affected by heat waves, which

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aggravate socioeconomic inequality, strain public services, and cause avoidable mortality and morbidity (Heaviside, 2020). As a reaction to this rising threat, the role of urban governance has received renewed significance in defining heatwave mitigation and adaptation programs (Zaidi & Pelling, 2015). In Bangladesh, however, despite the expanding policy rhetoric around climate adaptation, urban governance structures remain weak and ill-equipped to respond effectively to the complexities of climate-induced disasters, particularly heatwaves (Naser, 2012).

The purpose of this study is to explore the challenges of urban governance in heatwave mitigation and adaptation in the RCC, Bangladesh, with a focus on identifying the institutional, infrastructural, and socio-economic barriers hindering effective heatwave governance. Rajshahi, which lies in Bangladesh's northwest and has little tree cover, inadequate ventilation, and concrete-dominated infrastructure, experiences severe UHI impacts that heighten the severity of heat waves (Hossain et al., 2024; Tawsif et al., 2022). Rajshahi, one of the major urban areas in Bangladesh, has been repeatedly recognized as one of the hottest cities in the country over recent summers (Shahid et al., 2016; Tawsif et al., 2022). Rising to 42.6°C in 2023, the hottest recorded in decades, the city has seen hitherto unheard-of temperature swings (Hossain et al., 2024). In order to comprehend why cities like Rajshahi endure more severe heatwaves than the rural areas around them, it is essential to consider the UHI effect (Hossain et al., 2024). The UHI effect happens when urban areas especially those with dense infrastructure like concrete buildings, asphalt roads, and little green space, absorb and retain more heat during the day and release it gradually at night, (Mohajerani et al., 2017). As a result, cities get much warmer than their rural counterparts, which makes the impact of heatwaves worse and raises the need for cooling equipment in cities. The UHI effect is more pronounced in Rajshahi due to the lack of urban green spaces and insufficient planning for heat-resilient infrastructure. As highlighted in previous studies (Hossain et al., 2024; Shahid et al., 2016; Tawsif et al., 2022), Rajshahi's UHI effect significantly raises the city's vulnerability to extreme heat, further exacerbating the public health impacts of heatwaves. Moreover, the majority of the urban poor in Rajshahi reside in high-density informal settlements with limited access to cooling systems, potable water, and healthcare, rendering them highly sensitive to heat-related stress (Hossain et al., 2024). In this setting, governance plays a vital role in mobilizing resources, creating early warning systems, establishing green infrastructure, and encouraging community-based adaptation solutions.

Urban governance, widely defined as the interplay between official institutions, civil society, and local communities in addressing urban concerns, is vital for climate resilience (Pierre, 2011). Effective urban governance entails proactive planning, cross-sectoral collaboration, participatory decision-making, and transparency in resource distribution (Neely et al., 2021). In the context of studies on urban governance and climate resilience, Rajshahi is frequently categorized as a secondary city. Numerous criteria, such as the population size, economic activity, and level of infrastructure development are used to determine this classification (Alam et al., 2025). Rajshahi and other secondary cities are crucial regional centers that provide resources and services to the nearby rural communities (Ilme Faridatul, 2014). Nonetheless, Rajshahi is smaller in population, has less built infrastructure, and has less funding set aside for climate resilience initiatives than major towns like Dhaka or Chittagong. However, governance in Bangladesh’s urban sectors, particularly in secondary cities like Rajshahi, suffer chronic issues such as weak institutional coordination, insufficient budgetary allocation, limited technical capacity, and a top-down approach to policymaking (Zafarullah & Ferdous, 2024). These issues are further worsened by political interference, lack of autonomy at the municipal corporation level, and insufficient integration of climate change into local development planning (Corfee-Morlot et al., 2009). As a result, heatwave management is frequently reactive rather than anticipatory, focusing on emergency solutions rather than long-term mitigation and adaptation initiatives.

The recent heatwave events in Rajshahi have shown severe governance flaws in reacting to the situation. Despite being under extreme heat stress, Rajshahi City Corporation (RCC) has few policies and institutional structures directly addressing heatwaves. Existing Disaster Management Plans, developed under national frameworks, do not prioritize urban heat as a distinct hazard, resulting in inadequate forecasting, minimal public communication, and poor coordination between RCC and health or environment departments (Shahid et al., 2016; Tawsif et al., 2022). Moreover, the absence of climate-sensitive urban design, such as shaded walkways, green areas, and reflective roofing, demonstrates a governance failure in mainstreaming heatwave considerations into urban planning. The issue is not only technical but also political and institutional, involving power relations, bureaucratic inertia, and a lack of accountability procedures.

2.0 Literature Review

Urban areas across the globe are getting increasingly vulnerable to climate-induced dangers, and among them, heatwaves have emerged as one of the most prevalent and lethal hazards, particularly in the context of global warming (AghaKouchak et al., 2020). The UHI effect, resulting from high population density, built-up surfaces, and limited greenery, enhances the impact of heatwaves in cities, rendering them more vulnerable to health and infrastructural shocks (Santamouris, 2015). In this context, the topic of urban governance has attracted substantial attention in climate change adaptation literature.

Several global studies have studied how cities can efficiently regulate excessive heat. The seminal work of Harlan and Ruddell (2011) demonstrated how social and environmental vulnerabilities connect with government inadequacies to raise heatwave mortality in cities like Phoenix, Arizona. Likewise, research on Ahmedabad's Heat Action Plan in India have demonstrated that evidence-based, city-level planning, public awareness, and inter-sectoral collaboration can considerably reduce heat-related mortality (Knowlton et al., 2014). The Ahmedabad case highlights how climate adaptation can be localized through novel governance models including city authorities, meteorological departments, public health institutions, and community organizations (Knowlton et al., 2014). Similarly, other cities, such as Los Angeles, Paris, and Melbourne, have integrated heatwave adaptation into their larger urban climate resilience strategies through institutional reforms, urban greening programs, and early warning systems (Stone et al., 2010; Oleson et al., 2013). These experiences demonstrate that local governments, when sufficiently empowered and organized, can play a transforming role in mitigating excessive heat.

In contrast, cities in developing nations have major governance challenges in handling climatic stressors such as heatwaves. The research on urban governance in the Global South generally underlines the issues of weak institutional capacity, limited fiscal autonomy, fragmented authority, and inadequate stakeholder involvement (Parnell & Robinson, 2012). In South Asia, cities such as Dhaka, Karachi, and Colombo have been reluctant to institutionalize climate-responsive urban government, partly due to competing development objectives and the absence of decentralization (Bonifacio et al., 2010). According to Söderström (2013), urban government in many Asian cities is characterized by ad hocism, elite capture, and inadequate coordination between municipal authorities and national agencies, which prevent sustained climate action. In the context of heatwaves, this translates into poor preparedness, delayed responses, and disproportionate consequences on vulnerable populations such as slum dwellers, street vendors, and the elderly (Tan et al., 2010).

The literature on climate governance in Bangladesh displays similar limits. Although Bangladesh is widely known for its creative methods to cyclone and flood management, the governance of heatwaves remains underexplored in academic and policy discourses (Huq et al., 2015). Most

national climate change plans, such as the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) and the National Adaptation Programme of Action (NAPA), focus largely on floods, riverbank erosion, and cyclones, with scant reference to excessive heat (MoEFCC, 2009). Even the Delta Plan 2100, which gives a long-term vision for climate resilience, fails to explicitly include heatwave mitigation into urban planning frameworks. Recent research by Hossain et al. (2024) proposes that this policy gap represents a broader epistemic neglect of heat as a climate danger in Bangladesh, despite rising evidence of temperature rise and heat-related health difficulties in cities like Rajshahi and Khulna.

From a governance standpoint, urban municipal organizations such as City Corporations in Bangladesh suffer from persistent institutional flaws. According to Ayers et al. (2014) and Araos et al. (2017), most city corporations lack the financial autonomy, human resources, and technical knowledge required to create and implement localized climate adaptation programs. In Bangladesh, urban governance usually functions in a top down manner, with central ministries exercising major control over money, project approval, and planning choices, leaving city corporations in a reactive and subordinate position. Several parts of this study are closely aligned with the conclusions presented by Zafrullah and Ferdous (2024), especially with regard to the difficulties urban governance faces in minimizing hazards associated with climate change. Their study identifies comparable institutional obstacles like inadequate funding, low public awareness, and poor coordination among government institutions that impede successful climate adaptation in urban Bangladesh. Unlike Zafrullah and Ferdous (2024), this work focuses on the problem of heatwave mitigation in context of RCC. Their research looks at climate adaptation initiatives in different metropolitan locations, but this study offers a more in-depth, localized look at Rajshahi's ability to handle heatwave threats, which are made worse by the UHI impact and a lack of green infrastructure. Additionally, whereas both studies stress the value of interagency cooperation, this research further elaborates on the challenges RCC faces in effectively coordinating its departments, particularly in terms of integrating heatwave adaptation into broader urban planning and disaster management strategies.

At the same time, there is a rising body of work calling for Forecast-based Financing (FbF) as a proactive governance instrument for climate adaptation in Bangladesh (Rahman et al., 2024). FbF involves delivering cash before an anticipated disaster occurs, allowing for early response and preparedness (Coughlan de Perez et al., 2015). While this method has been applied to floods and cyclones by groups such as the Red Cross and UN agencies, its applicability to heatwaves remains restricted. However, the FbF model presents a potential governance innovation that could solve some of the institutional and operational delays in heatwave response in places like Rajshahi. Integrating FbF into urban government could enable RCC to build localized heat action plans, mobilize resources in advance, and coordinate with public health and meteorological authorities more efficiently.

Another relevant strand in the literature is the role of green infrastructure in urban climate governance. Urban greening, including the establishment of parks, green roofs, and tree-lined roadways, has been found to considerably reduce UHI impacts and increase thermal comfort in cities (Gill et al., 2007; Norton et al., 2015). Yet, the governance of green infrastructure remains poorly structured in many cities of the Global South, including those in Bangladesh. A recent study reveals that urban greening efforts in Bangladesh are generally project-based, donor-driven, and divorced from broader urban planning processes (Sultana et al., 2022). As a result, they fail to establish long-term climate resilience or equitable outcomes. The absence of heat-sensitive urban design principles and zoning rules further exacerbates the problem.

In terms of public perception and social vulnerability, recent multidisciplinary researches have underlined the necessity to include local knowledge and citizen feedback into heatwave governance (Martin et al., 2022). In Bangladesh, however, there is a shortage of empirical evidence on how urban inhabitants experience heatwaves, what coping techniques they choose, and how they judge government actions. A study by Jabeen (2019) indicates that residents in informal settlements of Khulna utilized informal coping techniques such as increased water consumption, usage of traditional cooling materials, and temporary migration during extreme heat. These adaptive behaviors are rarely included in formal governance procedures, resulting in a gap between policy formulation and ground reality. As such, participatory governance and community participation emerge as key features of effective heatwave management, especially in low-resource urban contexts.

The literature discloses various gaps that this study tries to fill. First, while there is extensive study on climate adaptation governance, few studies have focused especially on heatwaves in the urban governance setting of Bangladesh. Second, although best global practices in heat action planning offer useful insights, their relevance in secondary Bangladeshi cities like Rajshahi remains under-examined. Third, there is a dearth of empirical studies on institutional obstacles, stakeholder cooperation, and public perceptions connected to heat governance at the municipal corporation level. This research aims to bridge these gaps by offering a context-specific analysis of the governance landscape in RCC, with a focus on identifying institutional bottlenecks, assessing community-level vulnerabilities, and recommending actionable pathways for heatwave mitigation and adaptation.

3.0 Theoretical Framework

Urban governance is a complex and multidimensional topic when taking climate change and heatwave response into account. In its broadest sense, urban governance describes the systems, procedures, and exchanges that city officials, businesses, and civil society use to collaborate on urban issues (Pierre, 2011). In order to lessen the effects of extreme weather events like heatwaves, cities must implement efficient governance frameworks as the threat posed by climate change continues to grow. A crucial theoretical framework for comprehending how cities might manage their vulnerabilities and adjust to the changing climate is the idea of urban climate resilience (Bulkeley et al., 2013). Urban resilience is the ability of urban areas to foresee, prepare for, and react to climate-related risks in ways that minimize risk, enhance recovery, and maintain essential urban functions (Pelling, 2011).

A key element in the development of climate-resilient cities is the integration of climate change adaptation into urban governance systems. Climate adaptation is the process of adjusting urban systems to reduce the negative impacts of climate change, such as heatwaves, flooding, and droughts. According to Adger et al. (2007), successful adaptation involves addressing the underlying social, economic, and institutional vulnerabilities that exacerbate exposure to climate hazards. For cities in the Global South, such as those in South Asia, these vulnerabilities are often amplified by rapid urbanization, informal settlements, and inadequate infrastructure, which further complicate governance and policy implementation for climate adaptation (Satterthwaite et al., 2019). In such contexts, urban governance must transcend traditional top-down decision-making models, incorporating inclusive and participatory approaches to ensure that marginalized communities are not excluded from the benefits of adaptation measures (Betsill & Bulkeley, 2006).

The concept of institutional capacity is central to understanding the challenges faced by urban governments in adapting to heatwaves. The effectiveness of urban governance in heatwave mitigation is closely tied to the institutional arrangements, resources, and capacities of city

authorities to implement and enforce policies. Governance mechanisms that are fragmented, underfunded, or lack coordination between agencies often result in ineffective climate responses (Corfee-Morlot et al., 2009). Additionally, the absence of climate considerations in urban planning and development processes can lead to the construction of infrastructure that exacerbates the UHI effect, increasing vulnerability to heatwaves. Studies by Santamouris (2015) and Masson-Delmotte et al. (2021) emphasize the importance of incorporating green infrastructure and climate-sensitive urban design in mitigating heat stress in cities. Urban greening, such as the development of parks, tree-lined streets, and green roofs, has been useful to reduce surface temperatures and improve urban resilience by providing shade, cooling the air, and promoting social cohesion (Gill et al., 2007).

In parallel, vulnerability theory offers a valuable perspective for understanding how social and economic factors intersect with environmental risks, particularly in urban contexts where inequality and marginalization are prevalent. Vulnerability is defined as the degree to which a system is susceptible to, and unable to cope with the adverse effects of climate change (Füssel, 2007). In cities, vulnerable populations, such as the elderly, low-income groups, and informal settlers, are disproportionately affected by heatwaves due to inadequate access to cooling systems, healthcare, and other essential resources. The social vulnerability framework, as proposed by Wisner et al. (2004), argues that vulnerability is not merely a function of exposure to hazards but also of the socio-political and economic factors that shape the capacity to respond to such hazards. In this way, urban governance must focus on building resilience not only through physical infrastructure but also by addressing the socio-economic vulnerabilities that make certain populations more susceptible to heat-related health impacts.

Finally, the governance for climate adaptation framework (Bulkeley & Betsill, 2005) emphasizes the role of multi-level governance in achieving effective adaptation outcomes. This framework suggests that local governments, national agencies, and international organizations must collaborate to implement policies that address the interrelated challenges of climate change. In many urban settings, especially in developing countries, political will and institutional coordination are often the greatest barriers to effective climate governance. The lack of political commitment and the dominance of short-term development goals can hinder the integration of long-term climate adaptation strategies into urban planning (Betsill & Bulkeley, 2007). Therefore, for urban areas like Rajshahi, where heatwaves are becoming increasingly frequent and severe, establishment of strong governance frameworks that foster collaboration across sectors and scales is critical for ensuring sustainable climate adaptation.

4.0 Methodology

The study employs a mixed-methods approach to investigate the challenges of urban governance in heatwave mitigation and adaptation in RCC, Bangladesh. Primary data were collected through a stratified random sample of 300 urban residents across six selected wards, representing both low-income and middle-income areas. Structured questionnaires were used to gather information on socio-demographics, residents' heatwave experiences, awareness of governance responses, and perceptions of RCC's heatwave management efforts. Additionally, 20 Key Informant Interviews (KIIs) were conducted with stakeholders, including RCC officials, disaster management personnel, urban planners, health experts, and NGO representatives. Quantitative data from the surveys were analyzed using descriptive statistics (SPSS), while qualitative data from the interviews were analyzed thematically, focusing on key themes related to institutional capacity, coordination, resource constraints, and community engagement in heatwave management. This approach ensures a comprehensive understanding of the governance challenges in RCC's response to heatwaves.

5.0 Results and Discussion

5.1 Organizational and Institutional Challenges in Heatwave Mitigation and Adaptation

Within urban governance frameworks, institutional and organizational difficulties play a crucial role in determining how well heatwave adaptation and mitigation initiatives operate. Effective action is severely hampered by government agency and division fragmentation and a lack of cooperation (Bulkeley & Betsill, 2005). The implementation of comprehensive and integrated heatwave resilience measures is hampered by this lack of coordination, which frequently leads to redundant efforts, wasteful resource allocation, and disconnected plans (Bulkeley et al., 2014). During KII, a respondent argues,

> It can be challenging to collaborate while working across departments and divisions in the government when people are working on the same projects and have similar ideas but aren't taking a coordinated, comprehensive approach (KII, Rajshahi, Bangladesh).[5]

Moreover, institutional changes are required to improve planning, decision-making, and capacity-building initiatives because of the changing nature of heatwave threats brought on by climate change (IPCC, 2014). To guarantee proactive and adaptable reactions, institutions need to adjust to shifting environmental conditions and new problems (Bulkeley et al., 2014). But the adoption of novel approaches and the incorporation of climate considerations into governance frameworks may be hampered by institutional inertia and resistance to change (Bulkeley & Betsill, 2005). In this aspect, a KII respondent says,

> As heatwaves are predicted to become more common due to climate change, more planning, and teaching will be needed to determine what needs to be done. Therefore, I think there needs to be an institutional shift that is probably required (KII, Rajshahi, Bangladesh).[6]

Furthermore, the necessity for institutions to take a more proactive approach to building resilience and assisting with adaptation initiatives is becoming increasingly apparent. Although changing one's own behavior is crucial, heatwaves can present systemic problems that cannot be solved by relying alone on this strategy (Adger et al., 2007). To improve communities' ability to adapt, institutions should actively participate in resilience-building initiatives, including policy creation, land-use planning, and infrastructure development (UNDP, 2019). During KII, a respondent says,

> The main obstacles to constructing resilience, in my opinion, are institutional. I believe that too much emphasis has been placed on trying to influence people to alter their behavior in response to extreme occurrences. Institutions should play a part in fostering a resilient society (KII, Rajshahi, Bangladesh).[7]

However, institutional obstacles such as insufficient financing, bureaucratic procedures, and lack of ability frequently prevent resilience measures from being implemented effectively (Bulkeley et al., 2014). Institutional changes that emphasize resilience-building initiatives, encourage intersectoral cooperation, and support adaptive governance mechanisms are necessary to overcome these obstacles (Bulkeley & Betsill, 2005). Moreover, measures aimed at increasing capacity, knowledge exchange, and technology transfer can fortify institutional capacities and augment resistance to

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[5] Sajedur Rahman, Program Officer of Bangladesh Red Crescent Society, Key Informant Interview (KII), 05 April 2024

[6] Program Director, DASCOH, Rajshahi, Key Informant Interview (KII), 15 April 2024

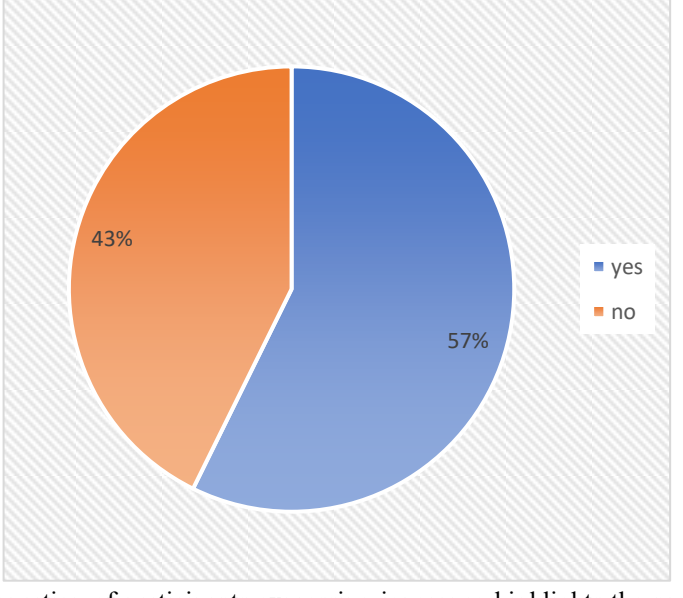
[7] Assistant Engineer, Bangladesh Water Development Board, Rajshahi, Key Informant Interview (KII), 19 April 2024

heatwave hazards (Pelling & Blackburn, 2013). Urban governance frameworks can enhance their capacity to successfully adjust to changing climatic conditions and lessen the effects of heatwaves by tackling these organizational and institutional problems.

5.2 Urban Residents' Lack of Information Regarding Heatwave Adaptation and Mitigation

From the gathered data, it is evident that effective urban governance in tackling heatwave consequences is significantly hampered by the RCC residents' ignorance about heatwave adaptation and mitigation. With 42.7% of respondents stating they were aware of heatwave adaptation strategies and 57.3% of respondents stating they were not, it is clear that a sizable segment of the urban population is still ignorant of these strategies. This result is consistent with a larger body of research showing that a major impediment to successful urban climate change adaptation is the lack of awareness among urban people (Moser & Ekstrom, 2010).

Figure 1: Unawareness for Heatwave Mitigation and Adaptation



The significant proportion of participants expressing ignorance highlights the pressing requirement for focused outreach and education programs. In this situation, proactive steps to educate locals about the dangers of heatwaves and the significance of implementing suitable mitigation and adaptation plans are essential for effective urban government (Measham et al., 2011). Public awareness campaigns, community seminars, and educational programs in colleges and universities that are specifically designed to address the needs and vulnerabilities of inhabitants of the RCC are a few examples of such projects. A KII respondent says,

> Raise awareness on the risks of heatwaves and on how to stay safe (KII, Rajshahi, Bangladesh).[8]

Furthermore, the difference in knowledge of heatwave adaptation and mitigation strategies between those in the know and those in the dark draws attention to potential disparities in urban residents' access to resources and information. According to Huang et al. (2011), vulnerable communities, including low-income households and marginalized groups, may encounter more difficulties in

[8] MD. Rafiquzzaman Shah, Divisional Forest Officer, Forest Department, Rajshahi, Key Informant Interview (KII), 30 March 2024

obtaining information and putting adaptive measures in place, which could exacerbate already-existing socioeconomic disparities. Thus, inclusive strategies that provide fair access to resources and information for all citizens, especially those most at risk from heatwave effects, must be given top priority in effective urban administration (Bulkeley et al., 2013). In this aspect, during KII a respondent says,

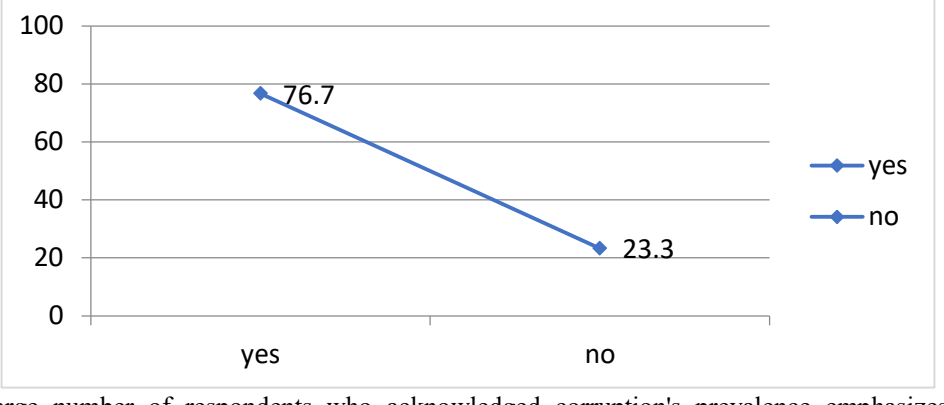
> A lack of knowledge on the likelihood of hazards associated with heatwaves is the biggest issue, in my opinion. There is currently a general lack of awareness and information, and not many individuals are aware of it (KII, Rajshahi).[9]

Urban inhabitants' lack of awareness necessitates a multimodal response that includes cooperation between public and private sector entities as well as civil society organizations and academia. Urban governance institutions can create complete awareness-raising campaigns that are suited to the local context of RCC by utilizing the networks and resources that are already in place. Moreover, the incorporation of climate education into policies related to urban planning and development has the potential to cultivate a resilient culture and enable inhabitants to take an active role in efforts to mitigate and adapt to heatwaves (IPCC, 2014).

5.3 Corruption in Relation to Adaptation and Mitigation of Heatwaves

The RCC corruption statistics on heatwave adaptation and mitigation highlights a major obstacle to urban governance efforts to address the effects of climate change. With 76.7% of respondents acknowledging corruption and 23.3% disputing it, it is clear that corruption is a significant barrier to good governance when it comes to putting heatwave mitigation and adaptation plans into action (Figure 2). This result is consistent with larger studies showing the negative effects of corruption on efforts for sustainable development and environmental management (Bardhan & Mookherjee, 2005).

Figure 2: Corruption for Heatwave Mitigation and Adaptation



The large number of respondents who acknowledged corruption's prevalence emphasizes how widespread this problem is in RCC's governing structure. In the context of mitigating and adapting to heatwaves, corruption can take many different forms, such as nepotism, bribery, embezzlement, and resource misallocation (Pirard et al., 2015). The integrity and effectiveness of governance systems are compromised by corrupt activities that divert finances and resources from crucial

[9] MD. Abu Taher, Assistant Director of Divisional Social Services, Rajshahi, Key Informant Interview (KII), 20 April 2024

climate adaptation measures. This, in turn, increases vulnerability to the effects of heatwaves, especially for marginalized groups (Tacoli et al., 2015). In this aspect, a KII respondents informs,

> It is difficult due to cutbacks and scarce funds. Usually, it is something that gets addressed later rather than right away because of corruption and financial instability (KII, Rajshahi).[10]

Furthermore, the frequency of corruption in RCC points to structural flaws in the regulatory and governance systems. The persistence of corrupt practices is facilitated by weak institutional capacity, a lack of openness, and insufficient oversight, which makes it more difficult for effective urban government to handle climate change concerns (Kaufmann et al., 2010).

Figure 3: Corruption in Heatwave Management in the RCC

According to the research findings, corrupt behaviors within local governance institutions frequently result in the misappropriation of scarce resources such as money for infrastructure development, public awareness campaigns, and cooling system installation intended for heatwave mitigation, (Figure 3). For example, some respondents claim that bribery and political interference in government contracts lead to the misallocation or delay of funds meant for the construction of green infrastructure, such as planting trees or putting up reflective materials in cities. These actions not only postpone critical infrastructure improvements but also increase the susceptibility of marginalized populations, particularly those residing in informal settlements, to extreme heat events. Additionally, the RCC's corruption has made resource distribution opaque and unaccountable, which has further undermined efforts to implement effective heatwave adaptation policies. This reinforces findings from previous studies (Kaufmann et al., 2010) that emphasize how weak institutional frameworks, combined with pervasive corruption, contribute to the failure of climate adaptation measures in the Global South. To address these issues, RCC must strengthen its governance structures by implementing anti-corruption measures, promoting greater transparency, and ensuring public accountability in the management of climate adaptation resources. By doing so, it will be better positioned to allocate resources effectively, engage in meaningful heatwave mitigation strategies, and improve overall climate resilience in Rajshahi.

[10] Syed Mahmud-ul-Islam, Environmental Development Officer of Environment Department, Rajshahi, Key Informant Interview (KII), 15 April 2024

Comprehensive reforms targeted at bolstering governance institutions, improving transparency, and encouraging accountability at all levels of government are necessary to combat the problem of corruption. Strong legislative frameworks, impartial oversight agencies, and channels for public involvement and accountability are all important components of anti-corruption initiatives (Kaufmann et al., 2010). Additionally, encouraging collaborations with the private sector and civil society organizations as well as creating a culture of integrity and ethical behavior within public administration can aid in the fight against corruption and advance good governance practices (UNDP, 2019).

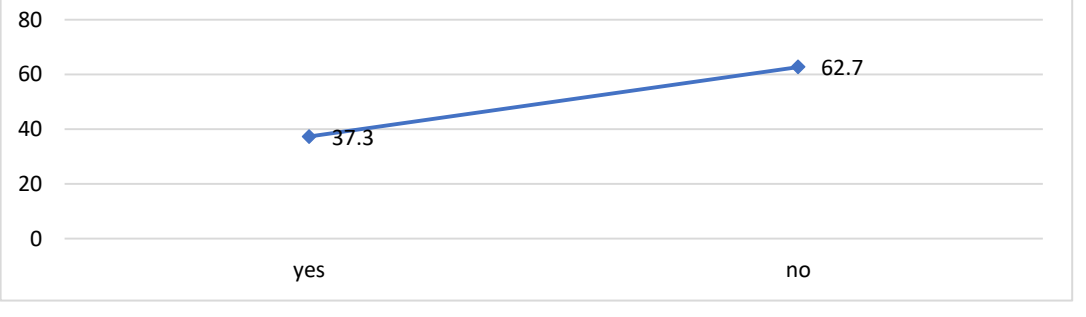
5.4 Poverty in Relation to Adapting and Mitigating Heatwaves

The information gathered on poverty in RCC with respect to heatwave adaptation and mitigation highlights it as a major obstacle to urban governance initiatives aimed at mitigating the effects of climate change Although 62.7% of respondents did not consider poverty a key factor, 37.3% identified it as a barrier to effective governance in implementing heatwave mitigation and adaptation strategies; highlighting that, for a substantial portion of the population, poverty remains a meaningful obstacle. This result is consistent with previous research showing the disproportionate susceptibility of urban poor populations to the effects of climate change (Füssel, 2007). A respondent says,

> Coping with heatwave is quite difficult for poor and marginalized people. As their income is low, they cannot afford the necessary materials to deal with the heatwave, so their dealing capacity is less than that of the financially sound people (KII, Rajshahi, Bangladesh).[11]

The significant correlation between socioeconomic position and susceptibility to heatwaves is highlighted by the proportion of participants who acknowledged poverty as a hindrance. Due to factors like inadequate housing, lack of access to cooling infrastructure, limited healthcare resources, and reliance on informal livelihoods, poverty increases one's vulnerability to heatwaves (Revi et al., 2014). Furthermore, poverty increases vulnerability and decreases resistance to the effects of heatwaves by making it more difficult for households to invest in adaptive measures like air conditioning, insulation, and other sources of income (Huang et al., 2011).

Figure 4: Poverty for Heatwave Mitigation and Adaptation



Moreover, disadvantaged urban residents confront extra difficulties as a result of the intersections between poverty and other socioeconomic vulnerability factors such as gender, age, ethnicity, and disability (Adger et al., 2007). Due to their limited mobility, access to healthcare, and capacity for adaptation, women, children, the elderly, and people with disabilities are disproportionately affected by heatwaves (UN-Habitat, 2011). Consequently, tackling poverty as an obstacle to mitigating and

[11]Chief Community Development Officer, Rajshahi City Corporation, Key Informant Interview (KII), 17 April 2024

adapting to heatwaves necessitates focused initiatives that tackle fundamental social disparities and foster development that is both inclusive and equitable (Pelling & Blackburn, 2013). A KII respondent argues,

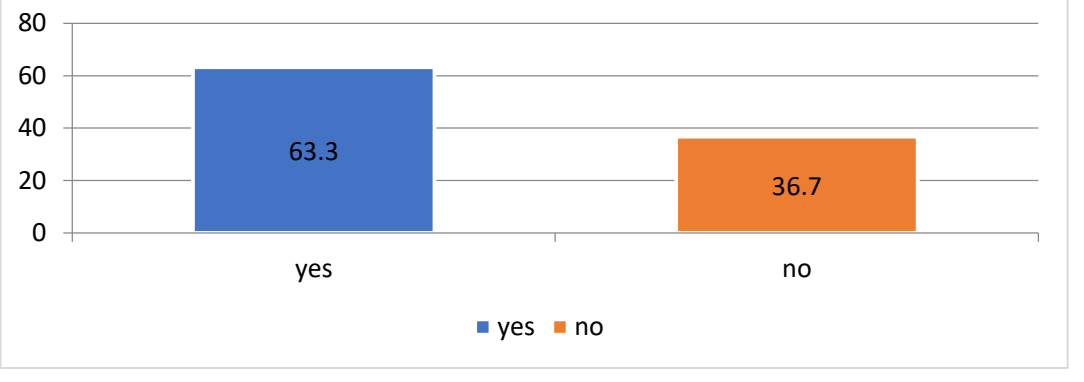
> The biggest problem faced by the public sector today is maintaining resilience in the face of steadily declining staffing levels and capital availability, both within individual organizations and throughout the public sector (KII, Rajshahi).[12]

A comprehensive strategy that incorporates climate change adaptation into more comprehensive measures for reducing poverty is necessary for effective urban governance to address issues related to poverty (Satterthwaite et al., 2019). In order to meet the requirements of vulnerable urban populations, investments in social protection programs, affordable housing, healthcare infrastructure, and sustainable livelihood options are all included in this (UNDP, 2019). Moreover, social cohesion and resilience can be strengthened through participatory methods that empower excluded groups and involve communities in decision-making (Bassett & Shandas, 2010).

5.5 Insufficient Political Willingness to Address and Prepare for Heatwaves

The information gathered about political willingness within RCC to mitigate and adapt to heatwaves offers insights into a critical component of municipal governance in tackling the effects of climate change. A majority of respondents (63.3%) acknowledged the presence of political readiness, while 36.7% expressed concerns about its absence, it is clear that political commitment has a major impact on how well governance mechanisms for heatwave adaptation and mitigation work. This result emphasizes how crucial political leadership and governance frameworks are in promoting local climate action (Bulkeley et al., 2014).

Figure 6: Political Willingness for Heatwave Mitigation and Adaptation



The proportion of participants expressing political willingness is indicative of the degree to which climate resilience and sustainability are given priority by local authorities during the urban planning and decision-making phases. A city's ability to deal with the effects of heatwaves can be improved by political commitment to heatwave adaptation and mitigation, which can help with resource allocation, regulatory measures implementation, and stakeholder coordination (Betsill & Bulkeley, 2007). In addition, political leadership has the power to ignite public participation and understanding, cultivating a climate resilient community culture (Betsill & Bulkeley, 2006).

[12] MD. Sadrul Anam, Assistant Town Planner, RDA, Rajshahi, Key Informant Interview (KII), 18 April 2024

The fact that a sizable percentage of respondents indicated that there was no political will, however, draws attention to potential difficulties and obstacles to efficient governance in managing heatwave threats. Political commitment to climate action may be weakened by elements such as conflicting political agendas, scarce resources, institutional inertia, and cyclical election cycles (Bulkeley et al., 2014). Furthermore, the implementation of climate policies and decision-making processes can be impacted by political dynamics, power dynamics, and interests both inside and outside of the local government (Bulkeley & Betsill, 2005). A KII respondent says,

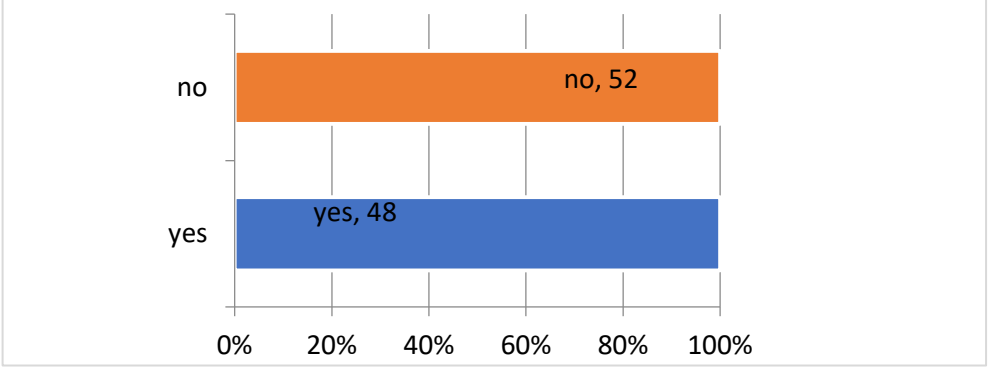
> Thinking in the present rather than planning for the future is the main challenge. People may not have a clear idea of what heatwaves may look like or feel like in 2030 or 2040. They can be far more embedded than they are now and extremely significant (KII, Rajshahi).[13]

To tackle the issue of political willingness, it is necessary to implement tactics that improve political dedication, institutional strength, and the efficiency of government. This includes lobbying campaigns to educate decision-makers about the seriousness of climate change consequences and the advantages of funding adaptation and mitigation strategies for heatwaves (Bulkeley et al., 2014). Moreover, encouraging multi-level governance strategies that incorporate cooperation between national, regional, and local government agencies as well as interactions with the private sector and civil society organizations can encourage coordinated action and get past obstacles to governance (Betsill & Bulkeley, 2006).

5.6 The government's indifference to heatwave adaptation and mitigation

The information gathered on RCC authorities' indifference to heatwave adaptation and mitigation underscores a serious obstacle to municipal governance initiatives aimed at mitigating the effects of climate change. Given that 52.0% of respondents denied the influence of authority apathy and 48.0% acknowledged its existence, it is clear that attitudes of bureaucratic apathy represent a significant barrier to efficient governance in the implementation of mitigation and adaptation strategies for heatwaves. This result is consistent with previous research on the role institutional impediments and administrative inertia play in impeding climate action (Bulkeley & Betsill, 2005).

Figure 7: Apathy of the authority for Heatwave Mitigation and Adaptation



Concerns regarding the responsiveness, dedication, and accountability of urban governing institutions in RCC to climate change threats are shown in the percentage of respondents who

[13] MD. Jamat Khan, President, Rajshahi District Committee, Bangladesh Poribesh Andolon, Key Informant Interview (KII), 21 April 2024

endorse authority apathy. Authorities' indifference can take many different forms, such as poor resource distribution, lax enforcement of rules, sluggish decision-making, and minimal community involvement (Bulkeley et al., 2014). The city's ability to proactively manage heatwave threats and adapt to changing climate conditions is undermined by such bureaucratic lethargy (Pelling & Manuel-Navarrete, 2011). A KII respondent argues,

> There is a significant gap in accountability when it comes to managing heatwave risks. Officials in the relevant departments often fail to provide clear reports or updates on the allocation and use of funds designated for heatwave mitigation. Moreover, the lack of transparency in decision-making processes leads to mistrust among the public and other stakeholders. When the public has no insight into how decisions are made or how resources are allocated, it fosters suspicion that funds are being misused or diverted. (KII, Rajshahi, Bangladesh).[14]

Furthermore, vulnerable communities with little participation and voice in decision-making processes may be disproportionately affected by authority apathy, which could exacerbate already-existing vulnerabilities and inequities within the metropolitan population (Leichenko & O'Brien, 2008). Because, if authorities do not give priority to the needs and concerns of vulnerable groups, such as low-income households, minorities, and informal settlers, they may be the ones most affected by heatwaves (Adger et al., 2007).

It will take coordinated efforts to improve accountability, openness, and governance effectiveness at all administrative levels to address the problem of authority apathy. This entails establishing mechanisms for public oversight and accountability, encouraging participatory decision-making processes, and cultivating a culture of responsiveness and citizen involvement within urban governance institutions (Betsill & Bulkeley, 2006). Furthermore, funding initiatives aimed at increasing capacity, educational opportunities, and knowledge-sharing portals can enable authorities to efficiently plan, organize, and carry out policies for climate adaptation (Bulkeley et al., 2014).

5.7 Absence of foreign assistance for adaptation and mitigation of heatwaves

The information gathered about RCC's lack of international assistance for heatwave adaptation and mitigation highlights a potential obstacle in urban government initiatives to address the effects of climate change. It seems that inhabitants have relatively low opinions of insufficient foreign support for heatwave reduction and adaptation, with 14.7% of respondents reporting the absence of such aid and 85.3% dismissing its influence. The existence of a non-negligible percentage suggesting a lack of international aid, however, underscores the need of outside assistance in enhancing local resistance to heatwave threats, even though the majority of respondents do not view this as a significant issue. A KII respondent opines,

> The World Bank provides minimum funding to Bangladesh on the climate change issue, but there is no funding specifically for heatwave. The other international organizations are playing a silent role in this regard.[15]

Concerns regarding the low availability of financial resources, technical skills, and capacity-building support from the international community to address climate change impacts in RCC are suggested by the number of respondents who affirm the lack of international aid. Bangladesh is acknowledged as one of the nations that are most susceptible to the effects of climate change, especially heatwaves; yet, improving adaptive capacity and carrying out resilience-building programs still depend on having access to international climate money and help (IPCC, 2014).

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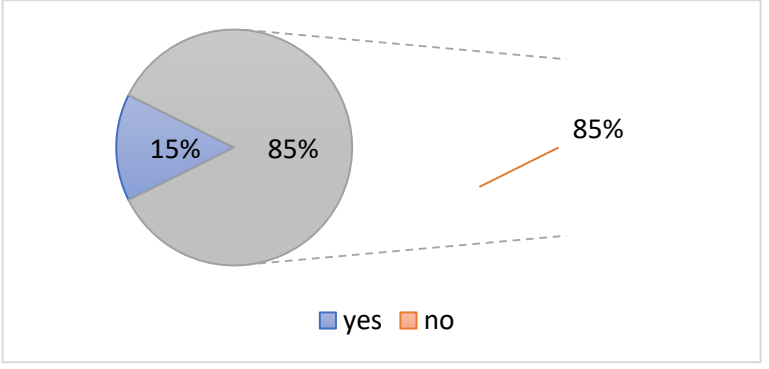
[14] Vice President of Green Voice Organization, Key Informant Interview (KII), 21 April 2024

[15] Officer, United Nations Development Program, Key Informant Interview (KII), 05 April 2024

Figure 8: Lack of international aid for Heatwave Mitigation and Adaptation



[Source: Field Survey, 2024]

The implementation of community-based initiatives, infrastructure development, and climate adaption strategies might be impeded by the lack of international aid. Furthermore, as underprivileged communities with low resources may find it more difficult to get financial and technical assistance, a lack of foreign support may make existing socioeconomic inequities and inequalities worse (UNDP, 2019).

Advocacy efforts are necessary to gather worldwide support for climate resilience programs in RCC and other vulnerable urban areas, in order to address the difficulty of a lack of international help. In order to boost funding for climate adaption projects, encourage technology transfer, and assist local capacity-building initiatives, it is necessary to collaborate with foreign donors, multilateral organizations, and development agencies (Biermann et al., 2009). Furthermore, enhancing collaborations across academic institutions, corporate sector, civil society organizations, and local governments might improve the efficiency of foreign assistance in fostering resilience and sustainable development (UNEP, 2012).

6.0 Conclusion and Recommendations

This paper critically analyzes the difficulties RCC faces in reducing the effects of heatwaves and adjusting to them. Particularly in the areas of institutional coordination, public awareness, resource allocation, and infrastructure planning, the findings highlight serious governance deficiencies. These gaps are in line with the theoretical framework of vulnerability theory and urban governance, which emphasize the significance of reducing socio-economic vulnerabilities, multi-level coordination, and institutional capacity in addressing the impacts of climate change (Adger et al., 2007; Bulkeley & Betsill, 2006). According to the study, RCC's urban governance processes are fragmented, understaffed, and characterized by a lack of interagency collaboration, making them ill-equipped to respond to heat episodes. These results highlight the importance of the principle of urban resilience, which urges cities to implement more proactive and integrated approaches to climate adaptation (Pelling & Blackburn, 2013).

Furthermore, the research points to the vulnerability of marginalized groups in Rajshahi, particularly the low-income residents in informal settlements, whose limited access to cooling infrastructure, healthcare, and other resources exacerbates their exposure to heatwave risks. This finding aligns with the vulnerability framework, which asserts that socio-economic disparities play a significant role in determining the ability of communities to cope with climate hazards (Füssel, 2007). RCC's

limited engagement with these vulnerable communities, coupled with insufficient data on local climate risks, exacerbates the lack of heatwave preparedness.

In light of these findings, several recommendations are made to enhance RCC's capacity for heatwave mitigation and adaptation. Firstly, strengthening institutional capacity is paramount. RCC should establish a dedicated climate governance unit to coordinate efforts across various departments, ensuring a cohesive and integrated approach to heatwave management. In line with the principles of urban resilience and climate adaptation, RCC should also prioritize the development of heat-resilient infrastructure, such as green spaces, reflective roofing, and urban cooling systems, to reduce the urban heat island effect and mitigate the impacts of extreme heat (Santamouris, 2015). Secondly, public awareness campaigns must be expanded to educate residents, particularly in vulnerable communities, on heatwave risks and adaptive strategies. This aligns with the vulnerability theory, which stresses the importance of information dissemination and public education in enhancing adaptive capacity (Moser & Ekstrom, 2010). These campaigns should be tailored to local needs, utilizing community-based approaches to ensure broad participation and engagement.

Additionally, RCC should explore the potential of Forecast-based Financing (FbF) to proactively address heatwave risks. FbF, which involves mobilizing resources preemptively, based on forecasts of extreme weather events, could significantly enhance RCC's preparedness and response capabilities (Rahman et al., 2024). The integration of FbF into RCC's disaster management strategies would also help to overcome the institutional inertia and slow decision-making processes identified in the study.

Finally, a more participatory governance approach is essential for improving heatwave mitigation and adaptation in Rajshahi. Involving local communities, particularly marginalized groups, in the planning and implementation of heatwave adaptation strategies will ensure that interventions are inclusive and meet the needs of those most affected. This recommendation is rooted in the theoretical framework of participatory governance, which advocates for the inclusion of diverse stakeholders in climate adaptation processes (Betsill & Bulkeley, 2006).

By addressing these governance gaps and embracing a more integrated, participatory, and proactive approach to climate adaptation, RCC can enhance its resilience to heatwaves and other climate hazards. This will not only protect public health and well-being but also foster sustainable urban development that can withstand the challenges posed by climate change.

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