

Understanding the Impact of Governance Frameworks on Transportation Resilience in Metropolitan Dhaka

Dr. Sabkat Kamal¹
Dr. Md. Lutfur Rahman²

Abstract: Transportation networks are considered to be the backbone of cities. The governance of a metropolitan city is highly dependent on the functionality of well-managed transport infrastructures and services, where the movement of people, goods and information plays a critical role. The transportation system of Dhaka is managed by a range of state agencies, including the City Corporation, Metropolitan Police, RAJUK, and DTCA. However, they are poorly interconnected and seldom interdependent. Such interdependencies not only question the efficiency of infrastructure management but also increase system vulnerability. The study employed a qualitative empirical method based on the interactions between four main agents: transport authority, public authorities, transport-specific conditions, and level of performance. This paper outlines the primary disruptions to transport systems resulting from the urban governance structures. It identifies that governance within metropolitan Dhaka is not a standalone process, but rather a number of transport and non-transport actors and institutions significantly influence the role, function, coverage, and quality of governance to a great extent at national, regional, sub-regional, and other levels, affecting stakeholders. Fragmented organizations and institutions, and their overlapping character, are the prime pressing problem that has been acknowledged. The study showcases six key organizations, including DMP, DTCA, RAJUK, DSCC, DNCC, and BRTA, that play a significant role in Dhaka's traffic governance. Theoretically, it has been argued that the key organizations managing the transport system or transport governance system should be aligned with DTCA, but DMP, DSCC, and DNCC are seen to have more control for compliance and performance. The outcome evidences transport resilience deeply rooted in non-transport networks, including the absence of role casting; all organizations involved in transport governance suffer from unclear institutional roles and limited functional assignments.

1. Background of the Study

Transportation networks are considered to be the backbone of cities (Sciara, 2017). The governing of metropolitan areas is highly dependent on the functionality of well-managed transport infrastructures and services, where the movement of people, goods and information is critically important (Iles, 2005; Popescu, Stefan-Gorin, & Tache, 2017). In urban regions, transportation networks are fundamentally interdisciplinary, with a particular focus on the evolving connections among socio-economic, historical,

¹ Associate Professor, Department of Urban and Regional Planning, Jahangirnagar University, Savar, Dhaka-1342. Email: sabkatkamal@juniv.edu

² Associate Professor, Department of Urban and Regional Planning, Jahangirnagar University, Savar, Dhaka-1342. Email: lrahman@juniv.edu

environmental, and political elements (Waddell, Ulfarsson, Franklin, & Lobb, 2007). Dhaka is an emerging metropolitan city that has more than doubled in size in the past two decades (Dewan, Islam, Kumamoto, & Nishigaki, 2007). Dhaka is growing and becoming increasingly dependent on transportation systems to support its economy and the quality of life for its citizens (Alam & Rabbani, 2007). This growth has exceeded the demand for transport services, and the quality of the service has been deteriorating. Dhaka City Corporations-north and south (DNCC, DSCC), Dhaka Metropolitan Police (DMP), Dhaka Transport Coordination Authority (DTCA), Bangladesh Road Transport Authority (BRTA), Bangladesh Road Transport Corporation (BRTC) and their concerned different departments, and line ministries manage the transportation system of Dhaka (Panday & Jamil, 2011; Ahsan et al., 2023). The transportation system of Dhaka is now in a state of crisis, due to declining levels of services; low standards of efficiency, reliability and safety, poor enforcement of regulations; poor synchronisation, with fast-changing land use; and management of multiple responsible organisations (The Strategic Transport Plan for Dhaka, 2005; Hanson & Giuliano, 2004).

The transportation system in Dhaka is managed by several state agencies. They are poorly interconnected and seldom interdependent (Stephens & Wikstrom, 2000; Ahsan et al., 2023). Such interdependencies not only question the efficiency of infrastructure management, but they can also increase system vulnerability (Wang, Hong, and Chen, 2012). Therefore, guaranteeing their resilience has become an essential component of managing and governing a city that is both economically sustainable and livable (Chao, 2023). Additionally, it is essential to examine transportation resilience in consideration of its existing governance interdependencies, which are often overlooked in the literature. Because development agencies frequently focus on studying the effects of changes on modal splits, route assignment and trip distribution, travel behaviors, geographical analysis or developing models under software packages (Jonkeren, Jourquin and Rietveld, 2008). However, a significant knowledge gap exists between those with experience in transportation planning and those responsible for making decisions in the metropolitan area. This scenario results in the transport of both people and goods becoming increasingly slow, costly, unpleasant, and dangerous, with an increased risk of disaster each year (Vigar, 2017).

Theoretically, it is assumed that the transportation system within the metropolitan arena operates in a sustained way (Jelti et al., 2023). The transportation system in Dhaka is subject to rapid change; the metropolitan governance framework can become particularly fragile because of complex environments and heterogeneous boundaries of public services (Ahsan et al., 2023, Bai et al., 2010). Metropolitan areas have different levels of exposure because the problem is not only that the city has grown, but also that the area has expanded to hazardous areas on the floodplains of rivers (Liu et al., 2015). Uncoordinated transportation systems can significantly alter exposure to and the severity of metropolitan services, ultimately questioning the sustainability of transportation resilience within a metropolitan area (Li et al., 2025). Managing a metropolitan city and building transportation resilience requires an integrated response at a metropolitan scale. Because in a metropolitan context, density is high and land use is mixed, a well-integrated transport system can create walkable, human-scale neighbourhoods, improving the overall quality

of urban life. Recent patterns in the transportation system, especially those influencing the current regulatory framework, suggest that significant shifts in technology, public policy, and personal behaviors are essential for aligning the transportation system with environmental sustainability. By emphasizing the importance of transportation resilience, this analysis will effectively outline the shortcomings of the current governing framework and consequently improve the resilience of transport risk management.

This research aimed to understand the impact of metropolitan governance frameworks on transportation resilience in Dhaka city. The application of a case study approach to Dhaka will provide a key opportunity to evaluate the transport system of the metropolitan governance framework. The outcome of the research will provide an assessment of how issues related to the transportation system within metropolitan governance framework impact transport resilience in Dhaka metropolitan city.

2. Objectives of the study

The objectives of the study are;

1. To observe the metropolitan governance framework, operate in metropolitan Dhaka.
2. To describe the way, the metropolitan governance framework operates the existing transportation system.
3. To evaluate the impact of the existing metropolitan governance framework on transportation resilience.

3. Literature Review

This research is cross disciplinary that connects transport system, governance and transportation risk and resilience. Therefore, the literature review focuses on transportation system, transportation risk and resiliency, and metropolitan governance framework in order to synergize between vulnerability and resilience of metropolitan governance systems of metropolitan Dhaka.

3.1 Transportation System and Risk

Transportation system is one of the major urban infrastructure sectors that have changed over the years in response to technological and governance changes (te Brömmelstroet, Skou Nicolaisen, Büttner, & Ferreira, 2017). The transportation networks within urban regions are intricate, ever-changing, and internally linked, in addition to being linked with other complex and dynamic systems such as the environment and the economy; they also exhibit variations across different locations and throughout time (Mostashari & Sussman, 2009). Transportation systems need to adopt various approaches including urban development, policies for urban transport, legislative measures, funding organizations, and project administration (Banister, 2008).

Governing of transport system vary from city to city and linked to institutional legacies, ownership and performance (Balsas, 2017). Individuals responsible for decision-making, utilizing intricate decision processes, make selections that influence the transportation

network (Smyth, Christodoulou, Dennis, Al-Azzawi, & Campbell, 2012). The history and present function of these entities are typically ambiguous and contradictory (Sciara, 2017). The conflict begins when their goals and objectives differ from others, with resulting services offered on piecemeal basis (Hanson & Giuliano, 2004). The evident result has been inadequate service governance characterized by regular malfunctions, restricted growth potential, bureaucratic complications, gaps and deficiencies in service, variability in resources and policies, fault tolerance issues, and shifting resource conditions (Pérez, 2002; Rahman & Weber, 2003). Concrete governance platforms have shown limited advancement in establishing a significant regional forum, modifying institutions and practices to enhance stakeholder participation and expanding the breadth of transport planning (Poiani & Stead, 2015).

Risk is the possibility or uncertainty that a negative event, harm, or loss will occur (Wisner et al., 2003). However, risk in the transportation sector encompasses several interrelated concepts, including transportation safety risks (like accidents, pollution, terrorism) and risk perception among travelers and workers, as well as the risk management of complex transit system (Fletcher and Ekern, 2016). The various types of risks in the governance of metropolitan transport systems typically arise from errors and accidents involving personnel or users, technological malfunctions, breakdowns of components, defective constructions, and issues related to overload, among others. Additionally, risks can also be deliberate, such as disputes in the labor market. Fletcher and Ekern's (2016) again define aforementioned statement as intentional disruptions take place because one or more actors decide to cause the disruption.

3.2 Transport resilience

Resilience focuses on examining and implementing the factors that guarantee the system's capacity to function at a specific level, whether under typical circumstances or during severe conditions (Tamvakis & Xenidis, 2012). In the event of unforeseen circumstances, the resilience of the systems allows them to react, thereby restoring balance and returning to normal operations (Suriya & Mudgal, 2012). Reliance on the transportation sector is on the rise, leading to heightened demand for travel and commerce due to a growing population (Vuchic, 1999). This increased demand has highlighted reliability of a transportation system's robustness depends on its functioning against unexpected disturbances (Tamvakis & Xenidis, 2012). Consequently, building resilience in transportation systems begins with pinpointing the vulnerabilities, followed by exploring various alternatives that can lessen these vulnerabilities and enhance adaptive capacity by ensuring a swift return to normal operations while minimizing losses (Wang, 2015).

A resilient transportation system is vital in the simplest terms that can maintain critical functions during a disruption, yet, current transportation infrastructure faces a diverse set of emerging risks, which no one has full jurisdictional responsibility to address (Waddell, et al., 2007). This makes systems more fragile in the event of a major catastrophe (Hao et al., 2012). Consequently, how transport and infrastructure operators handle their services during times of disruption is a crucial aspect of their overall resilience (Reggiani, Nijkamp, & Lanzi, 2015).

3.3 Transport Governance

Transport governance refers to the mechanisms and structures through which decisions about transport systems are made and implemented (Ahsan et al., 2023). It encompasses various actors, including government agencies, private companies, and civil society organizations, all contributing to the development, management, and utilization of transport infrastructure and services (Qazi and Hoque, 2009). The objective is to develop a system that is sustainable, effective, and attuned to the public's requirements. Transport policy and planning necessitate governance, which relates to the practical application of current resources as well as the distribution of new resources, including investments (Rundmo et al., 2014). Transportation, like all industries, has distinct governance features shaped by the involvement of both public and private sectors (Rahman, 2015).

The management of transportation systems is particularly significant due to its strategic, economic, and social relevance, as well as the cross-border nature of various infrastructures, including highways, railways, and telecommunications networks (Rahman, 2015). Transportation is not just a convenience; it is a critical infrastructure that needs to be consistently and reliably available to its users. This is where governance is essential in maintaining operational continuity (Quazi and Hoque, 2009).

3.4 Metropolitan Governance

The framework for metropolitan governance and its organizational strategies are crucial elements of this study. Although commonly utilized, metropolitan governance is still a concept characterized by various dimensions and applications, along with intergovernmental connections (Heinelt & Kübler, 2004; Skelcher, 2005). A metropolitan governance framework can be most accurately interpreted as the practical rules and a set of operational guidelines that establish who has the authority to make decisions in a particular area, along with what actions are permitted or restricted (Ostrom & Walker, 2003). Marceau (2008) envisions this metropolitan governance framework as a system, and this system requires access to governmental authority but need not be confined to government institutions (Feiock, 2009; Kearns & Forrest, 2000; Marceau, 2008). They are organized through functional networks that traverse boundaries defined by institutions (Einstein & Kogan, 2016). However, there is a baseline agreement that organizations are the main concern and dominant institution by which governance authority in a country is exercised (Pierre, 1999). The study of metropolitan governance is equally important for a better understanding of governance resiliency operating in any complex environmental structures (Mitchell, 1998). Metropolitan governance resiliency, the new format of governance is cross-disciplinary, problem-driven, multilevel, and comparative and stimulates interactive research (Delmas & Young, 2009). In these settings, resources are spread out across various locations, with different organizations managing and owning them under diverse policies, all linked through interconnected networks. As a result, the idea of vulnerability is crucial to address the perceived risk of degradation happening at various sites (Shaw, 2016).

4. Methodology

The research was guided through following methods;

4.1 Selection of the study area

Dhaka was selected for the study (Figure 1). Dhaka is example of extensive urbanization, poor governance performance, especially in terms of managing transportation sector. The research investigated Dhaka's existing metropolitan governance framework on transportation systems. It has assessed the impact of existing governance structure on transport resilience.

4.2 Selection of study Method

The methodological approach chosen to identify and explain the metropolitan governance framework on transportation resilience involved

mixed-method research. In particular, it will use a qualitative empirical method as “it is a dynamic option for expanding the scope and improving the analytic power of studies”(Johnson & Onwuegbuzie, 2004). To address objectives, a combined deductive and inductive approach was used, drawing on the analytical framework described. The analysis of the transport system was based on the interactions between four main agents, namely: transport authority, public authorities, transport-specific conditions and level of performance. The data collection method employed was a semi-structured interview with relevant officials and experts from existing organizations and institutions that govern Dhaka. This approach allowed for flexibility, not adhering strictly to a formalized list of questions. Instead, the questions were open-ended, facilitating a more engaging discussion with the interviewees rather than a simple question-and-answer exchange (Soeters, Shields, & Rietjens, 2014). The goal was to assess institutional arrangements, explore significant organizational differences, and identify both the strengths and limitations of various types

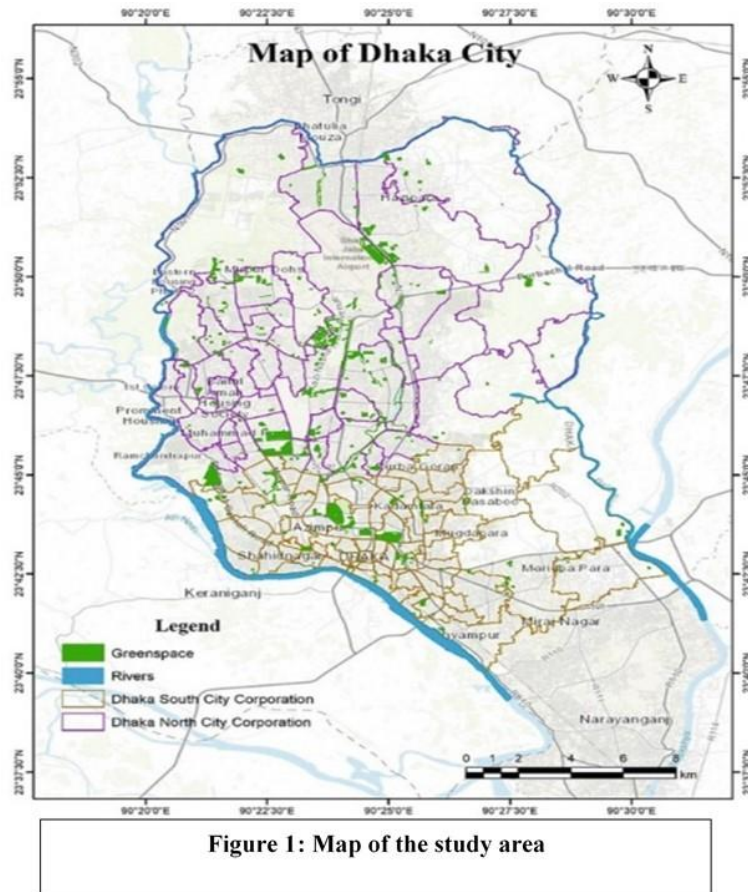


Figure 1: Map of the study area

of interventions. The differences in urban transport governance systems are evident not only in these relationships but also in the distinct roles of various agents. Gathering secondary information from government ministries and organizations was a crucial step prior to data analysis. Relevant policies, laws, and ministerial guidelines were collected from the concerned organizations. During the interviews, representatives were asked to provide insights from their respective organizations, and in the days following the interviews, they compiled their information for the researcher to collect.

5. Examining the Context of Metropolitan Governance Framework

The research thrives to observe two sets of context. At first place it observed the existing metropolitan governance organizations and public service institutions and organizations serving Dhaka at current state. On the second place it observed the existing transport network serving Dhaka Metropolitan area.

5.1 Existing Metropolitan Governance Institutions in Dhaka

Theoretically, governance is defined by its capacity to comprehend the institutional processes that function at the state level to enable collective action (Stoker, 2018). In the context of Dhaka, governance is traditionally synonymous with authority and the state, referring to a structure or order that cannot be externally imposed; instead, it emerges from the interactions among various governing actors (Patti, 2017). Dhaka, as the metropolitan city, has shared governance procedures, where the state gives its authority across a hierarchy of scales (Rahman, 2015). Governance in metropolitan Dhaka is not an isolated process; rather, it involves a multitude of actors and institutions that significantly shape its role, function, scope, and quality. This governance is further influenced by a variety of strategic engagements and partnerships with national, regional, sub-regional, and other stakeholders (Keck et al., 2009).

Dhaka's governance system is complex and fragmented. At the primary level, the city corporation is divided into the Dhaka North City Corporation (DNCC) and the Dhaka South City Corporation (DSCC), which are the primary local government bodies for civic services. The main organizations involved in Dhaka's urban planning include the Capital Development Authority (RAJUK), the central authority for planning and development. Also, Urban Development Directorate (UDD) acts as a planning operative in metropolitan Dhaka. To manage public and utility services more efficiently, the Dhaka Metropolitan Area (DMA) has individual service organizations. They are, namely, Dhaka Water Supply and Sanitation, TITAS for piped gas supply, DESA for electricity supply, BTCL for telephone, and BTRC for internet supply (Table 1).

Table 1: Metropolitan Governance Organizations, services and jurisdiction

Type of Government	Name of Organization	Type of Services	Jurisdiction
Municipal Government	Dhaka North City Corporation (DNCC) & Dhaka South City Corporation (DSCC)	Civic services	Independent
Planning and Development	Rajdhani Unnayan Kartipakhaya (RAJUK)	Land use Planning and Development and regulation	Independent
Planning and Development	Urban Development Directorate (UDD)	Urban Planning and Development	Independent
Traffic Management	Dhaka Metropolitan Police (DMP)	Law enforcement, traffic and transportation.	Independent
Service delivery/Public Utility Services	WASA, DESA, TITAS, BTRC, BTCL	Water supply, Sewerage management, Gas supply, Electricity, Cable and internet.	Independent

Over the years, various authorities have shared responsibilities for planning and developing Dhaka city, encompassing administration, law and order, utilities, and services. The current metro-governance framework of Dhaka comprises three types of agencies: national, sectoral, and local. Out of a total of 37 ministries, 22 ministries and 51 agencies are involved in the planning and development of the Dhaka metropolitan area (Islam, 2000; Rahman 2015).

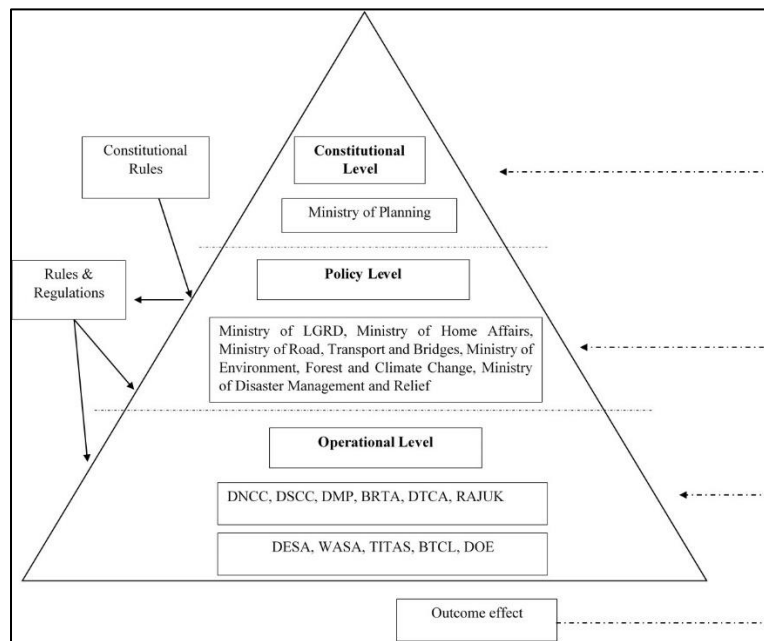


Figure 2: Metropolitan Governance Framework

The “top-down” planning approach merely concerns for sharing common goals and objectives. These organizations governing metropolitan Dhaka are operated under independent autonomous bodies having an independent mandate, rules and regulations separate from ministries, departments and divisions they have to report to. The scenario of fragmented structure leads to significant overlapping functions not only within ministries but also at local, national and regional state. This scenario creates a multifaceted problem of disagreement and an inability to provide cohesive strategic leadership for the metropolitan area.

5.2 Existing Transport Governance of Metropolitan Dhaka

A robust metropolitan transport system is vital because it serves as the "lifeblood" of a city, facilitating diverse activities such as commuting, commerce, and leisure by efficiently moving people and goods (Krizek and King 2021). Dhaka city is growing and experiencing unprecedented growth, and the challenges of urbanisation have become increasingly complex. Since the transport system is seamlessly integrated into the urban fabric, the need for efficient and durable transportation systems and their governing systems is at the forefront of these challenges (Ahsan et al., 2023). Dhaka's transportation sector is governed primarily through the following organizations, namely;

Table 2: Dhaka's Transport Organizations, Services and Jurisdictions

Name of the organization	Service	Type of Authority	Jurisdiction
DTCA (Dhaka Transport Coordination Authority)	- Managing transportation projects - Developing strategic plans for transportation and urban transport policies - Coordinating transportation efforts within the Dhaka Metropolitan Area (DMA) - Creating guidelines and policies for public transportation. - Planning and overseeing traffic management - Designing initiatives aimed at enhancing traffic safety.	Policy formulation, planning and monitoring	Project-based area jurisdiction
DMTCL (Dhaka Mass Transit Company Limited)	Government-owned company in charge of operating and maintaining the Dhaka Metro Rail	Operation and Maintenance of Metro Rail	Dhaka metropolitan and adjoining areas
Dhaka BRT (Dhaka Bus Rapid Transit)	To establish a modern bus-based public transport network in the Greater Dhaka Area that is quick, cost-effective, safe, comfortable, environmentally friendly,	Project management and implementation	Service corridor-based.

Name of the organization	Service	Type of Authority	Jurisdiction
DTCA (Dhaka Transport Coordination Authority)	- Managing transportation projects - Developing strategic plans for transportation and urban transport policies - Coordinating transportation efforts within the Dhaka Metropolitan Area (DMA) - Creating guidelines and policies for public transportation. - Planning and overseeing traffic management - Designing initiatives aimed at enhancing traffic safety.	Policy formulation, planning and monitoring	Project-based area jurisdiction
Company Limited)	universally accessible, and has a high capacity for passengers.		
RHD (Roads and Highways Department)	A government agency in Bangladesh is responsible for the construction and maintenance of highways and bridges throughout the country.	Road construction and maintenance	Dhaka metropolitan and adjoining areas (national highways and local roads.)
BRTA (Bangladesh Road Transport Authority)	Regulation and registration of motor vehicles in Bangladesh, including the issue of driving licenses, roadworthiness certificates, and route permits for motor vehicles. Identification of new bus routes and public transport services -Identification of defective and faulty vehicles - Accountability for road safety and the regulation of truck overloading - Establishment of regulations and protocols for motorized transportation overall - Examination of government cars and vehicles that are part of traffic accidents - Enrolling driver training schools and upkeep.	Provide regulatory service and licensing	Dhaka metropolitan and adjoining areas

Name of the organization	Service	Type of Authority	Jurisdiction
DTCA (Dhaka Transport Coordination Authority)	- Managing transportation projects - Developing strategic plans for transportation and urban transport policies - Coordinating transportation efforts within the Dhaka Metropolitan Area (DMA) - Creating guidelines and policies for public transportation. - Planning and overseeing traffic management - Designing initiatives aimed at enhancing traffic safety.	Policy formulation, planning and monitoring	Project-based area jurisdiction
BRTC (Bangladesh Road Transport Corporation)	BRTC provides both passenger and cargo transport services. In Addition to BRTC, driving training is also offered to the general public.	Provide public transport services	Dhaka metropolitan and adjoining areas
BIWTA (Bangladesh Inland Water Transport Authority)	It is also accountable for overseeing the development and upkeep of the inland water transport system.	Provide regulatory service	Dhaka metropolitan and adjoining areas (Water and ferry service)
BIWTC (Bangladesh Inland Water Transport Corporation)	A state-owned enterprise based in Dhaka, Bangladesh, manages and operates inland vessels and ports. This organization primarily generates its income through ferry service operations.	Provide service (water taxi, circular water bus).	Dhaka metropolitan and adjoining areas (Water and ferry service)

In Dhaka, over 31 agencies are involved in the transportation sector, with many serving as stakeholders in various transportation initiatives. Among these, several government bodies and institutions are pivotal in managing the transportation system of Dhaka, categorized mainly into four types based on their roles and responsibilities: (i) Policy and plan formulation; (ii) Infrastructure development and maintenance; (iii) Regulatory functions; (iv) Law enforcement on the road. Specifically, six agencies are crucial in overseeing the transportation in Dhaka city. The majority of interview participants indicated that the construction, management, and upkeep of roads are the most critical components of transport governance. After roads are built and expanded, they are eventually handed over to local governments, including the Roads and Highways Department (RHD), RAJUK (Capital Development Authority), Public Works Department (PWD), and City

Corporation, for maintenance at different times within the metropolitan area. Consequently, both the Dhaka South City Corporation (DSCC) and Dhaka North City Corporation (DNCC) manage over 3,000 kilometers of various types of roads.

The road network has historically been developed to address short-term needs and often constructed without adequate planning or thorough assessment of road users' requirements. This is evident in the comparatively limited number of secondary and feeder roads in relation to primary roads, along with the prevalence of narrow local roads.

Multiple administrative bodies mentioned above make the management issue more complicated. As a result, roads once dug for construction or maintenance remain unexploited for long time. Infrastructure development, maintenance, and enforcement in Dhaka are governed by the Local Government (City Corporation) (Amendment) Act, 2011. This act outlines the responsibilities for maintaining and developing city streets, roads, and lanes, as well as operating streetlights and traffic signals, and sweeping and clearing streets, roads, lanes, drains, markets, and public areas. The Dhaka Metropolitan Police (DMP) operate under the Motor Vehicles Ordinance of 1983 and the Dhaka Metropolitan Police Ordinance of 1976. The DMP is responsible for traffic management, including the enforcement of parking regulations, maintaining lane discipline, and ensuring pedestrian crossing safety. Additionally, the Rajdhani Unnayan Kartipakkha (RAJUK) is guided by the Town Improvement Act of 1953 and the Dhaka Improvement Trust (Allotment of Land) Rules of 1969.

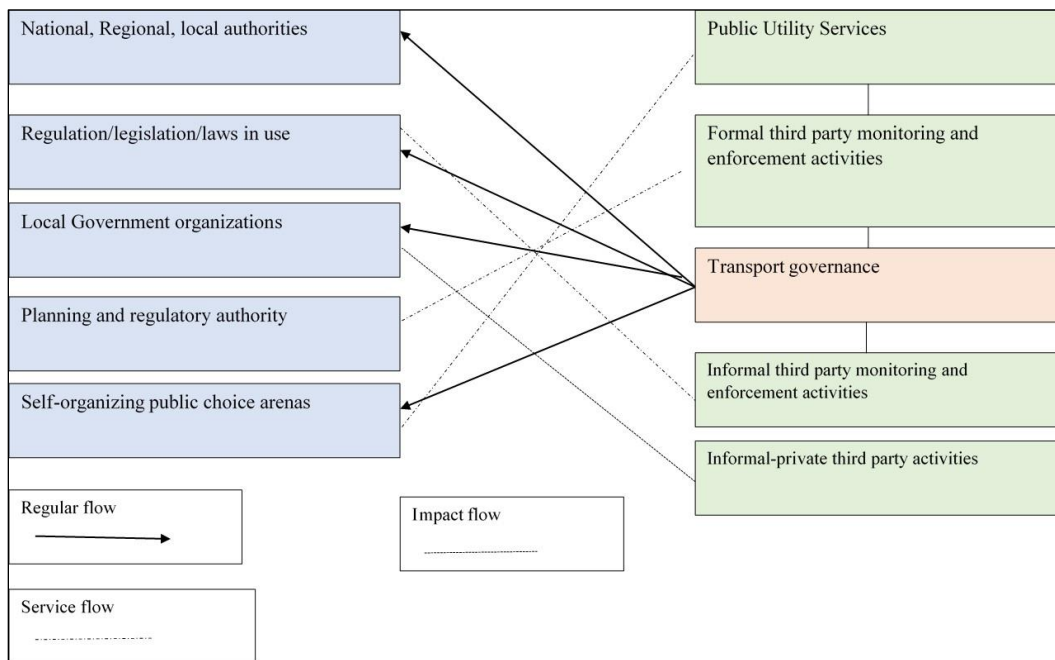


Figure 3: Transport Governance Framework

RAJUK is responsible for preparing master plans and development plans for the Dhaka Metropolitan Area, as well as land use planning and zoning control, detailed area planning,

and planning and construction of new major roads, link roads, bridges, and culverts. Notably, those departments such as TITAS, WASA, DESA, and PWD are also empowered to perform dissection and reconstruction. DMP, DOE and a few other organisations are also responsible for the management of legal and environmental issues, respectively.

6. Evaluate the Impact of Metropolitan Governance Framework on Transportation Resilience.

6.1 Evaluate the Metropolitan Governance Framework

Governing a metropolitan area is a complex task. The scenarios are more pressing for Dhaka since the organizations are big in number and interact at different levels of spatial scale and bring together different transport modes; and serve different functions that are often interconnected at national, regional and local levels. Therefore, transportation management is a comprehensive process that has to have some strong functional connections with all organizations working in Dhaka, by influencing how people move within urban spaces, informing decisions regarding land use, zoning, and infrastructure investment, demonstrating higher levels of connectivity and economic vitality. Fragmented organizations and institutions, and their overlapping character, are the prime pressing problem that has been acknowledged. Dhaka's local and transport governance are both operated under independent autonomous bodies. The Ministry of Road Transport and Bridges, the Ministry of Housing and Public Works, the Ministry of Local Government, Rural Development, and Cooperatives, and the Ministry of Home Affairs, along with the diffusion of external responsibilities across multiple ministries, make coordination much more difficult. Individual ministries have their own jurisdiction, independent mandate, rules, regulations, and separate ministries, departments, and divisions to which they report. The scenario of fragmented structure leads to significant overlapping functions not only within ministries but also at local, national and regional levels.

Over time, these fragmented organizations have complicated the involvement of urban planning agencies, as their unclear division of responsibilities has resulted in a plurality in planning. In the absence of a central authority, companies manage municipal services; their responsibilities may overlap, but their legal frameworks, constitutional duties, and jurisdictions differ, resulting in additional service overlaps and bureaucratic challenges. Without well-defined jurisdictional areas, both the Dhaka North City Corporation (DNCC) and the Dhaka South City Corporation (DSCC) share a planning jurisdiction of 360 square kilometers (BBS, 2001). Conversely, independent and specialized planning agencies like the Capital Development Authority (RAJUK) and the Dhaka Water and Sewerage Authority (DWASA) manage a larger city area and a greater population compared to the Dhaka City Corporation (DCC), especially since urban planning and water supply responsibilities were delegated from DCC to RAJUK and DWASA, respectively.

No single agency has the capacity or the comprehensive authority to provide strategic leadership for the entire metropolitan area. Dhaka Metropolitan Development Plan (DMDP) was introduced to share common goals and interests for the future development of Dhaka city. But there is no policy of integration in DMDP that may lead to shared common goals and objectives among the transport management organizations like DTCA,

BRTA etc. Furthermore, DMDP struggled to delineate the roles and responsibilities of various organizations through effective role casting, largely due to their independent autonomy governed by different ministries and corresponding laws. As a result, transport governance in the Dhaka metropolitan area involves multiple stakeholders that are interconnected and form part of a broader system linked to existing local governance organizations, such as DNCC, DSCC, RAJUK, WASA, DESA, TITAS, and other relevant entities.

The study highlights the significant roles played by six key organizations in Dhaka's traffic governance: DMP, DTCA, RAJUK, DSCC, DNCC, and BRTA. Among these, RAJUK, PWD, RHD, DNCC, and DSCC are crucial for road construction and management. Additionally, TITAS and WASA are essential as they manage sewer lines, gas lines, and drainage systems that run alongside the roads. Theoretically, it has been suggested that these key organizations involved in managing the transport system should align with DTCA to enhance the coordination of their activities. However, DTCA, as a legal entity, lacks the enforcement capacity to do so. In practice, DMP, DSCC, and DNCC tend to have greater control over compliance and the performance of responsible authorities concerning overall traffic governance.

These institutional challenges stem from the structures and mandates of the organizations involved. In Dhaka, there are six primary institutions with different goals and strategies, and their respective business rules present a significant hurdle in addressing a singular issue, such as traffic congestion. During interviews, some organizations expressed concerns about overlapping mandates related to constructing flyovers and developing roads. At the field level, cooperation among these agencies is even less pronounced.

Senior management frequently conducts meetings at the organizational level, yet field officers often remain uninformed about the resulting decisions. This lack of communication leads to surprises among team members as they undertake their initiatives independently. For instance, roadwork can present significant and unforeseen challenges for the Dhaka Metropolitan Police (DMP) in maintaining traffic flow. Additionally, frequent political and social events exacerbate traffic congestion. Issues such as parking violations and footpath occupations are prevalent, yet the responsible organizations are frequently absent on the ground to address these problems.

Organizations like WASA and TITAS routinely dig up roads for sewer and gas line installations, but once the work is done, the sites are often left in disarray due to the absence of a single authority to oversee the situation. As a result, road excavation can lead to prolonged disruptions. In response to the coordination gaps and challenges faced, the government has decided to reconstitute the Dhaka Transport Coordination Board (DTCB) as the Dhaka Transport Coordination Authority (DTCA) to enhance the coordination of mass transit development in Dhaka. In theory, the DTCA possesses the authority to coordinate various organizations; however, it lacks enforcement and control powers, as well as adequately trained personnel.

The Dhaka Mass Transit Company Limited (DMTCL) was established in 2014 through an act of parliament to design, construct, and operate the metro system. A separate entity is also being developed for the Bus Rapid Transit (BRT) system. However, how these

organizations will be coordinated by the DTCA remains unaddressed. Thus, the involvement of multiple agencies fosters inequalities in planning efforts.

The involvement of multiple agencies leads to constraints in human resources. RAJUK employs the largest number of staff, with 905 personnel, while BRTA follows with 573, although not all of these employees are directly engaged in traffic management. In contrast, city corporations have almost fully utilized their sanctioned personnel, but their numbers are relatively small compared to other organizations. Additionally, disparities in planning further impede the effective use of available resources. For instance, in terms of RAJUK's responsibility for preventing illegal establishments and enforcing parking regulations in both residential and commercial buildings, as well as BRTA's role in controlling unfit vehicles, minimal progress has been made, often attributed to a shortage of human resources. The DMP, tasked with managing road traffic, is primarily responsible for maintaining signals at intersections and monitoring illegal vehicles; however, their numbers fluctuate based on central decisions. In some instances, the actual availability of human resources may be underestimated. For example, interviews have indicated that the DMP strongly believes their staffing levels are insufficient, particularly as traffic congestion continues to spill over into residential areas, necessitating the deployment of additional traffic police. The human resources issue extends beyond mere staff numbers; it also encompasses the effectiveness of their utilization. This challenge is not limited to DMP; it is also prevalent in other institutions. For instance, city corporations have outsourced their traffic signal management systems to private companies for a specified annual fee. However, merely having a large number of personnel does not guarantee the institution's capacity to function effectively unless those employees possess the necessary skills. A significant problem in Dhaka's traffic management is the shortage of skilled human resources. In many organizations, technical positions are often filled by individuals who lack the required expertise. This situation is exacerbated by an organizational structure that frequently transfers and replaces staff, preventing them from developing the necessary expertise in traffic management. In institutions such as the DTCA, RAJUK, and both DCCs, many technical roles are occupied by civil engineers and bureaucrats.

None of the organizations have a distinct budget allocated for traffic management, except for a few specific projects. Even among those that do have published budgets, there is often a lack of clarity regarding how much was spent on various aspects of traffic management. This absence of a clear estimation of total expenditures for traffic management makes it difficult to assess the effectiveness of the budget. The situation is further complicated by the fact that many organizations undertake individual projects related to traffic management. However, according to a BUET expert, such separate allocations and implementations of budgets can lead to overlapping efforts and duplication of resources.

Evaluating the transport governance scenario in metropolitan Dhaka reveals significant ambiguity regarding role distribution, particularly concerning which organization will effectively oversee the implementation of a cohesive transportation system for the city. Currently, there are over 50 primary planning organizations and an additional 79 organizations operating at secondary and tertiary levels, all of which govern Dhaka in a fragmented manner. As a result, the city has struggled to foster an environment that can leverage its potential in this globalized era. The increased interconnectedness between

transport and non-transport systems has heightened the risks of disruptions, particularly due to cascading effects from these shocks.

7.2 Mapping the impact of Metropolitan Governance on Transport Resilience

The process of mapping the impact of metropolitan governance on transport resilience requires mapping transport networks as well as local governance networks to administer the extent to which actual transport systems resemble and the implications for the vulnerability of these networks to disruptions. For Dhaka, the aforementioned assessment evaluates organizations acts more of as circuit like networks those are randomly connected. The study reveals that a randomly connected network found in Dhaka poses the highest risk, resulting in the least resilience. Therefore, the least resilient network leads to slow recovery; consequently, after any immediate impact of the disruption, restoring system function becomes complicated in the long term and confusing. Multiple organizations or the absence of a core system creates an obstacle in the articulation of strategic choice and hampers trade-offs between resilience and efficiency.

Table 3: Risk Characterization of Transport Governance

Risk Characterisation	Risk Issues	Risk Sources
Simple risk	Routine transport system risk	- Disruptions in operations lead to delays, impacting the timely delivery of products and services. - Delays and disruptions increase transportation costs due to the need for rerouting, heightened demand for alternative paths, and repair expenses. - Deteriorating infrastructure can create bottlenecks, hinder the flow of goods and people and cause delays. - The most immediate and devastating outcome of these incidents is the loss of life and physical injuries, which not only affect those directly involved but also their families and communities.
	Physical risks	- Accidents may cause considerable harm to vehicles and infrastructure, including roads and bridges. - This leads to expenses for repairs, insurance claims, and possible losses of goods. - There is a service gap along with delays in construction and maintenance. - The expense of investing in infrastructure is quite high. - Regular Maintenance: Plan routine inspections and upkeep to detect and address wear and tear before it escalates into a major problem. - Upgrades: Allocate funds for infrastructure enhancements to guarantee that transportation routes and facilities are secure, efficient, and fulfill current demands.
	Natural Disaster	Floods and storms, resulting from various disruptions, can harm transportation infrastructure due to environmental occurrences such as damage to roads and bridges.

Risk Characterisation	Risk Issues	Risk Sources
Complexity induced risk	Interconnected Nature	The governance of transportation systems includes both transport and non-transport components. It represents a large part of a complex puzzle. The process may begin with contingency planning and culminate in revealing the profound interconnectedness of different transportation modes.
	External risk	Hazards associated with water supply, waste disposal, gas pipelines, execution of strategies, constructed surroundings, industrial growth, urban development, environmental contamination, and flooding.
	Planning and control risks	The dangers stem from both internal and external transport governance. DMDP, master plans, the policies and planning of city corporations, utility plans, and the coordination of planning extensions with current transport planning initiatives.
	Cultural risks	The likelihood of conflict arises from the cultural inclination of various ministries, departments, divisions, and local organizations to conceal or postpone sharing negative information.
Uncertainty induced Risk	Trade-off, Negotiation	- Acts of vandalism, forgery, bribery, organized crime within their sector, and widespread informal practices. - Infrastructure that is both compromised and unsafe. - Lack of proactive safety measures and the absence of established safety protocols and standards. - Lack of preparedness measures for both natural and human-made disasters.
	Political Control and process	- Changes in government policy can lead to regulatory compliance challenges. - Misalignment among stakeholders, including government agencies, operators, and local residents, can impede the effective planning and implementation of transportation initiatives.
	Legal settlements	- Legal resolutions, law enforcement actions, and regulatory penalties imposed by organizations such as DMP and RAJUK.
Ambiguity induced Risk	Horizontal and vertical coordination and interaction	- The interaction among interconnected entities across various levels of transport authority, local government, ministries, and community transport systems. - The presence of both formal and informal regulations, along with different levels of self-regulation. - The influence of power dynamics within the network. Challenges related to regulation and compliance. - Lack of established contingency planning. Insufficient compliance checks. Conduct regular inspections to ensure that all operations adhere to existing regulations.

Risk Characterisation	Risk Issues	Risk Sources
		- Neglect in developing contingency plans. Develop strategies for alternative routes and transportation methods to utilise during environmental disruptions. - Lack of risk assessments. Frequently assess vulnerable areas within your transportation network and devise strategies to reduce potential impacts from natural disasters.

Therefore, disruption in governing transport sector can significantly impact the entire governance system resulting multiple spillover effects. Hence, understanding these disruptions is crucial for strengthening their resilience at the first place. Since governing transportation system is interconnected in nature. In a broader context, it connects the City Corporation, the metropolitan police, gas supply lines, water and sewer systems, and planning organizations such as RAJUK, among others. Its transition point is critical because it governs the transport system simultaneously, connecting traffic management, vehicle management, road, and infrastructural management at the primary level. Although it is said to impact Dhaka's built environment and natural and man-made environments at the secondary level, in reality, it runs parallel with primary-level governance. The outcome results in the scenario of interaction between these two sectors being barely considered together.

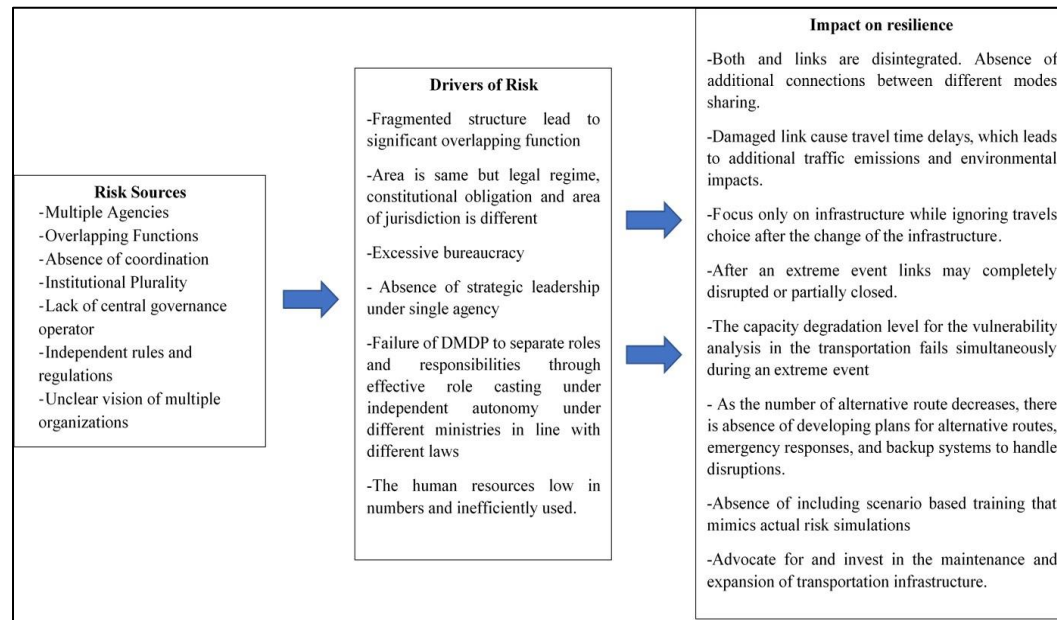


Figure 4: Impact of Metropolitan Governance Framework on Transport Resilience

The transportation community in Dhaka generally focuses on challenges facing the nation's transportation systems, such as traffic congestion, parking, longer commuting, inadequate public services, and difficulties for non-motorized vehicles. The challenge of addressing

environmental impacts, such as severe weather events, and responding to system vulnerabilities and emergencies, while ensuring the system's resilience, is very poor, especially through the lens of urban governance performance. To identify the faces of resilience, it is essential to outline the primary disruptions to transport systems resulting from the urban governance structures.

8. Discussion and Conclusion

Transportation sector in Dhaka has played a significant role allowing Dhaka to become industrialized, expand, and grow, and have fueled global prosperity by enabling international trade. The growth has placed both positive and negative sides to the progress causing serious pressure on transportation system resilience. The study aims to evaluate the impact of the metropolitan governance framework on urban resilience. The outcome evidences transport resilience deeply rooted in the metropolitan governance network, as well as in non-transport networks, including the City Corporation, the Dhaka Metropolitan Police, planning organizations, and public utility organizations. Although, a good number of transportation organizations exist, their role is unclear and dependent on local governance institutions. Also, due to the absence of role casting, all organizations involved in transport governance suffer from unclear institutional roles and limited functional assignments. Over the years, different authorities have been sharing responsibilities for the planning and development of Dhaka city including its administration, law and order, utility and services etc. These institutions are generating plurality in the planning and development approach and this pluralism results in uncoordinated efforts which in fact creates more problems than solutions.

Further, inadequate investment in expanding, lack of capacity development programs, and outdated infrastructure results a significant challenge in capacity development, and upgrading road and bridge infrastructure to match population growth and urbanization, leading to bottlenecks and outdated systems. The scenario further challenges integrated transport hubs, severe traffic congestion, high rates of road accidents, with inadequate road safety measures and poor driver training and limited sidewalks and unsafe crossing options challenging resilient and sustainable transport system in Dhaka. Public transport networks are thus vulnerable to a wide array of incidents that can disrupt or terminate services temporarily during a crisis. These incidents range from accidents and natural events such as floods, typhoons, or earthquakes. They can vary from minor, localized emergencies to full-scale crises and everything in between.

Metropolitan governance plays a crucial role in shaping transportation management by affecting its coherence, effectiveness, and sustainability. The governance structure in Dhaka is characterized by complexity in administration, infrastructure, and traffic, all of which are subject to rapid change. Transportation systems interact significantly with various layers of governance; as metropolitanization intensifies, so does this interaction causing the governance and decision-making around transportation has fragmented. There is also a lack of alignment between the owners and managers of transportation infrastructure and those who make budgetary and policy decisions. Effective planning and regular practice of response strategies are essential to ensure business continuity and maintain a resilient network. When an incident occurs, a coordinated and well-managed

response is vital. By analyzing the current metropolitan governance framework pertaining to the transport system, we can identify critical concerns that affect the system's resilience in Dhaka. Understanding these impacts can lead to improved urban local governments that provide more accessible and efficient public services. Furthermore, enhanced transportation governance can help coordinate multi-jurisdictional efforts, optimize resource allocation, and establish cohesive policies to manage traffic congestion, environmental impacts, and the mobility needs of the public.

9. References

- Ahsan et al., (2023) Changing institutional landscape and transportation development in Dhaka, Bangladesh, *Heliyon* 9(6):e17887 DOI:10.1016/j.heliyon.2023.e17887
- Alam, M., & Rabbani, M. D. G. (2007). Vulnerabilities and responses to climate change for Dhaka. *Environment & Urbanization*, 19(1), 81-97. doi: 10.1177/0956247807076911
- Aligicǎ, P. D. (2014). *Institutional diversity and political economy: the Ostroms and beyond*. New York: Oxford University Press.
- Bai et al., (2010). Urban policy and governance in a global environment: Complex systems, scale mismatches and public participation. *Current opinion in Environmental Sustainability* 2(3) : 129-1
- Balsas, C. (2017). Blending Individual Tenacity with Government's Responsibility in the Implementation of US Non-motorized Transportation Planning (NMT). [Article]. *Planning Practice & Research*, 32(2), 197-211. doi: 10.1080/02697459.2017.1286920
- Banister, D. (2008). The sustainable mobility paradigm. *Transport Policy*, 15(2), 73-80. doi: 10.1016/j.tranpol.2007.10.005
- Bull-Kamanga, L., Diagne, K., Lavell, A., Leon, E., Lerise, F., MacGregor, H., . . . Reid, H. (2003). From everyday hazards to disasters: the accumulation of risk in urban areas. *Environment and Urbanization*, 15(1), 193-204. Retrieved from
- Cao.H (2023), Urban Resilience: Concept, Influencing Factors and Improvement. *Frontiers in Business Economics and Management* 9 (1): 343-346. DOI:10.54097/fbem.v9i1.877
- Dauvergne, P. (2012). *Handbook of Global Environmental Politics* (2;2nd; ed.). Cheltenham: Edward Elgar Publishing Ltd.
- Delmas, M. A., & Young, O. R. (2009). *Governance for the environment: New perspectives*: Cambridge University Press.
- Dewan, A. M., Islam, M. M., Kumamoto, T., & Nishigaki, M. (2007). Evaluating Flood Hazard for Land-Use Planning in Greater Dhaka of Bangladesh Using Remote Sensing and GIS Techniques. *Water Resources Management*, 21(9), 1601-1612. doi: 10.1007/s11269-006-9116-1

- Einstein, K. L., & Kogan, V. (2016). Pushing the City Limits: Policy Responsiveness in Municipal Government. *Urban Affairs Review*, 52(1), 3-32. Retrieved from <http://gateway.library.qut.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=eoah&AN=37598785&site=ehost-live&scope=site>
- Feiock, R. C. (2009). Metropolitan governance and institutional collective action. *Urban Affairs Review*, 44(3), 356-377. Retrieved from <http://gateway.library.qut.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=swb&AN=59328&site=ehost-live&scope=site>
- Fletcher, D. R., & Ekern, D. S. (2016, August 25, 2016). *UNDERSTANDING TRANSPORTATION RESILIENCE: A 2016-2018 ROADMAP*. Retrieved from http://environment.transportation.org/pdf/infrastructure_resilience/understandingtransresil_jan2017.pdf
- Hanson, S., & Giuliano, G. (2004). *The geography of urban transportation* (3rd ed.). New York: The Guilford Press.
- Hao, T., Rogers, C. D. F., Metje, N., Chapman, D. N., Muggleton, J. M., Foo, K. Y., . . . Saul, A. J. (2012). Condition assessment of the buried utility service infrastructure. *Tunnelling and Underground Space Technology*, 28(2), 331-344. Retrieved from <http://gateway.library.qut.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=eoah&AN=26705404&site=ehost-live&scope=site>
- Heinelt, H., & Kübler, D. (2004). *Metropolitan governance in the 21st century: Capacity, democracy and the dynamics of place*: Routledge.
- Huq, S., & Alam, M. (2003). Flood management and vulnerability of Dhaka City. *Building Safer Cities*, 121. doi: <https://elibrary.worldbank.org/doi/abs/10.1596/0-8213-5497-3#page=145>
- Iannone, G. (2014). *The great Maya droughts in cultural context: case studies in resilience and vulnerability*. Boulder, Colorado: University Press of Colorado.
- Iles, R. (2005). *Public transport in developing countries* (1st ed.). Amsterdam;London;San Diego, CA;: Elsevier.
- Jahan, S. (2000). Coping with Flood: The Experience of the People of Dhaka during the 1998 Flood Disaster. *Australian Journal of Emergency Management*, The, 15(3), 16-20.
- Jelti et al., (2023), Transition Paths towards a Sustainable Transportation System: A Literature Review. *Sustainability* 2023, 15(21), 15457; <https://doi.org/10.3390/su152115457>
- Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, 33(7), 14-26. Retrieved from

<http://gateway.library.qut.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip,sso&db=coah&AN=19071557&site=ehost-live&scope=site>

- Kearns, A., & Forrest, R. (2000). Social Cohesion and Multilevel Urban Governance. [Article]. *Urban Studies (Routledge)*, 37(5/6), 995-1017. doi: 10.1080/00420980050011208
- Krizek, K.J. and D.A. King (2021) Advanced Introduction to Urban Transport Planning, Northampton, MA: Edward Elgar Publishing
- Kübler, D., & Heinelt, H. (2002). An analytical framework for democratic metropolitan governance. In *30th ECPR Joint Sessions of Workshop. Turin*.
- Kurzban, R., Houser, D., & Ostrom, E. (2005). Experiments Investigating Cooperative Types in Humans: A Complement to Evolutionary Theory and Simulations. *Proceedings of the National Academy of Sciences of the United States of America*, 102(5), 1803-1807. doi: 10.1073/pnas.0408759102
- Mahmud, Hoque and Qazi (2009), Conference Paper Conference: 13th Conference of the Road Engineering Association of Asia and Australasia (REAAA), Songdo Convensia, Incheon, Korea
- Marceau, J. (Singer-songwriter). (2008). Introduction: Innovation in the city and innovative cities. On: Taylor & Francis.
- McLuckie, G. (2012). Will the RDR really solve charging transparency? *Investment Adviser*. Retrieved from
- Mitchell, J. K. (1998). Urban metabolism and disaster vulnerability in an era. In *Earth System Analysis* (pp. 359-377): Springer.
- Mostashari, A., & Sussman, J. M. (2009). A Framework for Analysis, Design and Management of Complex Large-Scale Interconnected Open Sociotechnological Systems. *International Journal of Decision Support System Technology (IJDSST)*, 1(2), 53-68. doi: 10.4018/jdsst.2009040104
- Olaf J, Bart J, Piet R (2008) Modal split effects of climate change: the effect of low water levels on the competitive position of inland waterway transport in the river Rhine area DOI:10.13140/2.1.2054.2725
- Ostrom, E. (2011). Background on the institutional analysis and development framework. *Policy Studies Journal*, 39(1), 7-27. Retrieved from <http://onlinelibrary.wiley.com.ezp01.library.qut.edu.au/store/10.1111/j.1541-0072.2010.00394.x/asset/j.1541-0072.2010.00394.x.pdf?v=1&t=j5n3wnhj&s=30beb5885a7c32e6fd28c6e771a669a8dd23671f>
- Ostrom, E., & Cox, M. (2010). Moving beyond panaceas: a multi-tiered diagnostic approach for social-ecological analysis. *Environmental Conservation*, 37(4), 451-463. doi: 10.1017/S0376892910000834

- Ostrom, E., & Walker, J. (2003). *Trust and reciprocity: Interdisciplinary lessons for experimental research*: Russell Sage Foundation.
- Panday, P., & Jamil, I. (2011). Challenges of Coordination in Implementing Urban Policy: The Bangladesh Experience. [Article]. *Public Organization Review*, 11(2), 155-176. doi: 10.1007/s11115-010-0116-5
- Pierre, J. (1999). Models of Urban Governance: The Institutional Dimension of Urban Politics. *Urban Affairs Review*, 34(3), 372-396. doi: 10.1177/10780879922183988
- Pírez, P. (2002). Buenos Aires: fragmentation and privatization of the metropolitan city. *Environment and Urbanization*, 14(1), 145-158. Retrieved from <http://gateway.library.qut.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip.sso&db=eoah&AN=19073544&site=ehost-live&scope=site>
- Pojani, D., & Stead, D. (2015). Sustainable Urban Transport in the Developing World: Beyond Megacities. *SUSTAINABILITY*, 7(6), 7784-7805. doi: 10.3390/su7067784
- Popescu, O., Stefan-Gorin, J., & Tache, A. (2017). THEORETICAL ASPECTS OF TERRITORIAL AND METROPOLITAN GOVERNANCE. *Urbanism. Arhitectura. Constructii*, 8(1), 37. Retrieved from <http://gateway.library.qut.edu.au/login?url=https://search.proquest.com/docview/1836008655?accountid=13380>
- Rahman, K., & Weber, T. (2003). Sustainable urban development in Brisbane City - the Holy Grail? *Water Science and Technology*, 47(7-8), 73-79. Retrieved from <http://gateway.library.qut.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&AuthType=ip.sso&db=eoah&AN=4826011&site=ehost-live&scope=site>
- Rahman Md Ashiq Ur (2015), Coordination of urban planning organizations as a process of achieving effective and socially just planning: A case of Dhaka city, Bangladesh International Journal of Sustainable Built Environment 4(2) DOI:10.1016/j.ijbsbe.2015.09.003
- Reggiani, A., Nijkamp, P., & Lanzi, D. (2015). Transport resilience and vulnerability: The role of connectivity. *TRANSPORTATION RESEARCH PART A-POLICY AND PRACTICE*, 81, 4-15. doi: 10.1016/j.tra.2014.12.012
- Rodrigue, J.-P., & Notteboom, T. (2013). The geography of cruises: Itineraries, not destinations. *Applied Geography*, 38(1), 31-42. doi: 10.1016/j.apgeog.2012.11.011
- Rundmo et al., (2014), 'Transport priorities, risk perception and worry associated with mode use and preferences among Norwegian commuters, Accident Analysis & Prevention. Volume 72, November 2014, Pages 391-400, <https://doi.org/10.1016/j.aap.2014.07.028>

- Sciara, G.-C. (2017). Metropolitan Transportation Planning: Lessons From the Past, Institutions for the Future. [Article]. *Journal of the American Planning Association*, 83(3), 262-276. doi: 10.1080/01944363.2017.1322526
- Shaw, R. (2016). *Urban disasters and resilience in Asia*. Amsterdam: Elsevier.
- Skelcher, C. (2005). Jurisdictional Integrity, Polycentrism, and the Design of Democratic Governance. [Article]. *Governance*, 18(1), 89-110. doi: 10.1111/j.1468-0491.2004.00267.x
- Smith, G., & McLuckie, D. (2015). Delineating hazardous flood conditions to people and property. In *Proc. Of FMA conference, Brisbane Australia*. [http://www.floodplainconference.com/papers2015/Grantly% 20Smith% 20Full% 20Paper.pdf](http://www.floodplainconference.com/papers2015/Grantly%20Smith%20Full%20Paper.pdf).
- Smyth, A., Christodoulou, G., Dennis, N., Al-Azzawi, M., & Campbell, J. (2012). Is air transport a necessity for social inclusion and economic development? *Journal of Air Transport Management*, 22, 53-59. doi: 10.1016/j.jairtraman.2012.01.009
- Soeters, J., Shields, P. M., & Rietjens, S. (2014). *Routledge Handbook of Research Methods in Military Studies*. Florence: Routledge Ltd - M.U.A.
- Sohn, J. (2006). Evaluating the significance of highway network links under the flood damage: An accessibility approach. *Transportation Research Part A*, 40(6), 491-506. doi: 10.1016/j.tra.2005.08.006
- Stephens, G. R., & Wikstrom, N. (2000). *Metropolitan government and governance: Theoretical perspectives, empirical analysis, and the future*: Oxford University Press on Demand.
- The Strategic Transport Plan for Dhaka*. (2005): Government of The People's Republic of Bangladesh
- Retrieved from www.dtca.gov.bd.
- Suriya, S., & Mudgal, B. V. (2012). Impact of urbanization on flooding: The Thirusoolam sub watershed - A case study. *Journal of Hydrology*, 412-413, 210-219. doi: 10.1016/j.jhydrol.2011.05.008
- Tamvakis, P., & Xenidis, Y. (2012). Resilience in transportation systems. *Procedia-Social and Behavioral Sciences*, 48, 3441-3450. doi: 10.1016/j.sbspro.2012.06.1308
- te Brömmelstroet, M., Skou Nicolaisen, M., Büttner, B., & Ferreira, A. (2017). Experiences with transportation models: An international survey of planning practices. [Article]. *Transport Policy*, 58, 10-18. doi: 10.1016/j.tranpol.2017.04.007
- Vuchic, V. R. (1999). *Transportation for livable cities*. New Brunswick, N.J: Center for Urban Policy Research.

- Waddell, P., Ulfarsson, G. F., Franklin, J. P., & Lobb, J. (2007). Incorporating land use in metropolitan transportation planning. *Transportation Research Part A*, 41(5), 382-410. doi: 10.1016/j.tra.2006.09.008
- Wang, J. Y. T. (2015). 'Resilience thinking' in transport planning. *Civil Engineering and Environmental Systems*, 32(1-2), 180-191. doi: 10.1080/10286608.2015.1014810
- Wang, Hong and Chen, (2012), Vulnerability analysis of interdependent infrastructure systems: A methodological framework. *Physica. A Statistical Mechanisms and its Application* 391 (11): 3323-3325. DOI: 10.1016/j.physa.2011.12.043
- Wisner, B., Blaikie, P., Cannon, T., & Davis, I. (Singer-songwriters). (2003). *At Risk* Second Edition. On: New York: Routledge. Retrieved from http://www.preventionweb.net/files/670_72351.pdf
- Vigar, G (2017), The four knowledges of transport planning: Enacting a more communicative, trans-disciplinary policy and decision-making. *Transport Policy* 58:39-45. DOI: 10.2016/j.tranpol.2017.04.013