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A photograph of a heavily damaged urban area. In the foreground, there is a large pile of rubble, including bricks, concrete, and debris. In the background, several multi-story buildings are visible, many of which are severely damaged, with missing windows and crumbling facades. A tall, metal communication tower with multiple antennas is visible on the right side of the image. The sky is clear and blue.

EXAMINING CRITICAL INFRASTRUCTURE RESILIENCE IN URBAN WARFARE INSIGHTS FROM COLOMBIA, TUNISIA, AND THE PHILIPPINES

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Abbreviations

ANME	Tunisian National Energy Management Agency
ARP	Applied Research Project
AGC	Gaitanist Self-Defense Forces of Colombia (<i>Autodefensas Gaitanistas de Colombia</i>)
BARMM	Bangsamoro Autonomous Region in Muslim Mindanao
BAWASA	Barangay Waterworks and Sanitation Associations
BMCRRP	Bangon Marawi Comprehensive Rehabilitation and Reconstruction Plan/Program
BTA	Bangsamoro Transition Authority
CI	Critical Infrastructure
CIP	Critical Infrastructure Protection
CPC	Carthage Power Company
CRA	Commission for the Regulation of Water Supply and Sanitation
DHSUD	Department of Human Settlement and Urban Development
DRR	Disaster Risk Reduction
ELN	National Liberation Army
EPIRA	Electric Power Industry Reform Act
ERC	Energy Regulatory Commission
FARC-EP	Revolutionary Armed Forces of Colombia
GOCC	Government-owned and Controlled Corporations
ICRC	International Committee of the Red Cross
IDP	Internally Displaced Person
IPP	Independent Power Producers
IS	Islamic State

LASURECO	Lanao del Sur Electric Cooperative, Inc.
LGU	Local Government Unit
MAA	Most-affected areas
MCR	Make Cities Resilient
MCWD	Marawi City Water District
MME	Ministry of Mines and Energy
MWSS	Metropolitan Waterworks and Sewerage System
NDP	National Development Plan
NEA	National Electrification Administration
NEDA	National Economic and Development Authority
NHA	National Housing Authority
ONAS	<i>Office National de l'Assainissement</i>
PEN	National Energy Plan
PIEC	Indicative Coverage Plan
RISE	Resilience, Identity, Sustainability, and Evolution
RWSA	Rural Waterworks and Sanitation Associations
SDL	Local Distribution
SIN	National Interconnected System
SONEDE	<i>Société Nationale d'Exploitation et de Distribution des Eaux</i>
SSPD	Superintendence of Domiciliary Public Services
STEG	Tunisian Society for Electricity and Gas
STR	Regional Transmission
TFBM	Task Force Bangon Marawi
UPME	Mining and Energy Planning Unit
WSS	Water Supply and Sanitation
ZNI	Non-Interconnected Zones

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We, as the authors, take full responsibility for any errors in this report.

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Introduction

The escalating trend of urbanisation has led to a substantial increase in the urban population, with approximately 1.5 billion people currently residing in vulnerable urban areas.¹ This demographic shift underscores the urgent need to address the intricate complexities that urban structures introduce to the safety of civilians², particularly in light of the growing prevalence of armed conflicts in urban settings. The interconnected nature of urban infrastructure, in fact, not only brings about numerous benefits to civilians but also accentuates the extensive and far-reaching consequences resulting from any form of harm inflicted upon it.³ Such repercussions transcend the immediate aftermath of a singular event, such as an explosive blast, as the impacts permeate through interconnected structural networks. This interdependence amplifies the magnitude and duration of damages, thereby engendering widespread and long-term implications. Consequently, the initial and critical step towards establishing a suitable response capacity is to develop a comprehensive understanding of the frameworks governing Critical Infrastructure (CI) and the intricate interdependencies that exist among diverse systems.

As cities become more interconnected and dependent on each other, the protection of CI, which includes sectors like transportation, telecommunications, healthcare, energy, and water services, has gained significant attention. Critical Infrastructure Protection (CIP) refers to frameworks and measures aimed at safeguarding the vital systems and assets that are essential for the functioning of society, addressing risks to public safety, economic stability, and national security.⁴ Meanwhile, this report defines urban resilience as the ability of a city and its urban systems to withstand and recover from the impacts of disturbances such as natural disasters, crises, or disruptive events⁵. It involves the collective capacity of various dimensions of a city (social, economic, natural, human, technical, and physical) to absorb initial damage,

¹ ICRC, 'Present and Engaged – How the ICRC Responds to Armed Conflict and Violence in Cities'.

² Tumchewics, 'Fighting Wars in Cities'.

³ Graham, 'Conducting Urban Warfare in the Twenty-First Century'.

⁴ UN Security Council Counter-Terrorism Committee Executive Directorate (CTED) and UN Office of Counter-Terrorism (UNOCT), 'The Protection of Critical Infrastructures against Terrorist Attacks: Compendium of Good Practices'.

⁵ Kilcullen, 'The City as a System: Future Conflict and Urban Resilience'.

minimise the effects of the disturbance, and adapt to changing circumstances in a timely and efficient manner.⁶

Failure to address the challenges imposed by urban warfare poses a substantial threat to the maintenance of CIs, severely curtailing or impeding access to indispensable services, including WSS, and electricity. By building upon three case studies, the objective of this report is to examine the existing frameworks that establish and oversee CI with a primary focus on producing a valuable reference point for stakeholders when seeking to improve resilience and respond to the impacts of urban warfare.

In doing so, an outline of the applied methodology will be followed by an analysis of the case studies that assess the legal, policy, and practical frameworks governing WSS and electricity infrastructure. Subsequently, the next section will delve into the main findings and reflections, evaluating the resilience of the existing frameworks and identifying their limitations in the context of urban warfare. Lastly, a template based on our findings will be constructed, by which humanitarian responders can get a first overview of the CI landscape of any given context before outlining a summarising conclusion.

⁶ Ribeiro and Pena Jardim Gonçalves, 'Urban Resilience'.

Methodology

The aim of this research is to conduct a review and analysis of the legal and policy frameworks within the selected contexts of Colombia, Tunisia, and the Philippines, with a focus on understanding how these systems are established, function, and maintained. The primary objective of this project is to produce a reference point that authorities, Red Cross Red Crescent-National Societies, the ICRC, and other partners can use to improve resilience and respond to the impacts of urban warfare. To achieve this, the research employs a desk study of the applicable legal, practical, and policy frameworks, supplemented with valuable inputs gained through interviews with specialised staff of the Movement with experience of country-specific infrastructures or domestic legislation.

The case studies were carefully selected to ensure a diverse representation of geographic locations, varying levels of development and different governance structures, offering distinct frameworks for infrastructure. First, Colombia has endured protracted urban violence, resulting in significant loss of life and formidable obstacles in providing essential services.⁷ Moreover, the Colombian conflict has resulted in significant internal displacement, with millions of people forced to abandon their homes and seek refuge in cities which poses unique challenges for the provision of essential services.⁸ Next, Tunisia's case confronts a myriad of challenges that render its infrastructure susceptible to the detrimental effects of urban warfare, encompassing scarce natural resources, insufficient statistical information, and inadequate international collaboration in service provision.⁹ Lastly, the Philippines was chosen primarily due to the Marawi insurgency in 2017 which caused entire neighbourhoods to be decimated or rendered uninhabitable due to extensive damage inflicted upon WSS and electrical power sources.¹⁰

Although social and physical infrastructure have been widely discussed in previous literature¹¹, finding concise overviews of electricity and water sanitation infrastructure in

⁷ Collins, 'How Peace Efforts Are Making a Difference (or Not) in Colombia'.

⁸ European Union Agency for Asylum., *Colombia, Country Focus*.

⁹ Kilcullen, 'The City as a System: Future Conflict and Urban Resilience'.

¹⁰ Amnesty International, "'The Battle of Marawi": Death and Destruction in the Philippines'.

¹¹ Graham and McFarlane, 'Introduction'; Saidi and Hammami, 'Impact of Investments in Public Infrastructures on Economic Performance and Private Investment in Developing Countries: A Case Study for Tunisia'.

specific domestic contexts remains challenging. This report seeks to address the gap in documentation on country-specific infrastructure by providing a succinct overview of existing electricity and WSS infrastructure in Colombia, Tunisia, and the Philippines and subsequently construct a general list of questions that first-responders can refer to when supporting CIP in a post urban warfare scenario.

1. Case Studies

1.1 Colombia

CONTEXT

Colombia has been embroiled in a protracted asymmetric war for over fifty years, characterised by a slow-burning conflict. Despite the signing of a historic peace deal in 2016 between the Colombian government and the FARC-EP, violence continues to plague the country. This ongoing strife has resulted in Colombia hosting one of the largest populations of IDPs worldwide¹², with severe consequences such as protection issues, forced displacement, confinement, and various forms of violence including threats, killings, forced recruitment, and gender-based violence.

The demobilisation of the FARC-EP has created a power vacuum, allowing other armed factions such as the ELN, AGC, also known as the Gulf Clan, and FARC-EP dissident groups to exploit opportunities and gain control over different regions and resulting in a significant increase in armed confrontations over the past year.¹³ The Special Jurisdiction for Peace (JEP) war crimes tribunal in Colombia has even determined that 2021 witnessed the highest level of violence since the government and FARC-EP signed the peace accord.¹⁴ Furthermore, as of March 2022, the ICRC identified six ongoing non-international armed conflicts in Colombia.¹⁵ These conflicts primarily revolve around the Colombian government's efforts to combat three main armed groups: the ELN, AGC, and FARC-EP dissident groups. Additionally, conflicts have arisen between various factions within these groups.¹⁶ The consequences of this shifting power dynamics and ongoing violence are particularly pronounced in areas where state presence is minimal and violence rates remain high, leading to significant challenges in delivering essential services and meeting basic needs. Areas lacking adequate state control experience in fact challenges in delivering essential services to their populations. Furthermore,

¹² DRC, 'Factsheet - DRC Colombia'.

¹³ Collins, 'How Peace Efforts Are Making a Difference (or Not) in Colombia'.

¹⁴ European Union Agency for Asylum., *Colombia, Country Focus*.

¹⁵ ICRC, 'Humanitarian Challenges 2022'.

¹⁶ ACAPS, 'COLOMBIA Complexities in Negotiating "Total Peace"'.

humanitarian access in Colombia faces significant constraints due to the activities of armed groups¹⁷.

Despite the peace agreement, violence remains therefore a pressing concern and while the threat posed by armed groups may not pose a direct danger to the overall stability of the country, it continues to present a substantial threat, particularly in specific regions such as Catatumbo (Norte de Santander), Cauca, Valle del Cauca, the Pacific coastal region, Tumaco, and the borders with Ecuador and Venezuela. Overall, the situation in Colombia can be best characterised, as aptly described by the ICRC, as a low-intensity conflict with an "extremely high impact"¹⁸ that has the potential to generate significant humanitarian needs, as access to CI, including water, sanitation, and electricity, is frequently compromised.



Figure 1: Index of the impact of violence based on variables of homicides of social leaders, massacres, assassinations of ex-FARC-EP combatants, rates of confinement and rates of displacement, June 2022¹⁹

¹⁷ ACAPS, 'Colombia: Risk Analysis Update'.

¹⁸ European Union Agency for Asylum., *Colombia, Country Focus*.

¹⁹ UN OHCHR, 'Violencia Territorial En Colombia: Recomendaciones Para El Nuevo Gobierno'.

INFRASTRUCTURE

a) Legal Framework

The constitution of 1991 laid out a comprehensive framework for the provision of essential services in Colombia, emphasising decentralisation and encouraging both public and private sector participation.²⁰ The institutional framework of the country is built on the division of responsibilities between the national government, responsible for policy formulation and enforcement, and the municipalities, entrusted with the efficient delivery of services. Key provisions in this regard can be found in Article 334 and Article 365 of the Constitution, which affirm the state's obligation to ensure universal access to essential services for all citizens, including the most vulnerable. Consequently, water supply and sanitation and electricity hold a dual significance in the Colombian legal system, recognized as both fundamental rights and public services.²¹

The primary legislation governing the supply of WSS, and electricity is the Domiciliary Public Services Law (Law 142 of 1994). This law establishes the regulatory framework and criteria for the provision of public services across the country. Regarding WSS, Law 142 of 1994 also created the CRA²² and facilitated the involvement of private businesses, public-private partnerships, and municipally controlled corporatized public utilities in service provision.²³ Additionally, Law 1523 of 2012, which focuses on emergency and disaster management, mandates water providers to develop and implement Emergency and Contingency Plans. Guidelines for these plans are outlined in Resolution 154 of 2014 issued by the Ministry of Housing, City, and Territory Development, aimed at ensuring the prompt recovery of services in the event of emergencies.²⁴

Law 142 also serves as a comprehensive framework for regulating electricity as a public service and is complemented by Law 143 of 1994 which plays a crucial role in establishing the legal foundations for the generation, interconnection, transmission, distribution, and

²⁰ Andres, Sislen, and Marin, *Charting a New Course*.

²¹ Human Right 2 Water, 'Colombia Country Mapping'.

²² Human Right 2 Water.

²³ Saker, Bernal Pedraza, and Narayan, 'Regulating Citywide Inclusive Sanitation (CWIS) in Colombia'.

²⁴ Human Right 2 Water, 'Colombia Country Mapping'.

commercialization of electricity. Over the years, however, the regulation of electricity has become increasingly complex, with recent regulations focusing on areas such as self-generation, communities affected by armed conflict and the promotion of renewable energy sources²⁵, and burdened by bureaucracy.

b) Policy Framework

Colombia's approach to addressing water, sanitation, and electricity services has seen some progress, although challenges persist on the path towards universal access and equitable provision. While the conflict in Colombia has primarily resulted in visible humanitarian impacts such as displacement, confinement, and killings, the focus on infrastructure attacks has been relatively limited and resulted in less pressure to adopt contingency measures in this regard²⁶. Nevertheless, Colombia has recognized the need for comprehensive policies and strategic plans to enhance the development of water, sanitation, and electricity systems. The country periodically formulates NDPs that establish the government's objectives and strategies across various sectors, including energy, water, and infrastructure. These plans provide a crucial policy framework for promoting the resilience and sustainability of electricity and water supply systems.

In the case of electricity, moreover, Colombia has implemented energy access regulations based on several strategic guidelines, such as regional development plans, the PEN, and the PIEC which are prepared by the MME and the Mining and UPME. The PEN proposes the utilisation of alternative sources of electricity generation to ensure supply security, as the country heavily relies on hydro generation, which is vulnerable to variable hydrological availability. On the other hand, the PIEC serves as the foundation for determining infrastructure needs and development priorities in extending electricity coverage, encompassing both the Regional Transmission (STR) and Local Distribution (SDL) systems, as well as the ZNI²⁷. Various funds and subsidies are in place to support these plans and increase electrification throughout the country but while significant progress has been made in achieving widespread electricity access in urban areas, rural areas still face significant gaps.

²⁵ Holland & Knight LLP - José V Zapata Lugo, 'In Review'.

²⁶ Legal Advisor to the Colombian Red Cross, War in Cities Research Interview - Colombia.

²⁷ Human Right 2 Water, 'Colombia Country Mapping'.

Regarding water and sanitation services, Colombia has recognized that specialised knowledge is necessary, particularly at the municipal level and consequently pursued a policy of encouraging regionalization of water sanitation services through the implementation of Departmental Water Plans. These plans consist of coordinated strategies and interinstitutional cooperation, with municipalities voluntarily opting into them. The Ministry of Housing, Cities, and Territory collaborates closely in their execution, bringing a more organised approach to WSS service provision and facilitating the expansion of services by larger private operators into small towns and rural areas. However, these plans often lack regular updates and fail to provide accurate coverage information, especially for rural areas. Some regions lack even basic mapping of their infrastructure, making it difficult for the government to ascertain the existing infrastructure and its current status in these areas²⁸. In summary, although Colombia has made significant efforts to enhance water, sanitation, and electricity services, there is still work to be done to address the remaining gaps, especially in rural areas.

c) Practical Framework

Colombia's framework for potable water and electricity utilities is characterised by decentralised authorities and market-based regulation. The energy sector operates through a network of specialised institutions. The MME takes on the responsibility of formulating national energy policies and strategic planning. Supporting the MME in achieving its objectives is the UPME, a special administrative unit attached to the MME that oversees planning in the energy and mining sectors. The Regulatory Commission of Energy and Gas (CREG) ensures compliance with legal and regulatory requirements in the gas and electricity markets, while also promoting efficient service provision.²⁹ Additionally, the SSPD plays a crucial role in ensuring the sustainable and high-quality delivery of public household services.³⁰

Within the electricity sector, two main frameworks are in place. The SIN covers 48% of the territory and serves as the primary transmission system, providing electricity to nearly the entire population (95%). On the other hand, the ZNI covers 52% of the territory and serves approximately 4% of the population (around 625,000 people). These zones include municipalities, cities, towns, and villages that are not connected to the SIN and rely on smaller

²⁸ Water and Habitat Coordinator for the Colombian Red Cross, War in Cities Research Interview - Colombia.

²⁹ Holland & Knight LLP - José V Zapata Lugo, 'In Review'.

³⁰ Garces et al., 'Lessons from Last Mile Electrification in Colombia'.

local grids or stand-alone solutions powered by diesel generators.³¹ The electricity providers in Colombia comprise a mix of public and private companies. For instance, the capital city is served by Codensa, a private subsidiary of the Italian company Enel. In the north, cities like Barranquilla and Cartagena are served by the Spanish-owned company Electricaribe, which, despite being privatised, faces financial sustainability challenges and provides subpar service quality to its customers. Lastly, in Medellin, the local municipal company EPM manages the utility services, including water and sanitation, natural gas, fixed-line communications, and public transportation.³²



Figure 2: Electricity sector snapshot³³

In the WSS sector, the primary regulatory authority is the CRA, operating under the Ministry of Housing, Cities, and Territory.³⁴ Similar to electricity, the SSPD oversees the performance of service providers.³⁵ The Autonomous Regional Corporations (CAR) issue water permits, and specialised utilities—whether public, private, or semi-private—receive

³¹ Garces et al.

³² Rudnick and Velásquez, ‘Learning from Power Sector Reform: The Case of Colombia’.

³³ Roy, Briones, and Dizy, ‘Market Information Report: Colombia’.

³⁴ Hayward, ‘Colombia’s Emerging Regulatory Framework for Inclusive Sanitation Access’.

³⁵ Saker, Bernal Pedraza, and Narayan, ‘Regulating Citywide Inclusive Sanitation (CWIS) in Colombia’.

concessions from municipal authorities to operate WSS services. The funding for investment and operations primarily comes from user tariffs, which are adjusted based on income levels, often resulting in subsidised tariffs for low-income users.³⁶ Over the past decade, external partners such as the World Bank, the Inter-American Development Bank, and the Andean Development Corporation have implemented water and sanitation projects in Colombia, providing loans to contribute to the improvement of water and sewage infrastructure.³⁷

³⁶ Saker, Bernal Pedraza, and Narayan.

³⁷ Human Right 2 Water, 'Colombia Country Mapping'.

Figure 3: Overview of WSS frameworks in Colombia

Water and Sanitation in Colombia		
Legal Framework	Policy Framework	Practical Framework
<p>Colombia's Constitution of 1991</p> <ul style="list-style-type: none"> - Article 334 and 365: ensuring universal access to essential services is a duty of the state. 	<p>NDPs: establish the government's objectives across the infrastructure sector and provide a policy framework to promote resilience of WSS.</p>	<p>CRA: operates under the Ministry of Housing, Cities and Territory is the primary agency regulating the WSS sector.</p> <p>WSS services are provided by a mix of public and private utilities based on a tariff structure.</p>
<p>Law 142 of 1994 (Domiciliary Public Services Law): establishes Colombia's regime of domestic public services.</p> <ul style="list-style-type: none"> - Establishes the CRA <p>Law 1523 of 2012 regulates the development of policies and institutional mechanisms to address risk management.</p>	<p>Departmental Water Plans in collaboration with the Ministry of Housing Cities and Territories</p>	<p>CRA: operates under the Ministry of Housing, Cities and Territory is the primary agency regulating the WSS sector.</p>
<p>Colombia's Constitution of 1991 → Article 334 and 365: ensuring universal access to essential services is a duty of the state.</p>	<p>NDPs: establish the government's objectives across the infrastructure sector and provide a policy framework to promote resilience of WSS.</p>	<p>WSS services are provided by a mix of public and private utilities based on a tariff structure.</p>

Figure 4: Overview of the electricity framework in Colombia

Electricity in Colombia		
Legal Framework	Policy Framework	Practical Framework
<p>Colombia's Constitution of 1991</p> <ul style="list-style-type: none"> - Article 334 and 365: ensuring universal access to essential services is a duty of the state 	<p>NDPs: establish the government's objectives across the infrastructure sector and provide a policy framework to promote resilience of electricity.</p>	<p>MME: national executive ministry that oversees the regulation of the electricity sector.</p>
<p>Law 142 of 1994 (Domiciliary Public Services Law): establishes Colombia's regime of domestic public services.</p>	<p>PEN: proposes utilisation of alternative sources of electricity generation to enhance resilience.</p>	<p>Electricity services are provided by a mix of public and private entities, examples include:</p> <ul style="list-style-type: none"> - Codensa: private company operating in Bogotá - Empresas Publicas de Medellin (EPM): municipal company operating in Medellin
<p>Law 143 of 1994: regulates the generation, interconnection, transmission, distribution and commercialization of electricity.</p>	<p>PIEC: establishes infrastructure needs and development priorities.</p>	

1.2 Tunisia

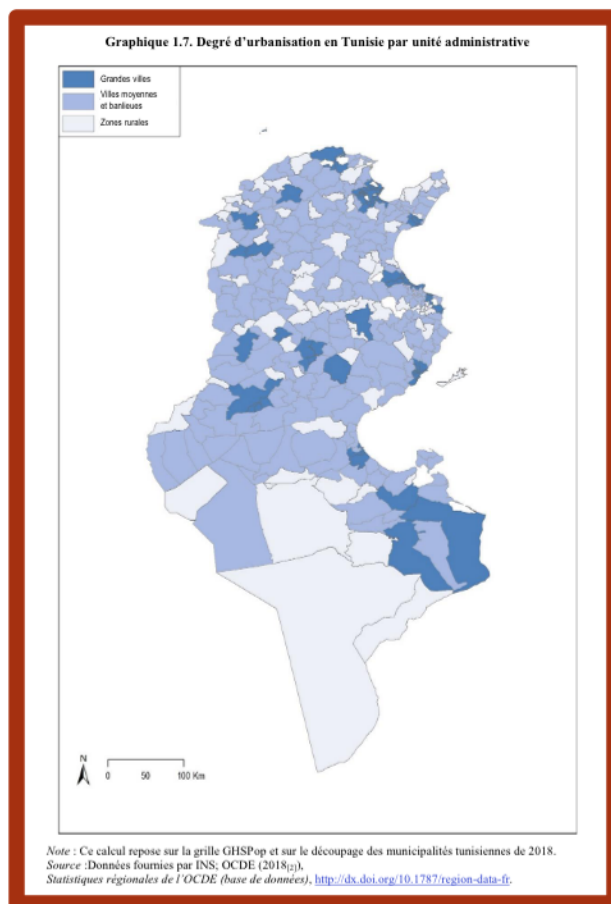


Figure 5: Urban centres Tunisia³⁸

CONTEXT

Tunisia's coastal cities have witnessed rapid urbanisation in the last decades and currently host 75% of the country's overall population³⁹. Although Tunisia has seen greater stability in its political landscape following the uprising and democratisation processes of the Arab Spring in 2010 and 2011⁴⁰, several challenges increasingly threaten urban security and could potentially strain essential infrastructure⁴¹.

Amongst these challenges are the regional disparities, with the wealthier coastal cities and the neglected rural areas, that cause frustration amongst the population and could

³⁸ OCDE, *Améliorer les statistiques régionales pour un développement territorial inclusif et durable en Tunisie*.

³⁹ Kilcullen, 'The City as a System: Future Conflict and Urban Resilience'.

⁴⁰ Brisson and Krontiris, *Tunisia, From Revolutions to Institutions*.

⁴¹ Kilcullen, 'The City as a System: Future Conflict and Urban Resilience'.

exacerbate civil unrest⁴². Further, the country's high unemployment rate offers a fertile ground for the appearance and recruitment of Islamic extremist groups, especially in rural border zones⁴³. And lastly, climate change increasingly challenges the security of the supply of natural resources such as water, which expands competition for resources amongst the population and further aggravates societal inequality⁴⁴.

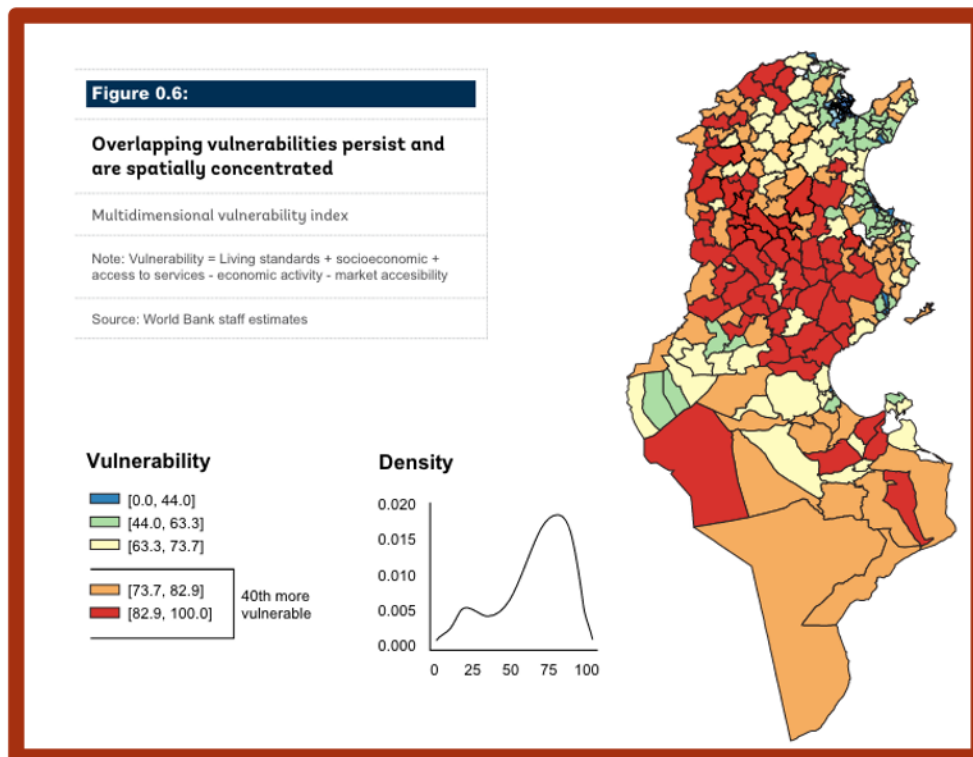


Figure 6: Social Inequalities⁴⁵

Apart from socio-political tensions, the provision of infrastructural services is also limited due to the country's authoritarian legacy and a moderate interest in foreign investment⁴⁶. The centralised nature of infrastructural services impedes international collaboration and a strategic vision of infrastructural policies⁴⁷ and ultimately decreases the resilience and

⁴² Bertelsmann, 'Country Report Tunisia'; Brisson and Krontiris, *Tunisia, From Revolutions to Institutions*.

⁴³ Bertelsmann, 'Country Report Tunisia'; Kilcullen, 'The City as a System: Future Conflict and Urban Resilience'.

⁴⁴ World Food Programme, 'Tunisia Annual Country Report 2022 - Country Strategic Plan 2022-2025'.

⁴⁵ World Bank Group, 'Tunisia's Systematic Country Diagnostics'.

⁴⁶ Kwakwa et al., 'Natural Resources and Economic Growth'; Saidi and Hammami, 'Impact of Investments in Public Infrastructures on Economic Performance and Private Investment in Developing Countries: A Case Study for Tunisia'.

⁴⁷ OECD, 'Water Governance in Tunisia - Overcoming the Challenges to Private Sector Participation'.

flexibility of services during conflict. Due to the lack of in-depth statistical regional data, it has furthermore, as of 2019, not been possible to conduct significant city-specific research on infrastructure maintenance⁴⁸.

INFRASTRUCTURE

a) Legal Framework

Tunisia has made several efforts to integrate infrastructure into its legislation. With its new constitution of 2014, the country incorporated water management into its legal framework by making it the duty of the state and society to guarantee access to water and use it rationally and conservatively.⁴⁹ The constitution also provides an article that foresees decentralised governance, which ensures that municipalities, regions, and districts can respond to the needs of their communities to the extent of their capacities.⁵⁰

Aside from the constitution, another crucial regulatory framework for WSS is the National Water Code of 1975. It merges all legal provisions concerning the distribution and management of natural and artificial water resources in the country into one overarching document.⁵¹ It thus proclaims that the Ministry of Agriculture, Water Resources, and Fishery is the governmental entity in charge of the management and supervision of WSS in Tunisia.⁵² As a subsection of the National Code, law n°95-70 of 1995 regulates the protection of infrastructural WSS installations from any form of degradation.⁵³ The protective and conservational measures of article 5 include dispersal, drainage and water storage, soil fixation by plant cover, the establishment of banks, and the adaptation of land use methods.⁵⁴ In case of threat to urban infrastructure, article 7 foresees that the Ministry of Agriculture, Water Resources and Fishery can issue such measures per decree if the urgency of the situation

⁴⁸ OCDE, *Améliorer les statistiques régionales pour un développement territorial inclusif et durable en Tunisie*.

⁴⁹ République Tunisienne, Constitution de la République Tunisienne, art. 44.

⁵⁰ République Tunisienne, art. 131.

⁵¹ Global Water Intelligence, 'Global Water and Wastewater Quality Regulations'.

⁵² République Tunisienne, Code des Eaux et ses Textes d'Application, art. 8.

⁵³ République Tunisienne, 71.

⁵⁴ République Tunisienne, Code des Eaux et ses Textes d'Application.

demands it.⁵⁵ Lastly, article 133 of the National Water Code foresees disposable water management of cities to be fast, efficient, and located on the outskirts of the urban centres, to prevent health issues or odour disturbances.⁵⁶

While access to WSS infrastructure is a specifically proclaimed right of the constitution and is legally well established through the National Water Code, there are no such comprehensive laws designated to electricity. The regulatory framework for electricity remains fragmented amongst several decrees and laws.⁵⁷ The decree n°64-9 of 1964 for example regulates the competencies of the STEG and its monopoly in the provision of electricity, while more recent decrees shift towards a sustainable approach to electricity production and distribution and continually encourage private stakeholder's investment.⁵⁸

b) Policy Framework

Infrastructure maintenance has widely been neglected in Tunisia's political agenda of the past decade, which inevitably led to worsening conditions and erosion of infrastructural installations.⁵⁹ Despite the Tunisian government's severe financial limitations⁶⁰, there are visible efforts to enhance the quality and coverage of infrastructural services.

The most notable in the light of CIP and urban warfare, is the MCR in collaboration with the United Nation Office for Disaster Risk reduction (UNDRR)⁶¹. MRC is a global partnership and unique cross-stakeholder initiative that aims to improve the city's resilience through advocacy, sharing knowledge and experiences.⁶² It reinforces city-to-city learning networks, by creating a platform for injecting technical expertise, connecting multiple layers of government, and building partnerships.⁶³ It therefore encourages dialogue on risk reduction and resilience, to improve strategic planning to take actions and progress along this resilience

⁵⁵ République Tunisienne.

⁵⁶ République Tunisienne.

⁵⁷ Cessac, 'Analysis of the Regulatory Framework Governing Network Access for Producers of Electricity from Renewable Energy Sources in Tunisia'.

⁵⁸ Decree n° 2015-12 of 2015 and n°2016-1123 of 2016 relating to the production of electricity from renewable energies.

⁵⁹ A Tunisian lawyer and civil engineer, War in Cities Research Interview - Tunisia, conducted online on the 16th of May 2023.

⁶⁰ OECD, 'Water Governance in Tunisia - Overcoming the Challenges to Private Sector Participation'.

⁶¹ 'Making Cities Resilient'.

⁶² UNDRR, 'Policy Brief - Make Cities Resilient 2030'.

⁶³ UNDRR.

roadmap.⁶⁴ It specifically targets CIP and therein offers several tools and programs to strengthen a city's resilience.⁶⁵

In the sector of WSS governance, Tunisia has not yet been able to achieve its proclaimed goal of decentralisation.⁶⁶ Management and service provision remain centralised and services at the local level are lacking.⁶⁷ Instruments to reform the current water management system, such as the 2050 Water Sector Strategy, the five-year plans, and the programme contracts, have not been sufficiently implemented.⁶⁸

However, there are actions taken to improve WSS governance, such as the establishment of the inter-ministerial Water Council⁶⁹, a growing focus on international cooperation and Public-Private Partnerships, or a planned reform of the National Water Code.⁷⁰ Through these measures, it can be expected that Tunisia's WSS infrastructure policy will increasingly integrate decentralised, multi-level management plans (national, regional, local) that include a variety of stakeholders.⁷¹

In the electricity sector, the government set up ANME in 1986.⁷² The ANME is under the supervision of the Ministry of Industry, Mines, and Energy transition and holds the mandate to cover all initiatives and actions directed towards enhancing energy efficiency and expanding the range of energy sources.⁷³

Notwithstanding STEG's monopoly position in the energy sector, Tunisia's policy-makers strive to enhance independence from neighbouring Algeria by encouraging IPPs and private investment.⁷⁴ In October 2010, the European Investment Bank invested 185 million euros to maintain and strengthen the power supply security. Various other projects to expand

⁶⁴ UNDRR.

⁶⁵ UNDRR.

⁶⁶ République Tunisienne, Code des Eaux et ses Textes d'Application, art. 131.

⁶⁷ Closas, Imache, and Mekki, 'Groundwater Governance in Tunisia: A Policy White Paper'.

⁶⁸ OECD, 'Water Governance in Tunisia - Overcoming the Challenges to Private Sector Participation'.

⁶⁹ By decree No. 2010-407 of 9th March 2010, see Closas, Imache, and Mekki, 'Groundwater Governance in Tunisia: A Policy White Paper'.

⁷⁰ OECD, 'Water Governance in Tunisia - Overcoming the Challenges to Private Sector Participation'.

⁷¹ Closas, Imache, and Mekki, 'Groundwater Governance in Tunisia: A Policy White Paper'.

⁷² Osman, 'Tunisia : A National Energy Efficiency Policy'.

⁷³ Osman.

⁷⁴ Cessac, 'Analysis of the Regulatory Framework Governing Network Access for Producers of Electricity from Renewable Energy Sources in Tunisia'.

electricity transmission and distribution networks exist, such as a direct sub-sea connection with Italy, that would loosen Tunisia's dependence on Algeria.⁷⁵ However, most of these projects have not yet been implemented and have been delayed indefinitely.⁷⁶

Lastly, as Tunisia is particularly vulnerable to climate change, and electricity is mainly gained through fossil fuels, sustainability seems to become a growing priority of the state.⁷⁷ It is thus a goal to replace the current energy policies by 30% with renewable energies by 2030.⁷⁸ This is an ambitious goal, given the fact that the rate of renewable energy is as of 2021 relatively low at only 4%.⁷⁹

c) Practical Framework

The arid conditions of Tunisia's land make water an extremely precious and scarce resource.⁸⁰ Moreover, the deterioration of infrastructure and increasing prices are further challenging the country's water system.⁸¹ As mentioned in the previous section, the Ministry of Agriculture, Water Resources, and Fishery is responsible for formulating policies and laws that are related to water management. It works towards optimising water use efficiency, developing irrigation infrastructure, and implementing water conservation measures. There are two state-owned utilities who carry out the operations inline with the Ministry's guidelines. The SONEDE is responsible for water supply, while the ONAS, carries out the main operations in the sanitary sector.

Despite significant improvements in the country's water management, access to drinking water and WWS services have not been fully realised. While the census on drinking water is relatively high, with a 98.4% satisfaction rate, only 64.5% of the overall population has access to sanitation.⁸² As a result, the government has not yet been able to pursue its commitments stated in Article 44 of the constitution.⁸³

⁷⁵ European Investment Bank, 'Tunisia'.

⁷⁶ European Investment Bank.

⁷⁷ Ministry of Foreign Affairs of the Netherlands, 'Climate Change Profile Tunisia'.

⁷⁸ Cessac, 'Analysis of the Regulatory Framework Governing Network Access for Producers of Electricity from Renewable Energy Sources in Tunisia'.

⁷⁹ Ministry of Foreign Affairs of the Netherlands, 'Climate Change Profile Tunisia'.

⁸⁰ Jouini, 'Technology, the Environment and a Sustainable World: Responses from the Global South'.

⁸¹ OECD, 'Water Governance in Tunisia - Overcoming the Challenges to Private Sector Participation'.

⁸² Statistiques Tunisie, 'Annual Report of Infrastructure Indicators'.

⁸³ Jouini, 'Technology, the Environment and a Sustainable World: Responses from the Global South'.

Overall, figures show that demand for electricity has steadily increased in Tunisia⁸⁴, owing to the rise in the use of technological devices and ongoing urbanisation.⁸⁵ Similarly to WSS, electricity is well provided all-over the country. According to Tunisia's National Institute of Statistics' most recent data from 2021, 99.9% of the population has access to power facilities.⁸⁶ The institute predicted that such a high rate would remain stable over the next few years and is the merit of successful development projects in rural areas.⁸⁷ However, scholars in the energy sector expect Tunisia's energy performance to gradually shrink, should there be no measures taken to improve energy security.⁸⁸

As previously mentioned, Tunisia's national grid is connected to Algeria and Libya and there is a strong dependence on neighbouring countries.⁸⁹ Despite facing some technical limitations, such as a lack of energy reserves and constraints in natural gas supply, the STEG furnishes 92,1 % of the overall electricity of the country.⁹⁰ The remaining 7,9 % are managed by the CPC, a private stakeholder, describing their public sector engagement as a 'pioneer' activity in the MENA region.⁹¹

⁸⁴ Brand and Missaoui, 'Multi-Criteria Analysis of Electricity Generation Mix Scenarios in Tunisia'; Gam and Ben Rejeb, 'Electricity Demand in Tunisia'.

⁸⁵ Brisson and Krontiris, *Tunisia, From Revolutions to Institutions*.

⁸⁶ Statistiques Tunisie, 'Annual Report of Infrastructure Indicators'.

⁸⁷ Statistiques Tunisie.

⁸⁸ Haddad, 'La Sécurité Énergétique de La Tunisie à l'horizon 2030'.

⁸⁹ International Trade Administration, 'Tunisia - Electrical Power Systems and Renewable Energy'.

⁹⁰ STEG, 'Rapport Annuel 2021'.

⁹¹ CPC, 'Bienvenue Au Site de CPC'.

Figure 7: Overview of the WSS frameworks in Tunisia

Water and Sanitation in Tunisia		
Legal Framework	Policy Framework	Practical Framework
<p><i>Constitution de la République Tunisienne</i> de 2014</p> <ul style="list-style-type: none"> - Article 44 regulating access to water - Article 131 regulating decentralised governance 	<p>Make Cities Resilient Campaign 2030 by UNDRR</p> <ul style="list-style-type: none"> - Cross-stakeholder initiative to enhance city's resilience and improve strategic planning - Thematic area 6 regulating CIP 	<p>SONEDE</p> <ul style="list-style-type: none"> - State-owned utility responsible for water supply - 98.4% of the population have access to drinking water
<p>National Water Code of 1975</p> <ul style="list-style-type: none"> - Article 8 regulating competence of the Ministry of Agriculture, Water Resources and Fishery - Article 133 regulating water management 	<p>Establishment of the inter-ministerial Water Council</p> <ul style="list-style-type: none"> - Encouraging decentralised water governance and multi-level participation (local, regional, national) 	<p>ONAS</p> <ul style="list-style-type: none"> - State-owned utility - Carries out main operations in sanitary sector - 64.5% of the population has access to sanitation
<p>Law n°95-70 of 1995</p> <ul style="list-style-type: none"> - Article 5 entailing protective and conservational measures 	<p>Growing focus on international cooperation and Public Private Partnerships</p>	

Figure 8: Overview of the electricity frameworks in Tunisia

Electricity in Tunisia		
Legal Framework	Policy Framework	Practical Framework
Decree n°64-9 of 1964 Regulating Competence of the STEG	Establishment of the ANME in 1986 <ul style="list-style-type: none"> - Mandate to cover all initiatives and actions directed towards enhancing energy efficiency 	STEG <ul style="list-style-type: none"> - State-owned utility responsible for 92.1% of the electricity production - 99.9% of the population has access to electricity
Decree n° 2015-12 of 2015 and Decree n°2016-1123 of 2016 <ul style="list-style-type: none"> - Relating to the production of electricity from renewable energy 	Goal to expand distribution networks <ul style="list-style-type: none"> - Achieve energy independence from Algeria - By engaging with independent power producers (IPP) 	CPC <ul style="list-style-type: none"> - Private Stakeholder responsible for 7.9% of the electricity production

1.3 The Philippines

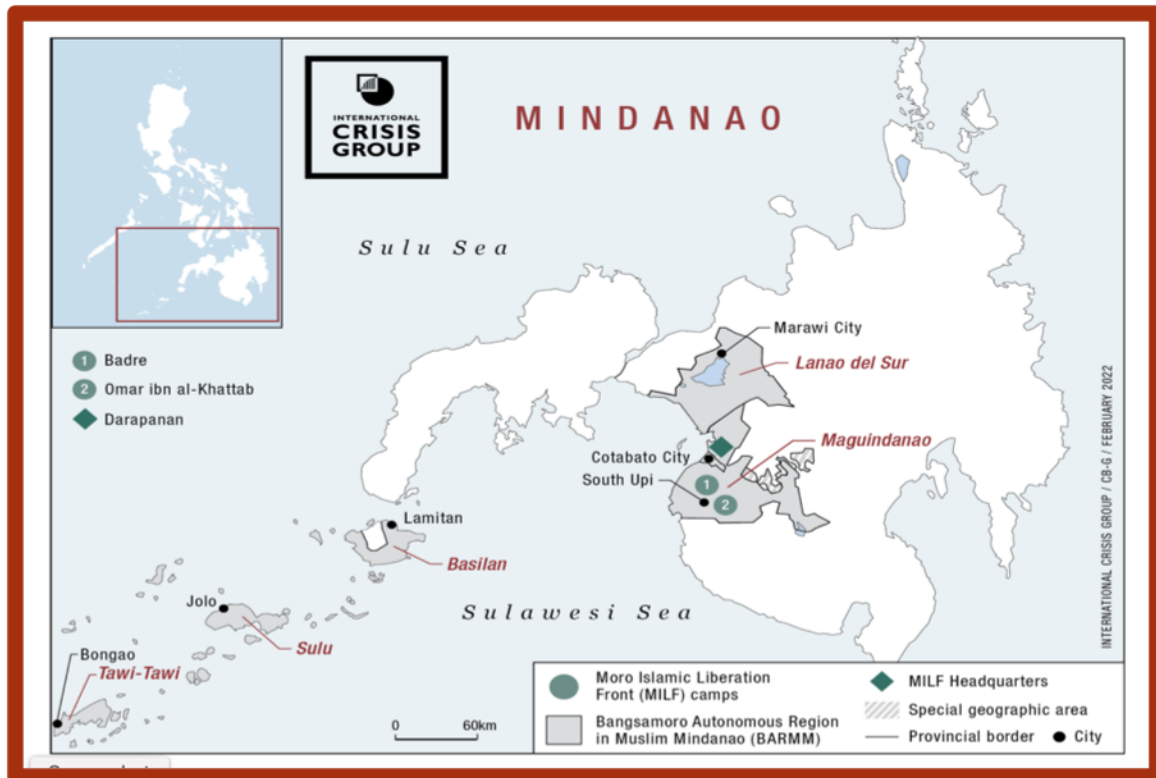


Figure 9: The Bangsamoro Autonomous Region of Muslim Mindanao and its six provinces (Maguindanao consists of two provinces: Maguindanao del Sur Maguindanao del Norte)⁹²

CONTEXT

The Philippines has established a hierarchical administrative division consisting of four levels to govern its vast archipelago. Starting from the broadest range, these divisions include regions, provinces, component cities and municipalities, and Barangays (villages). This section focuses specifically on the BARMM, which is an autonomous region with a special political jurisdiction located in the southwestern part of the Mindanao Island in order to focus on the context of post-conflict urban infrastructure, referring to the 2017 Marawi insurgency.⁹³

The BARMM in the Philippines is predominantly composed of provinces that were previously part of the Autonomous Region in Muslim Mindanao (ARMM). While certain areas

⁹² International Crisis Group, 'Southern Philippines: Fostering an Inclusive Bangsamoro'.

⁹³ Cadag et al., '48. Fostering Resilience in Water Supply Management'.

within the BARMM region may have urban centres and more developed infrastructure, there are also rural and remote areas within the region.

The BARMM region comprises seven urbanised provinces that have endured significant physical damage resulting from the 2017 insurgency led by the local Islamic State (IS) militant groups of Abu Sayyaf Group and the Maute Group.⁹⁴ In the context of post-conflict reconstruction, two focus areas known as the "Most-affected areas" (MAA) and the "Least affected areas" (non-MAA) are established within the Marawi City which is situated near Lake Lanao..⁹⁵

Since 2019, the BARMM region has been under the interim regional governance of the BTA, an entity established by the central government of the Philippines in collaboration with the regionally influential Moro Islamic Liberation Front following the 2019 Bangsamoro autonomy plebiscite.⁹⁶ The BTA is granted executive and legislative powers over the region, effectively making them responsible for overseeing the ongoing infrastructural development projects in the post-Marawi insurgency period.⁹⁷

INFRASTRUCTURE

a) Legal Framework

The acknowledgment of conflict or violence affecting urban infrastructure and planning is intrinsically embedded upon the Philippine DRR and Management Act of 2010. Despite this, the Act is a vital legal component to the urban infrastructure protection under urban warfare as it marks the transition of the DRR measures adopted by the country to foster resilience to being more proactive than reactive in nature.⁹⁸

⁹⁴ Special Committee on Marawi, 'Committee Report No.35'; Tumchewics, 'Fighting Wars in Cities'.

⁹⁵ Fernandez, *ILANG TAONG BAKWIT?: A Review of Post-Marawi Crisis Rehabilitation and Reconstruction, 2017-2020*

⁹⁶ International Crisis Group, 'Southern Philippines: Fostering an Inclusive Bangsamoro'.

⁹⁷ Cadag et al., '48. Fostering Resilience in Water Supply Management'.

⁹⁸ Cadag et al.; Congress of the Philippines, Philippine Disaster Risk Reduction and Management Act of 2010.

Notably, the Anti-Terrorism Act 2020 introduced a new definition of “CI” as systems, assets, and networks, whether physical or virtual, vital to the country's national security, economy, public health, safety, and defence. The Act aims to safeguard such infrastructure from terrorist attacks, including those that may cause significant disruption or destruction.

Under the Anti-Terrorism Act of 2020, certain acts related to CI can be considered terrorism offences and thus hold legal consequences. For instance, damaging or destroying CI with the intent to spread fear or coerce the government or the public may be treated as a terrorist act. Moreover, specific details related to CI are further elaborated in the implementing rules and regulations of the Anti-Terrorism Act of 2020 which provide more specific guidance on the application and enforcement of the law.⁹⁹ Additionally, the Philippines also actively cooperates with international frameworks, such as the United Nations Global Counter-Terrorism Strategy, and participates in regional initiatives to enhance counterterrorism cooperation.

A central legal foundation for the nation’s electricity management is the EPIRA which was enacted in 2001.¹⁰⁰ The act was created to essentially restructure and privatise the Philippine’s electricity power industry. Since its enactment, various proposals bills related to the power sector sought to amend or modify certain aspects of the EPIRA. Key institutions within the industry also originated from this legal act. Notably, the ERC was created and given a mandate to regulate the competition within the industry through the EPIRA in 2023. Additionally, electricity power management also falls under the jurisdiction of the NEA in the Philippines. The central power grid, operated by the National Grid Corporation of the Philippines, plays a critical role in interconnecting power plants and transmission lines, facilitating the distribution of electricity to different distribution utilities nationwide.¹⁰¹ Following the Marawi insurgency, the electrical infrastructure suffered extensive damage, incurring the highest cost among all affected infrastructures. Only one operational substation, located in Malabing, remained functional.¹⁰² Reports indicate that twenty-four barangays in Bangsamoro were severely affected, resulting in dire conditions for the affected communities.

⁹⁹ The shift towards the new Anti-Terrorism Act of 2020 has been a subject of significant debate and controversy, particularly regarding potential human rights concerns and the potential for abuse.

¹⁰⁰ Electric Power Industry Reform Act (EPIRA).

¹⁰¹ National Grid Corporation of the Philippines, ‘Transmission Development Plan 2014-2015’.

¹⁰² Special Committee on Marawi, ‘Committee Report No.35’.

Within the WSS system, local government units and water districts act as the duty bearers for infrastructural repairs by providing access to the central government. The authority of the water districts to charge rates adequate for repairs as well replacements, and the LWUA to review the rates to ensure compliance are outlined within the Presidential Decree 198 in 1973.¹⁰³

b) Policy Framework

The 2017 Marawi insurgency caught the local government off guard, resulting in a fragmented response to the immediate damage caused by the declared end of the attacks. Critics have pointed out the lack of preparedness and capacity to effectively respond to the crisis. This situation was further compounded by the transition to the interim governance of the BTA in 2019. Prior to the establishment of the BTA, President Duterte initiated TFBM with the aim of overseeing a comprehensive rehabilitation program for Marawi. However, despite the target of completing priority infrastructure by the end of 2021, TFBM only managed to achieve 72% of the rehabilitation program by mid-2022. The ongoing rehabilitation of water infrastructure is still underway as of February 2023.¹⁰⁴

Regarding the WSS system, multiple entities contribute to the provision of services in the Philippines. GOCC water districts are responsible for operating and maintaining WSS in specific cities or municipalities. Privatisation has also been implemented for some water districts, including the MWSS, which oversees two private concessionaires, namely Manila Water and Maynilad Water, while setting service standards.¹⁰⁵ Alongside water districts, LGU-led Waterworks and Private Water Service Providers play a role in catering to specific areas. Geographically, there are two categories of water utilities: RWSAs, serving at least one barangay (community) and functioning on a community-based level, and BAWASAs, representing smaller water supply beneficiaries at the community level.¹⁰⁶ The MCWD is

¹⁰³ President of the Philippines, Presidential Decree No. 198.

¹⁰⁴ Cahiles, 'Marawi Rehab Now 72% Complete a Month before Duterte Steps Down'; Fernandez, *ILANG TAONG BAKWIT?: A Review of Post-Marawi Crisis Rehabilitation and Reconstruction, 2017-2020*.

¹⁰⁵ Canlas, 'Philippine Policy Reforms and Infrastructure Development: A Historical Account'; Mouton, 'The Philippine Electricity Sector Reform and the Urban Question'.

¹⁰⁶ Cadag et al., '48. Fostering Resilience in Water Supply Management'.

responsible for overseeing the provision of WSS in the urban areas of the Lanao del Sur province, including Marawi City and Saguiaran.¹⁰⁷

Initially, the government formulated two official reconstruction plans for Marawi. The first plan is known as the BMCRRP, which primarily focuses on the non-MAA and falls under the supervision of the NEDA. The second plan is the Marawi RISE Plan, which specifically targets the MAA area and is overseen by the DHSUD along with its sub-agencies, including the NHA. This division of responsibility within the TFBM was influenced by the initial plan of implementing separate financial regimes for the MAA and non-MAA areas.

c) Practical Framework

The TFBM collaborated closely with the NHA to formulate an extensive master plan for infrastructure rehabilitation which is the aforementioned Marawi RISE plan. Within this plan, a specific section (point 6) was dedicated to addressing the critical issue of access to electricity for IDPs. Various solutions were recommended, including the distribution of solar power battery sources or lights as temporary measures within affected neighbourhoods, as well as the provision of electricity subsidies specifically targeted at IDPs.¹⁰⁸

However, despite concerted efforts towards reconstruction, the LASURECO came under scrutiny for its inadequate electricity distribution services. The committee's assessment revealed that LASURECO failed to fully comply with the TFBM/NHA Master Plan. Moreover, during the initial stages of reconstruction, LASURECO facilitated unauthorised access to electricity for displaced individuals in Kathagombalay.¹⁰⁹ Moreover, as of 2020, temporary shelters designated for IDPs still lack proper access to electricity, as highlighted by the findings of the Special Committee on Marawi.

In terms of water infrastructure restoration, the process involved a combination of national post-conflict reconstruction initiatives and international support from humanitarian and development organisations. Notably, the USAID's Cities Development Initiative included the SURGE project (Strengthening Urban Resilience for Growth with Equity), which aimed to provide support to various water utilities operating in the Philippines, including water districts, RWSAs, and LGU-led water utilities. Additionally, significant financial aid and the provision

¹⁰⁷ Cadag et al.

¹⁰⁸ Special Committee on Marawi, 'Committee Report No.35'.

¹⁰⁹ Cadag et al., '48. Fostering Resilience in Water Supply Management'.

of heavy equipment were contributed by foreign governments such as China and Japan to facilitate the reconstruction of WSS systems. A noteworthy collaborative effort between the International Labour Organization and the Japanese government resulted in the establishment of five new water systems in the Bangsamoro region in 2022.¹¹⁰

In terms of electrification efforts, the NEA focuses on providing electricity services to underserved communities, which can include both rural and remote areas. The NEA's mandate extends to supporting electrification initiatives in various regions, including those with predominantly rural populations. The goal is to ensure that electricity access reaches all communities, regardless of their classification as urban or rural.

While some parts of BARMM may have urban characteristics, there are still areas within the region that face challenges in terms of electricity access and infrastructure development. The NEA's efforts in the region aim to address these gaps and facilitate the provision of reliable and affordable electricity to all communities, including both urban centres and rural areas.

¹¹⁰ International Labour Organization, 'ILO and Japan Launch Five New Water Systems in Mindanao'; International Labour Organization, 'Improvement of Water Supply Equipment Management Capacity for the Establishment of Peace in Mindanao'.

Figure 10: Overview of the WSS frameworks in the Philippines

Water and Sanitation in the Philippines		
Legal Framework	Policy Framework	Practical Framework
2020 Anti-Terrorism Act introduced a definition of “CI”	Two official Marawi reconstruction plans: <ol style="list-style-type: none"> 1. BMCRRP under the supervision of NEDA 2. Marawi RISE Plan under the supervision of DHSUD including the NHA 	USAID SURGE Project
TFBM as the main institution that oversees Marawi rehabilitation process	Types of water districts based on ownership: <ul style="list-style-type: none"> - GOCCs water districts - Privatised water districts such as MWSS Types of water districts based on geographics: <ul style="list-style-type: none"> - RWSA serving at least one barangay (community) - BAWASA representing smaller water supply beneficiaries 	Humanitarian aid from states and international organisations

Figure 11: Overview of the electricity frameworks in the Philippines

Electricity in the Philippines		
Legal Framework	Policy Framework	Practical Framework
EPIRA 2001 - The ERC created in 2023 to regulate electricity industry competition	Marawi RISE plan point 6 discussing electricity access for IDPs	LASURECO: operates electricity distribution service for post-Marawi reconstruction
		NEA: provides electricity to underserved communities

2. Analysis and Findings

2.1 Advantages and Limitations of National Infrastructure System

This section focuses on analysing the strength and weaknesses of existing national infrastructure systems in our subsequent country case studies: Colombia, Tunisia, and the Philippines, within the context of *CIP*.

In Colombia, the provision of WSS and electricity in large and medium-sized cities poses minimal challenges due to the regular and efficient services offered by both private and public utilities. The coverage and quality of these services are generally very satisfactory, indicating that Colombia has made significant progress in establishing satisfactory standards for public services and urban infrastructure¹¹¹ compared to the Philippines and Tunisia. Difficulties involving essential infrastructures mostly arise when considering rural areas, where inadequate documentation regarding the existing infrastructure condition complicates the government's efforts to address gaps and implement effective policies and strategies.¹¹² The government's limited presence in these regions, which are often plagued by the activities of armed groups, further hampers its ability to tackle the infrastructural deficiencies effectively.

Nevertheless, Colombia has a comprehensive legal framework, including the constitution and key legislation such as the Domiciliary Public Services Law, which establishes the regulatory framework for the provision of WSS and electricity services. This framework recognizes these services as fundamental rights and emphasises the need for universal access as well as the involvement of public and private sectors. The involvement of the private sector, in particular, is a significant strength of the Colombian infrastructure system. Private companies bring valuable experience and expertise, enabling them to efficiently manage and operate infrastructure projects. Moreover, competition among private sector entities drives improvements in product quality and responsiveness to evolving consumer needs. Private sector participation also fosters enhanced transparency, accountability, and a focus on

¹¹¹ Polanía, 'Water and Sanitation for the Poorest Communities in Colombia's Cities'.

¹¹² Daheshpour and Herbert, 'Infrastructure Project Failures in Colombia'.

safeguarding consumer rights and environmental considerations. This ensures that service providers adhere to high standards of performance and responsible practices.¹¹³

Furthermore, the promotion of decentralisation and regionalization, with responsibilities divided between the national government and municipalities allows for larger private operators to expand services into small towns and rural areas. This approach helps in addressing local needs and enhancing service provision efficiency.¹¹⁴ Lastly, the establishment of specialised institutions such as the MME, the SSPD and the Regional Autonomous Corporations enhance governance and accountability.

In the case of Tunisia, the conducted research and subsequent interview revealed some interesting findings on the strengths and weaknesses of the current infrastructural system. Although Tunisia has a remarkable set of norms and regulations concerning infrastructural governance and policies are put in place to develop the existing structure¹¹⁵, the delivery of essential services runs the risk of becoming increasingly unreliable.¹¹⁶ This is due to specific vulnerabilities.

It was shown that Tunisia's physical infrastructure maintenance was neglected over the past decades, as priority was given to economic improvements.¹¹⁷ This deprioritisation inevitably led to the erosion and deterioration of installations.¹¹⁸ However, as the current government is financially restricted, there seem to be resources lacking to insure the functioning and transmission of services.¹¹⁹ These two short-comings are amplified by the fact that Tunisia faces some significant resource distress, as climate change is impacting precipitation and water scarcity¹²⁰, while energy is largely produced through fossil fuels.¹²¹

¹¹³ Andres, Sislen, and Marin, *Charting a New Course*; Rudnick and Velásquez, 'Learning from Power Sector Reform: The Case of Colombia'.

¹¹⁴ Rudnick and Velásquez, 'Learning from Power Sector Reform: The Case of Colombia'.

¹¹⁵ See section B.

¹¹⁶ A Tunisian lawyer and civil engineer, War in Cities Research Interview - Tunisia, conducted online on the 16th of May 2023.

¹¹⁷ A Tunisian lawyer and civil engineer.

¹¹⁸ 'Thirsty Crops, Leaky Infrastructure Drive Tunisia's Water Crisis'.

¹¹⁹ OECD, 'Water Governance in Tunisia - Overcoming the Challenges to Private Sector Participation'.

¹²⁰ Ministry of Foreign Affairs of the Netherlands, 'Climate Change Profile Tunisia'; Ben Youssef, 'Climate Change in the Tunisian Cities'.

¹²¹ STEG, 'Rapport Annuel 2021'.

A mitigation strategy taken more recently into consideration by the Tunisian government is the involvement of private stakeholders and international partnerships.¹²² This last engagement could boost Tunisia's infrastructural development and also contribute to merging the responsibility amongst different operators, as for now most of the services are managed by state-run utilities.¹²³

Moving on to the Philippines, three notable limitations of the electrical and WSS infrastructure are identified. Firstly, the deterioration of physical infrastructure due to poor maintenance or old parts, such as the water pipes, leads to extra vulnerabilities, particularly from the impacts of urban warfare. Secondly, infrastructure maps and plannings are mostly documented on papers, creating additional vulnerabilities to be easily destroyed and further complicating rehabilitation or reconstruction efforts.¹²⁴ Lastly, the fragmentation of governance in the context of post-Marawi insurgency or post-urban warfare creates many ambitious master plans that overlap and create confusion in terms of bureaucracy and reconstruction procedures. These limitations pose significant challenges to the effective coordination and consolidation of reconstruction efforts.

The primary challenge in the post-Marawi rehabilitation policy framework lies not in the quantity of post-conflict reconstruction plans, but rather in the fragmented nature of these plans across the region. This fragmentation poses significant obstacles in terms of consolidating and effectively coordinating reconstruction efforts. One proposed solution, as suggested by Fernandez, is the adoption of an "open data" culture for the foundation of open governance.¹²⁵ This would address the fragmentation issues and allow different actors, such as the BTA and the central government to make informed decisions across the multiple plans simultaneously and more efficiently. The Philippines government has made efforts towards open governance since 2014 through their partnership with the "Open Government Partnership". However, as of June 2023, data categories under "Public Infrastructure", "Energy", and "Housing and Urban Development" are still empty, indicating the need for further progress in realising the ambition of making data transparent and accessible.¹²⁶ Despite these challenges, governance of WSS

¹²² OECD, 'Water Governance in Tunisia - Overcoming the Challenges to Private Sector Participation'.

¹²³ See Section B.

¹²⁴ Fernandez, *ILANG TAONG BAKWIT?: A Review of Post-Marawi Crisis Rehabilitation and Reconstruction, 2017-2020*.

¹²⁵ Fernandez, Baunto, and Villasper, 'Open Data for the Bangsamoro Transition'.

¹²⁶ Republic of the Philippines, 'ODPH - Datasets'.

infrastructure extends to the small-scale barangay level, allowing for more direct community connection and responsiveness to specific needs.

In conclusion, while analysing the national infrastructure systems of Colombia, Tunisia, and the Philippines, several common themes and challenges emerge. One recurring theme is the importance of private sector involvement in infrastructure projects, which has the potential to bring expertise, efficiency, and competition. All three countries recognise the value of private sector participation in driving improvements in service quality and responsiveness to consumer needs.

A shared challenge is the need for effective governance and coordination. In all three cases, there are limitations in infrastructure maintenance and resource allocation, resulting in unreliable capacity to deliver the services of the essential infrastructures. Additionally, fragmentation of governance and coordination efforts hinders the efficient implementation of infrastructure projects and post-conflict reconstruction plans.

Furthermore, the importance of recognising the specific needs of smaller towns that may constitute as urban is evident across the case studies. Insufficient documentation primarily seems to hamper efforts to address infrastructure gaps and provide adequate service following disasters and destructions from conflict. Decentralisation and regionalisation, as seen in Colombia and the Philippines, offer potential solutions by allowing larger private operators to expand and ensure services to smaller centres.

In terms of resource management and sustainability, all three countries face challenges. Neglected maintenance, financial constraints, and lack of resources have led to infrastructure deterioration and vulnerabilities. Climate change impacts, such as water scarcity and reliance on fossil fuels for energy production in Tunisia, further compound these challenges. To overcome these obstacles, there is a need for long-term planning and investment in sustainable infrastructure solutions. This includes promoting renewable energy sources, improving water management practices, and implementing proactive maintenance strategies to ensure the longevity and reliability of critical infrastructure systems.

To address these overlapping issues, the involvement of private stakeholders and international partnerships emerges as a potential strategy. By leveraging the expertise and resources of private entities and engaging in collaborative efforts with international partners, these countries can enhance infrastructure development, share the responsibility among

different operators, and access additional funding sources. This requires establishing conducive regulatory frameworks, fostering a favourable investment climate, and promoting transparent and accountable practices in infrastructure projects.

In conclusion, while each country has its own unique advantages and limitations in their national infrastructure systems, addressing the common themes of private sector involvement, effective governance and coordination, recognition of smaller urban needs, and resource management and sustainability is crucial. By prioritising these areas of improvement, Colombia, Tunisia, and the Philippines can enhance the resilience, reliability, and effectiveness of their CI systems, thereby ensuring the provision of essential services and mitigating risks in the face of various threats and challenges.

2.2 Infrastructural Urban Resilience

Under the light of the aforementioned definition of *urban resilience*, the case studies demonstrate several parallels and differences in their capacity of responding to armed conflict.

One notable aspect in Colombia's protracted conflict is the striking disparity between the profound humanitarian impacts, such as killings and displacement, and the relatively lower focus on infrastructure attacks. This discrepancy reveals a significant gap within Colombia's urban resilience framework, as the existing weaknesses in the infrastructure sector remain largely unaddressed, and comprehensive policies, strategies, and contingency measures are lacking. This vulnerability hinders the sector's ability to effectively mitigate and respond to potential threats, posing a significant challenge to Colombia's overall resilience.

Moreover, the regulation of WSS and electricity in Colombia has grown increasingly complex over time, burdened by bureaucratic hurdles and issues of corruption. This complexity further complicates the efficient functioning of the infrastructure system, particularly in times of conflict or crisis when swift response and recovery are crucial. The pressing need for simplified regulations and streamlined processes becomes evident as a critical step toward enhancing the resilience of the infrastructure sector. By reducing bureaucracy and combating corruption, Colombia can ensure that the development and management of infrastructure are carried out with effectiveness and efficiency, thus enabling the system to better withstand and recover from a diverse range of challenges.

In Tunisia, the emphasis on urban resilience frameworks is currently insufficient, mirroring the situation in Colombia. This deficiency can be primarily attributed to the relatively low urgency to adopt comprehensive plans at present. As there is no immediate threat of an impending urban warfare, Tunisia has not developed relevant contingency plans¹²⁷. Consequently, there are doubts regarding the capability of Tunisia's existing system to effectively withstand significant damages with an efficient resilience strategy in the event of a conflict or natural hazard emergency. While, in fact, Tunisia has made notable strides in enhancing its adaptive capacity, exemplified by its participation in global initiatives like the 'Make Cities Resilient Campaign 2030'¹²⁸, there are specific areas within the country that remain particularly vulnerable.

Foremost, it is concerning that Tunisia does not possess city-specific data and statistics that oversee localisation and operations of facilities in urban areas.¹²⁹ In case of an emergency this would significantly render interventions and redirection of services difficult, and the overview of affected areas could be insufficient.¹³⁰ Moreover, as infrastructural governance remains extremely centralised, workflows are slowed down and necessities of affected areas are not sufficiently considered.¹³¹ As disturbances and changing circumstances demand a quick response, this slow transmission of information and delayed response can have crucial consequences.

The Philippines faces numerous challenges in maintaining infrastructural urban resilience, particularly in the context of post-conflict reconstruction in the BARMM. From a legal perspective, the Philippines lacks a specific contingency framework for urban warfare. The country did not have a specific framework on the infrastructural impact of urban warfare prior to the Marawi insurgency. As mentioned in the case study, the concept of CIP was only introduced to the context of violence (specifically terrorism) through the Anti-Terrorism Act in 2020. However, the Philippines DRR and Management Act of 2010 lays the foundation for promoting resilience of the urban infrastructure. While urban warfare is not explicitly

¹²⁷ A Tunisian lawyer and civil engineer, War in Cities Research Interview - Tunisia, conducted online on the 16th of May 2023.

¹²⁸ 'Making Cities Resilient'.

¹²⁹ OCDE, *Améliorer les statistiques régionales pour un développement territorial inclusif et durable en Tunisie*.

¹³⁰ Ben Youssef, 'Climate Change in the Tunisian Cities'.

¹³¹ Closas, Imache, and Mekki, 'Groundwater Governance in Tunisia: A Policy White Paper'; World Bank Group, 'Tunisia's Systematic Country Diagnostics'.

addressed, the Act provides a framework that can be applied to protect urban infrastructure during conflict whilst also putting emphasis on a more proactive approach to disaster risk reduction, aiming to foster preparedness and resilience.

Despite this, we see the reality of how electrical and WSS infrastructure reconstruction processes have been slower than expected. The establishment of TFBM and the formulation of comprehensive rehabilitation plans for the BARMM aimed to address these issues of fragmented and delayed reconstruction plans. In an attempt to make up for the lack of post-conflict context of urban resilience, the Philippines government seems to respond through efforts that involve the creation and involvement of multiple stakeholders, including government agencies, humanitarian organisations, and international partners, to develop comprehensive and more resilient infrastructure plans during this reconstruction period. Regretfully, it appears that provisions established by the aforementioned legal frameworks on disaster risk reduction that could potentially be utilised for urban resilience, fell short in the post-urban warfare context as can be seen through the delays which indicates the need for better coordination and streamlined policies.

This is not to fully condemn the collaborative approach to urban resilience in the Philippines as collaboration between various entities may facilitate the implementation of strategic measures. As an example, the TFBM was able to develop one of the main master plans for infrastructure rehabilitation that encompass access to essential services of electricity and water in close collaboration with the NHA.

The restoration of WSS infrastructure in particular seems to be a focus of collaborative efforts for the Marawi reconstruction efforts. Humanitarian and development organisations, along with support from foreign governments, have contributed to the reconstruction of WSS systems. Outside of the post-Marawi context, there is an effort to foster resilience specifically between the water utilities in the Philippines, most commonly through setting Key Performance Indicators within the water utilities' strategic business plans in order to mention interventions and milestones for resilient WSS systems.

When comparing the three case studies, it is evident that each country faces unique challenges and vulnerabilities in achieving urban resilience. Colombia's focus on humanitarian impacts rather than infrastructure attacks highlights a disparity in the urban resilience framework. The complex regulations and corruption further hinder the efficient functioning of

the infrastructure sector during conflicts or crises. Tunisia's relatively low pressure to adopt contingency plans due to the absence of an approaching urban warfare raises concerns about the country's preparedness for severe damages. The lack of city-specific data and centralised infrastructure governance slow down response and intervention efforts. Similarly to Tunisia, the Philippines' lack of a specific framework for urban warfare before the Marawi insurgency demonstrates the need for enhanced coordination and streamlined policies. However, collaborative approaches involving multiple stakeholders have shown promise in developing comprehensive infrastructure plans, particularly in post-conflict reconstruction efforts.

Ultimately, achieving infrastructural urban resilience in all three countries requires a multi-faceted approach that addresses the pre-existing legal and policy frameworks, or perhaps lack thereof. By fostering collaboration, integrating resilience into planning and development processes, Colombia, Tunisia, and the Philippines can build a more resilient and sustainable infrastructure that can withstand the impact of urban warfare and contribute to the overall wellbeing of its urban communities.

3. First-Responders Questionnaire

Based on our case studies and analysis we have compiled the following framework of general questions that can guide first-responders in supporting CIP efforts within the context of urban warfare.

1. Addressing the legal framework

- a. Has the country made efforts to incorporate infrastructure provision and protection in its legal framework?
 - i. If yes, have the amendments been achieved?
 - ii. If not, are there other institutional efforts (e.g., partnerships with the private sector, policy changes) envisioned?

2. Addressing the policy framework

- a. What are the specific regulations and procedures for responders when providing water, sanitation, and electricity services during emergencies?

3. Identifying the interlocutors

- a. What is the structure of governance for CIs?
- b. Are private stakeholders involved in the provision of electricity and WSS? If yes, how do they collaborate with governmental institutions?
- c. Who can be reached out to obtain contact information of relevant institutions or individuals?

4. CI documentation

- a. What is the documentation system of the CI and how can it be accessed? (i.e. cloud database, paper documents)
- b. Where are the grid maps of CI (e.g., pipelines, electricity transmission power line grid maps, etc.)?

- c. Where are the available resources or databases that provide localised information about urban areas, such as population density, infrastructure networks, and key facilities?
- d. How can responders quickly obtain access to grid maps of infrastructures and data of the affected areas and infrastructure during emergencies?
- e. What is the designated authority or point of contact responsible for providing real-time information on the status of infrastructure in different cities/regions?

5. Assessing CI condition

- a. What are the challenges threatening maintenance of infrastructural installations (e.g., financial constraints, climate change etc.)?
- b. When assessing infrastructure damage, how can we effectively differentiate and attribute the primary causes between the conflict and pre-existing issues?
- c. What practical indicators can be used to quantitatively measure the relative contribution of the conflict and pre-existing issues to the overall infrastructural damage?

6. Reconstruction and infrastructural rehabilitation

- a. How does the government choose which CI sector is prioritised within the reconstruction effort?
- b. What are the main reconstruction plans used by each CI sector?
- c. How are the CI sector divided (i.e., electricity, WSS)?

Conclusion

In conclusion, this report has examined the existing frameworks governing CI, with a specific focus on WSS and electricity in Colombia, Tunisia, and the Philippines. The objective was to gain insights into the establishment, functionality, and maintenance of these systems, particularly within the context of urban warfare. The findings informed the construction of a checklist of essential questions, serving as a valuable resource for humanitarian first responders when offering support in urban warfare scenarios. Through a comprehensive review and analysis of legal and policy frameworks, supplemented by interviews with local experts and a literature review, the case studies of Colombia, Tunisia, and the Philippines have shed light on the challenges these countries face in maintaining CI during times of armed conflict. From the devastation of water and wastewater systems in Marawi to the protracted urban violence in Colombia and the challenges faced by Tunisia in resource scarcity and international collaboration, these cases exemplify the importance of addressing the complexities of urban warfare.

The findings and analysis presented in this report underline the urgency of addressing the intricate complexities of urban infrastructure and provide a framework for better responding to the humanitarian impacts of urban warfare. To effectively address these challenges, it is essential to leverage private sector involvement and international partnerships to enhance infrastructure development and share responsibility among different operators. Simplifying regulations and combating corruption are critical steps toward improving infrastructure resilience. Moreover, long-term planning and investment in sustainable infrastructure solutions, including renewable energy and proactive maintenance strategies, are necessary to ensure long-term viability.

Overall, achieving infrastructural urban resilience requires a multi-faceted approach that acknowledges the unique characteristics of each context and emphasises the need for coordination and cooperation among government agencies, local municipalities, humanitarian organisations, and international partners. Additionally, integrating resilience considerations into urban planning and development processes is crucial to ensure that infrastructure is designed and constructed with long-term resilience in mind.

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