Oxford Research Encyclopedia of Natural Hazard Science

Summary and Keywords

In 1990, 43% (2.3 billion) of the world's population lived in urban areas, and by 2014 this percentage was at 54%. The urban population exceeded the rural population for the first time in 2008, and by 2050 it is predicted that urbanization will rise to 70% (see Albrito, "Making cities resilient: Increasing resilience to disasters at the local level," *Journal of Business Continuity & Emergency Planning*, 2012). However, this increase in urban population has not been evenly spread throughout the world. As the urban population increases, the land area occupied by cities has increased at an even higher rate. It has been projected that by 2030, the urban population of developing countries will double, while the area covered by cities will triple (see United Nations, Department of Economic and Social Affairs, "World Urbanization Prospects: The 2014 Revision"). This emphasizes the need for resilience in the urban environment to anticipate and respond to disasters. Realizing this need, many local and international organizations have developed tools and frameworks to assist governments to plan and implement disaster risk reduction strategies efficiently. Sendai Framework's *Priorities for Action, Making Cities Resilient: My City is Getting Ready*, and UNISDR's *Disaster Resilience Scorecard for Cities* are major documents that provide essential guidelines for urban resilience. Given that, the disaster governance also needs to be efficient with ground-level participation for the implementation of these frameworks. This can be reinforced by adequate financing and resources depending on the exposure and risk of disasters. In essence, the resilience of a city is the resistance, coping capacity, recovery, adaptive capacity, and responsibility of everyone.

Keywords: urban, disaster management, local government, resilience, risk reduction, finance, economic, physical

The Urbanization Challenge

The world has become increasingly urban. By 2050, the world's urban population (including those living in small urban centers) will represent about 70% of a projected global population of 9 billion (UNDESA). The proportion of the labor force in the industry

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and services sector, which has now reached 65%, has grown at approximately the same rate as the urban population (Global Construction Perspectives and Oxford Economics, 2011).

The urban population of sub-Saharan Africa is expected to grow from 298 million in 2010 to 596 million in 2030 and 1,069 million in 2050 (United Nations, 2012). The urban population of India is expected to grow from 379 million in 2010 to 606 million in 2030 and 875 million in 2050. Other regions and countries with high expected growth include North Africa and China (United Nations, 2012).

Historically, this represents a major shift in the distribution of the world's urban population and its largest cities. In 1970, the urban population of Europe represented 30.5% of world urban population; by 2050, this figure will have dropped to 9.5%. In contrast, the urban population of sub-Saharan Africa represented only 4.1% of world urban population in 1970; by 2050, it is expected to increase to 17.1% (United Nations, 2012).

Recent analyses of disaster impacts show that a high proportion of the world's population most affected by extreme weather events is concentrated in urban centers. More people and assets are located in areas of high risk. The proportion of the world's population living in flood-prone river basins has increased by 114%, while those living on cyclone-exposed coastlines have grown by 192% since the 1980s. Over half of the world's large cities, with populations ranging from 2 to 15 million, are currently located in areas highly vulnerable to seismic activity. Rapid urbanization will further increase exposure to disaster risk. The World Economic Forum (WEF) has estimated that by the year 2050 the exposure of city dwellers to various hazards—including earthquakes, tsunamis, urban floods, cyclones, and storm surges—will double (WEF, 2014).

Of the more than 450 urban areas with a million inhabitants or more in 2011 (representing 1.4 billion people), 60%, or about 890 million people, were living in areas at high risk of exposure to at least one natural hazard. Cities in Latin America and the Caribbean, in North America, and especially in Asia are often located in areas exposed to natural hazards. Depending on the region, between half and two thirds of the cities with a million inhabitants or more are located in areas that face high risk of exposure to at least one natural disaster (World Urbanization Prospects the 2011 Revision).

Flooding is the most frequent and greatest hazard for the 633 largest cities or urban agglomerations. At least 233 cities are located in or close to areas with a high risk of flooding—potentially affecting 663 million inhabitants. One hundred forty-eight of these cities are not coastal cities. In majority of cities, poverty forces low-income households to occupy areas of low land value that may be exposed to floods, landslides, and other hazards (Wamsler, 2014). At the same time speculative urban development, which can lead to the paving of green areas in rapidly expanding cities and subsidence due to over-extraction of groundwater, may also increase the frequency and severity of urban flooding.

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Drought is the second most frequent hazard, affecting areas where 132 cities are located, followed by cyclones affecting 68 cities and earthquakes threatening 40 of the 633 cities analyzed. Some 277 million people live in cities at high risk of droughts and 229 million reside in cities at high risk of cyclones. Other cities are, to a lesser extent, also exposed to some of these hazards (United Nations, Department of Economic and Social Affairs, Population Division, 2014).

Among the 63 most populated urban areas (with 5 million or more inhabitants in 2011), 39 are located in regions that are exposed to a high risk of at least one natural hazard; 72% of them are located on or near the coast, and two thirds of them are in Asia (World Urbanization Prospects the 2011 Revision).

Cities, particularly in the developing world, face numerous challenges in responding to a growing urban population by meeting rising demands for housing, food, water, transportation, and other infrastructure or services that ensure people's wellbeing. Moreover, these cities need to contend with the implications of known natural hazards and increasingly unpredictable weather as a result of climate change.

The Need for Resilience

Cities are complex in nature. They consist of a number of interdependent physical systems (Santos-Reyes, 2010) and human communities that are vulnerable to disasters in varying degrees. Kreimer and colleagues (2003) identified a city or an urban area as a "set of infrastructures, other structures, and buildings that create an environment to serve a population living within a relatively small and confined geographic area." Cities are seen as engines of economic growth where the majority of economic activity takes place (Pelling, 2003). In many cases, city centers are considered to be the preferred location for economic activities (as movement is cheap in terms of distance, time, and convenience of travel as a result of good transport facilities, providing a thriving labour market and good service facilities to support business organizations (Macionis & Parrillo, 2004). Increased global exposure to natural hazards has largely been driven by population growth and the trend for an increased proportion of that population to live in cities rather than in rural areas (United Nations, 2015A).

As cities grow larger and become economically more productive, they serve as magnets for rural-urban migration. As urbanization continues, more and more people settle in cities, leading to urban sprawl and also to increasing densification. Urbanization has the potential to make cities more prosperous and countries more developed, but, many cities all over the world are grossly unprepared for the multidimensional challenges associated with urbanization. As a result, the world's population is increasingly concentrated in large cities with poor housing and a lack of basic protective infrastructure. Cities are, therefore, characterized by high population density and a concentration of resources and infrastructure. There is thus a high risk of economic loss, damage to assets, and human casualties and injuries in disasters and extreme weather events, making cities particularly vulnerable. Many of the world's mega-cities are already situated in locations

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that are already prone to major earthquakes and severe droughts, or along flood-prone coastlines where the impacts of more extreme climatic events and sea level rise pose a greater risk of disaster.

Urbanization taking place in relatively smaller cities is also a concern—particularly in regions where the existing infrastructure and institutions are ill equipped to cope with disasters. The vulnerability of this new generation of urbanites will become a defining theme within disaster risk in the coming decades. In contrast, cities also have a concentration of resources, skills, and political power and, hence, more capacity for enabling resilience to hazards. Cities are also characterized by much more built-up areas as compared to rural regions. Because of its concentration and extent in cities, the built environment (infrastructure, facilities/installations, buildings, etc.) represents high asset value and is vulnerable to damage and loss due to disasters and climate change impacts.

The built environment contributes significantly to resource consumption and to greenhouse gas emissions (Rosenzweig et al., 2011) and, consequently, to climate change —a key risk element within cities. A significant proportion of urban development in cities occurs in an ad-hoc, unplanned, and unregulated pattern, characterized by large-scale informal developments that are particularly vulnerable to hazards. Urban planning and development agencies often lack the capacity and resources required to deal with the huge scale of the problem. And despite various localized coping strategies, urban communities cannot mitigate or manage disasters that stem from an urban development process beyond their control. As a result of rapid urbanization, cities are becoming extremely vulnerable to threats posed by natural hazards (Malalgoda & Amaratunga, 2015). Increase in severe weather events and disasters have highlighted the need for cities to augment their ability to withstand the disaster risks they may face and to respond to such risks in ways that minimize the impact of severe weather events and natural disasters on the social, environmental, and economic infrastructure of the city. Considering all the above factors, city leaders need to make significant transformative changes and investments in the resilience of their cities.

The "resilient city" is an emerging term that in the 21st century is used widely in disaster-related literature (Malalgoda, 2015) and policy documents (UNISDR, 2012). UNISDR (2009)[1] defines it as the ability of a system, community or society exposed to hazards to resist, absorb, accommodate, and recover from the effects of a hazard in a timely and efficient manner, including the preservation and restoration of its essential basic structures and functions. Friend et al. (2015) provided a context for considering the rapidly changing characteristics of local-level risk and, in doing so, considered how the notion of the local level could be reframed and how the opportunities for multiscale interventions for disaster risk reduction could be seized. Tyler and Moench (2012) drew on complex systems and resilience thinking to consider the implications of urbanization for an understanding of local disaster and climate risk. Furthermore, Friend et al. (2015) presented urbanization as a process of social and ecological transformation, and cities as dependent on complex systems and flows of resources beyond their physical location. These approaches emphasize the increasing influence of complex infrastructure and

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technology systems in shaping 113 cities and urbanization and the increasingly complex mobility of people across different social arenas and locations (Graham & Marvin, 2002).
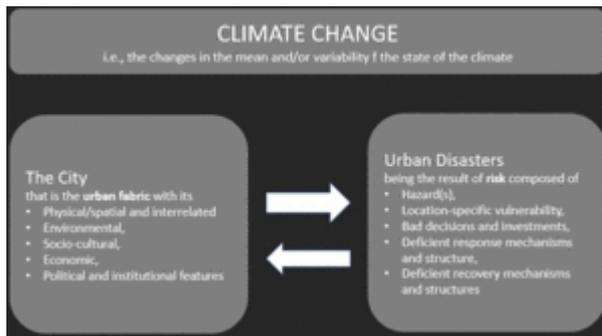

Figure 1. The city-disasters nexus: Cities, disasters and climate change.

Source: Adapted from Wamsler (2014).

Godschalk (2003) stated that a disaster resilient city goes beyond changing land use and physical facilities. It must also build up the capacity of the multiple involved communities to anticipate and respond to disasters. With the effects of evolving coastal hazards, this swift increase in exposure makes cities key areas in which to address evolving disaster risk.

Accordingly, what makes a city resilient to disasters can be seen as a combination of resilience accumulated through the process of urbanization and planning on the one hand and the result of specific actions to reduce disaster risk by various actors on the other. When viewed in this light, urbanization is obliged to consider actions to reduce vulnerability beyond the physical location of cities and, in so doing, to consider what is meant by the term "local." In considering the local dimensions of disaster risk reduction, the focus is thus on the process of urbanization rather than on the physical location of cities, or on the administrative units of the city or municipality. This is not to reject the importance of place as a key determinant in disaster risk and vulnerability but to also argue for the growing importance of more multiscale, systems-oriented approaches (Friend et al., 2015).

The growth of cities has resulted in a concentration of risk for people and assets alike. Catastrophes such as the 2004 Indian Ocean tsunami and Cyclone Nargis (which struck Myanmar just four years later) have led to the loss of hundreds of thousands of lives. These disasters also brought economic catastrophe: millions lost their homes and livelihoods, cities were reduced to rubble, and economic growth and development were set back by years, or even decades in some cases. Left unchecked, the cost of climate change could account for some 20% of global GDP by the end of the 21st century. Much of that bill will have to be paid for by cities and businesses (AXA, 2016).

Resilience planning is a complex issue that falls under the responsibility of multiple departments within governments. While some cities have set up plans that centralize the multiple aspects of resilience planning, others have integrated adaptation and resilience across departments and sectors. Cities are implementing both long-term adaptation measures as well as more immediate response activities. Given the nature of the challenges that cities will face, long-term planning and adaptation to the changing

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environment will be crucial for surviving the worst impacts of climate change. It is therefore necessary to move beyond plans that simply identify the potential for disaster and to outline emergency responses. There are also many cities and smaller urban centers where even the best-oriented disaster risk reduction policies have a limited impact due to large deficits in critical social infrastructure and in local investment capacity (UNISDR, 2012). Consequently, two of the key issues for building urban resilience is how to support and learn from the innovators, as well as how to leverage significant changes in city-level resilience, even where there are limited resources.

Another important trend is the extent to which cities are integrating disaster risk reduction into other local government activities, including education, livelihoods, health, environment, and planning, either by incorporating risk consideration into existing activities or by initiating projects that address multiple issues simultaneously.

The quality and capacity of city governance has an enormous influence on the disaster risk its population faces; quite simply, a city with a good urban and environmental plan and services and infrastructure in place, can prevent disasters better than one that does not. Weak urban governments tend to be less capable of addressing underlying risk drivers. Badly managed urban and local development; degradation of ecosystems such as wetlands, mangroves, and forests that can act as disaster buffers; and high levels of relative poverty are common drivers.

To build resilience, disaster risk reduction and adaptation to climate change need to be primary drivers of progress in urban centers—which now house more than half the world's population and concentrate most of its assets and economic activities.

International Operational Framework for Making Cities Disaster Resilient

The Sendai Framework for Disaster Risk Reduction: 2015–2030 (UNISDR, 2015) adopted at the Third UN World Conference for Disaster Risk Reduction, lays out the priorities of action necessary at both the national and local levels in order to reduce mortality and direct disaster economic losses (including damage to critical infrastructure); the goal is to increase the number of national and local disaster risk reduction strategies by 2020. These strategies and plans need to be available across different timescales, with targets, indicators, and time frames all aimed at preventing the creation of risk, as well as reducing existing risk and strengthening economic, social, health, and environmental resilience.

The United Nations General Assembly adopted, on September 25, 2015, the post-2015 development agenda, under the title "Transforming Our World: The 2030 Agenda for Sustainable Development" (United Nations, 2015B), which intends to renew the commitment toward sustainable development, following the 15 years of activity for the partial achievement of the eight Millennium Development Goals established in 2000 by

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the United Nations Millennium Declaration (United Nations, 2000). The 2030 Agenda for Sustainable Development is a global call for action directed to all stakeholders and countries to act in partnership to eradicate poverty, considered the key challenge in achieving sustainable development, integrating environmental, social, and economic dimensions; the 2030 Agenda establishes, for this purpose, 17 "Sustainable Development Goals" and 169 targets to be achieved within the next 15 years, addressing five key areas of actions: poverty, planet, prosperity, peace, and partnership. Goal 11, "Sustainable Cities and Communities," is specifically dedicated to urban systems and to "make cities and human settlements inclusive, safe, resilient and sustainable." All of these goals influence and are affected by disaster risk; but Goal 11 in particular aims for participatory, integrated, and sustainable urban planning and management, thereby reducing human and economic losses caused by disasters.

With the adoption of the Sendai Framework and Goal 11 of the Sustainable Development Goals (make cities inclusive, safe, resilient, and sustainable) local governments have become even more central to building resilience to disasters. In addition, if disasters and climate change exacerbations are not effectively addressed in cities programs and strategies, the risks will increase and have even more serious repercussions for residents, particularly the poorest ones, who often lack the benefit of safety nets (WEF, 2014).

According to Satterthwaite (2013) and Johnson and Blackburn (2014), urban resilience can come from two sources or pathways. The first is the set of activities undertaken to directly reduce exposure and sensitivity to known hazards. Together, these activities come under the umbrella of disaster risk reduction (DRR) and include hazard mitigation infrastructures, risk assessment and hazard-mapping, risk awareness and education, risk-sensitive urban planning, preparedness, and emergency response activities. But urban resilience is also related to additional qualities not associated with direct DRR activities. These are the product of accumulated resilience, which is the "built-in" resilience a city has accumulated through the processes of city building, infrastructure investment, and socioeconomic development.

Urban resilience requires a systematic, multifaceted, and proactive approach to identify, assess, and develop plans to reduce risks. In most cases, a city's disaster resilience is not entirely within its own control and needs extensive engagement of various stakeholders. This engagement, at times, includes private sector actors, other tiers of government, other urban local bodies in the same area, agencies focused on emergency response, and citizen groups. Involvement of multiple sectors places an extraordinary emphasis on collaboration based on shared information.

To address these complexities and to build consensus, local government leaders need a checklist that is detailed enough to be operational, includes specificities and is still broad enough to address various aspects. Resilience building, has to be a process that has co-benefits, some of which include: leveraging investments and adopting effective management practices; supporting up-to-date decision making; establishing a basis around which to identify and engage many organizations (state and local governments,

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utilities, grassroots organizations) on which the resilience of the city depends; increased economic investment potential, both from reduced exposure or vulnerability and the clear perception that risk is taken seriously; and potential reduction of some of the cost of insurance coverage and establishment of leadership as a resilient city with the visible evidence of adopting good practice.

Designed to support these ambitions, a checklist of "Ten Essentials" has been created to provide a perspective on a city's total disaster resilience posture, while also identifying gaps in plans and provisions. Fully implemented, these essentials support the local government to establish a baseline for the city of how resilient it is at a given point in time relative to foreseeable hazards—where it is strongest, and where it is weakest thus requiring time and attention, and potential resources required toward reducing risks. The biggest single contribution that the checklist can make is exposing the gaps that may exist but may have been overlooked, the conflicts hidden in assumptions, and plans that could derail a response to a disaster. This is made possible in the context of collaboration and multi-stakeholder dialogue. Implementing the essentials will allow any city to develop prioritized actions to improve the situation. Apart from the integration of the numerous existing data sources, and the identification of gaps, cities, and investors will gain many benefits.

Each of these essentials include set of actions and output with the overall aim to attain resilience. See Table 1.

Figure 2. Checklist of ten essentials for urban resilience.

Source: UNISDR (2017).

Table 1. Actions and Outputs to Attain Resilience.		
Essential	**What**	**Why**
1. Organize for disaster resilience	Put in place an organizational structure with strong leadership and clarity of coordination and responsibilities. Establish Disaster Risk Reduction as a key consideration throughout the City Vision or Strategic Plan.	Having an organizational structure means strong leadership, clear delineation of responsibilities and coordination mechanisms, effective stakeholder engagement information dissemination and lines of communication, and well-defined risk reduction

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		strategies and policies and mechanisms for risk reduction.
2. Identify, understand, and use current and future risk scenarios	Maintain up-to-date data on hazards and vulnerabilities. Prepare risk assessments based on participatory processes and use these as the basis for urban development and long-term planning goals.	Identifying probable and worst-case risk scenarios based on the understanding of multiple and changing hazards, geographical and economic exposure, and vulnerabilities can inform current and future investment decisions that will contribute to improved resilience.
3. Strengthen financial capacity for resilience	Prepare a financial plan by understanding and assessing the significant economic impacts of disasters. Identify and develop financial mechanisms to support resilience activities	Understanding the economic impact of disasters and developing financial mechanisms are essential to supporting resilience activities and strengthening opportunities for response and recovery
4. Pursue resilient urban development and design	Carry out risk-informed urban planning and development based on up-to-date risk assessments to reduce risks and prevent future ones, while giving particular attention to most vulnerable groups. Apply and enforce realistic, risk compliant building regulations and support relevant professional education and training for implementation	Pursuing resilient urban development based on risk-informed urban plans is essential to reducing current disaster risks and the prevention of future ones. Participatory urban planning processes and focus on vulnerable groups will not only decrease risk and facilitate the implementation of urban plans but will also help equitable and sustainable development of urban communities
5. Safeguard natural buffers to enhance ecosystems' protective functions	Identify, protect, and monitor natural ecosystems within and outside the city geography to sustain and safeguard their protective functions as natural buffers	Identifying, protecting, and monitoring natural ecosystems within and outside the city is imperative so that their protective functions as natural buffers are sustained and safeguarded. Ecosystems and their services not only support

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	and enhance their use for risk reduction.	city functions such as water provision but can also reduce risks from hazards and impacts of climate change.
6. Strengthen institutional capacity for resilience	Strengthen all institutions related to a city's resilience to have the capabilities to execute their roles and increase city's resilience. Understand institutional capacity to help detect and strengthen gaps in resilience capacity.	Multiple organizations and stakeholders in a city have roles to play to reduce risk and increase their resilience. Strengthening institutional capacities including but not limited to that of governmental organizations, private sector providing public services, industries, academic, professional, and civil society organizations) will increase the city's resilience as a whole.
7. Understand and strengthen societal capacity for resilience	Identify and strengthen the social connectedness and culture of mutual help through community and government initiatives and multimedia channels of communication.	Social connectedness and a culture of mutual help have a major outcome on the impact of disasters of any given magnitude. Understanding patterns of social vulnerability, developing a culture of risk reduction and adequately addressing the needs of the most vulnerable significantly contribute to increasing the city's coping capacity in the face of natural hazards.
8. Increase infrastructure resilience	Assess the capacity and adequacy of critical infrastructure and develop a plan or strategy for its protection, update, and maintenance. Where needed, ensure development of protective, risk-mitigating infrastructure	Adequate and well-maintained infrastructure is critical to providing essential services, responding to disasters, and reducing the creation of risks from hazards and the impacts of climate change.

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9. Ensure effective preparedness and disaster response	Ensure effective disaster response by creating and regularly updating contingency and preparedness plans, installing or linking with early warning systems, and increasing emergency and management capacities.	Emergency preparedness and response plans save lives and property and often contribute to resilience and post-disaster recovery by lessening the impact of a disaster. Preparedness efforts and early warning systems help ensure that cities, communities, and individuals can act in sufficient time and reduce personal injury, loss of life, and damage to property.
10. Expedite recovery and build back better (not rebuild)	Establish strategies for post-disaster recovery, rehabilitation, and reconstruction, ensuring that they are aligned with long-term planning and provide an improved city environment and increased resilience for the affected community.	Ensuring that recovery, rehabilitation, and reconstruction are collectively aligned with long-term planning goals that will result in an improved city environment and increased resilience for the affected community. This will also be a period to learn from past mistakes to develop sound rebuilding and development strategies.

Source: UNISDR (2017).

Hong Kong, as one of the most competitive megacities in the world, faces risks from various hazards, especially in the face of climate change (Sim et al., 2018). One of the early adopters of the "Ten Essentials," Hong Kong deployed a mixed bottom-up and top-down approach in assessing its resilience status. The process included review of government reports and data, followed up with inputs from relevant governmental departments. For certain essentials international experts were engaged to review the status: in this case experts from Taiwan were invited to Hong Kong to assess its risk identification and mitigation.

Based on the assessment, Hong Kong's integrated disaster resilience score stood at 4.2 out of 5. The findings from the assessment suggest that Hong Kong is a disaster-resilient city, with its strength in (1) mainstreaming DRR in its development agenda, (2) maintaining sufficient financial resources for DRR, and (3) defining governmental policies and standard operating procedures for disasters. The process also highlighted gaps that would need further actions. Hong Kong lacks fully comprehensive, detailed risk maps for

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the entire city, covering various hazards, assets, and populations at risk (Essential 2). Due to the lack of hazard maps in Hong Kong, it is apparent that disaster risks are not integrated into the city's long-term planning. Hong Kong's institutional DRR capacity is considered weak as compared with the other essential areas (Essential 6). Gaps include having a central institution to provide leadership, or laws to regulate disaster risks by establishing mechanisms for cross-sectoral coordination; or, a law for establishing local statutory funds dedicated to DRR gathered from a variety of funding sources.

Greater Manchester (GM), a city region of nearly 3 million people in the northwest of England, is both a role model city within the UNISDR's Making Cities Resilient (MCR) Campaign [1] and one of 100 cities globally in the 100 Resilient Cities (100RC) program pioneered by the Rockefeller Foundation. The city region, made up of 10 separate local government districts, constituted a formal multi-stakeholder partnership to coordinate resilience in 2004, developed its first resilience strategy in 2009, refreshed the resilience governance arrangements as the city region's own governance structures evolved ahead of an historic city-level devolution agreement in 2014, and has continued to strengthen resilience governance to embed learning from participating in the MCR Campaign.
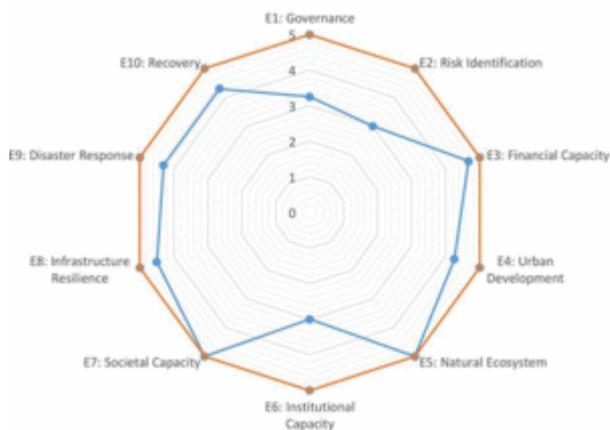

Figure 3. Hong Kong's integrated disaster resilient score.

Source: Sim, Wang, and Han (2018).

Governance and Resilience of Cities

Governance is a concept that recognizes the internal and external power of formal authorities and government institutions in exercising administrative bodies of a country at all levels (Pal & Shaw, 2018). Niekerk (2015) suggested governance is the umbrella under which disaster risk reduction should take place. And it is expected to be dictated by good governance principles including broad participation, transparency, accountability, equity, the rule of law, consensus orientation, efficiency, and responsiveness. However, urban governance is particularly complex as cities are highly dynamic and exposed to foreseen and unforeseen threats including economic, social, environmental, and institutional repercussions. Hence, urban resilience cannot be achieved in isolation by the government, NGOs, or communities; thus, collaboration

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among all the stakeholders is essential. Accordingly, current international discussions on disaster resilience emphasize localizing the global governance to the ground-level stakeholders. Subsequently, many countries are carrying out disaster risk reduction activities in the context of decentralized governance structure (Bae, Joo, & Won, 2016). Many developed and developing countries followed this strategy to enhance resilience of their cities.

A study conducted in Manchester, United Kingdom, by Oldham and Astbury (2018) shows that the interactive, multi-stakeholder disaster risk governance has steadily improved over decades of partnership and collaboration among several parties in Greater Manchester. In the beginning, the collaboration was only among key emergency services, local government, and specialist organizations such as the Environment Agency, Met Office, Highways England, and utilities companies. Later, it was expanded to a wide range of public sector, private sector, academic, and voluntary sector organizations. However, in order to ensure effective governance, Department of Communities and Local Government established the Resilience and Emergency Division (DCLG RED). DCLG RED has a specific role to act as a medium between the national government and local level in England. This enables two-way dialogue between national and local level stakeholders in disaster preparedness. Although some countries prove the benefits of localized disaster governance for urban resilience, lack of human, financial, and technical resources are some of the issues that hinder the effective implementation.

After the 2012 toxic gas leakage accident in the industrial city of Gumi, South Korea, the importance of vertical and horizontal collaboration in disaster governance was widely recognized in the country. Bae et al. (2016) asserted that this accident could have been handled as a minor incident if the local government had confronted it immediately. This became a costly citywide disaster owing to their lack of capacity. A simultaneous centralized and decentralized disaster management is practiced in South Korea. Bae et al. (2016) recommends that the national government should realize its role in disaster management under decentralized approach, rather than passing them to the localities. On the other hand, the local governments are already preoccupied with many tasks under limited financial capacities. Thus, the importance of disaster risk reduction should be communicated to the local authorities, citizens, and mass media.

Another case study by Marks and Lebel (2016) explained that the impact of power relations between government agencies at different levels affected the disaster governance in Thailand. The study shows that Thailand's initiatives for decentralization have been incomplete owing to the country's overall fragmented and politically polarized governance. This weakness in governance was visibly materialized during the 2011 floods in central Thailand. Insufficient capacity of local-level organizations to respond to floods and insufficient assistance by the central government distributed the risk unevenly and performed poorly. This shows how lack of dialogue in disaster governance leads to poor performance.

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These, Manchester, Gumi, and Thailand cases demonstrate the significance of national political commitment to urban disaster resilience. Therefore, scholars and international organizations attempt to recognize measures to assess effective governance. Currently, assessing the effectiveness of governance is restricted to measuring outcomes of resilience. On the other hand, Ahrens and Rudolph (2006) recognized accountability, participation, predictability, and transparency as the key features of effective disaster governance. Accountability ensures that the policymakers can be held accountable for their actions. This can be reinforced by participation that allows for all citizens to have formal or informal channels to influence the policymakers: Whereas predictability demands the existence of laws and policies binding both public and private actors. Finally, transparency is keeping people informed by publishing reliable information to avoid corruptive activities. However, it further requires the assessment of all stakeholders from local to global level to ensure effective governance (Gall, Cutter, & Nguyen, 2014). According to Ahrens and Rudolph (2006) an effective governance will generate a credible commitment and lead to policy reform and economic performance.

The discussion above shows that disaster governance is an evolving process, and horizontal connections influence the cross-cutting themes. Further, it needs ownership and partnership across sectors, including local government decision makers, city officials, departments, central and provincial governments, the private sector, civil society, nongovernmental organizations, community-based organizations, and research institutions and institutions of higher learning to provide focus on disaster risk reduction in their respective fields and make it everyone's business.

Financing Urban Resilience

The number of urban disaster events is visibly growing around the world, and the risk is particularly critical in urban cities where more people and assets are exposed to disasters due to population and economic growth. According to World Bank (2017) almost 60% of the areas that will be urbanized by 2030 have yet to be developed, which means that the world has a brief window of opportunity for investment—but it will take a significant amount of funding. According to estimates by World Bank, the need for global urban infrastructure investment is $4.5 trillion per year, and that making this infrastructure low carbon and climate resilient will take a premium of 9% to 27%. This is still the tip of the iceberg: cities with ample physical infrastructure are aiming for investments in better protection of its social infrastructure.

Thus, urban resilience can be viewed as a unique opportunity for development and poverty reduction of the cities. The discussions on the methods of financing such as embedded and standalone funding are widely recognized under international frameworks for the effective reduction of disaster risk. However, this will vary depending on the level of development, exposure, and risk for disasters. The importance of embedding disaster risk reduction into national development plans is seen as the way forward under the

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concept of integrated risk reduction (Kellett et al., 2013). On the other hand, the need for standalone funding still remains for high-risk locations.

However, financers are struggling with a range of obstacles when it comes to investing in urban resilience. To start, the capacity of cities to integrate risk reduction components in their programs, and to access funding, is limited. This also builds on existing regulatory systems that deter private investment and difficulties in planning, financing, and implementing projects. Lack of technical capacity and upfront costs needed to prepare projects mean that cities are able to offer few ready-to-go urban resilience projects to investors for financing.

According to Kellett and Caravani (2013), between 1991 and 2010 (constant 2010 US$), $106.7 billion was allocated to disasters. Of this, $13.5 billion is allocated for risk reduction measures, $23.3 billion is spent on reconstruction and rehabilitation, and $69.9 billion is spent on response. This shows that the amount spent on resilience is only 0.4% of the total amount spent on international aid. To enhance the spending on the disaster resilience rather than mitigation, many international declarations have been made including Sendai Framework for disaster risk reduction 2015–2030 (UNISDR & UNO, 2015). Priority 3 of this framework emphasizes the public and private investment in disaster risk prevention and reduction through structural and nonstructural measures for resilience.

Some of the domestic sources are public expenditures including public-private partnerships (PPP), insurance and disaster pooling, development assistance, and foreign direct investment (Bouwer & Aerts, 2006). Public expenditure is one of the most significant potential funds that can be allocated from the budget of a government for disaster resilience initiatives. It further includes partnerships with private companies, NGOs and development banks. Insurance and pooling are sources of finance that can absorb part of the losses. Further, it can help in setting standards for buildings and land-use planning. Foreign direct investments through national policy is also an attractive funding source. Although most countries depend largely on international funding sources, some countries have established and mobilized their own disaster risk reduction finance. According to Kellett and Caravani (2013) Guatemala, Indonesia, Peru, and Philippines are some of the countries that have a high level of disaster risk, and all have domestic investments for disaster risk reduction. Further, many countries have established national institutions to manage disaster resilience funding. Particular mentions are Indonesia, Philippines, Costa Rica, South Africa, and Mexico (Watson et al., 2015).

Conventional instruments will not be able to finance all required measures for district-level adaptation and disaster reduction. Local government leaders need to be innovative in accessing financing options that meet best their requirements and risk values.

According to Brugmann (2011), existence of a local tax assessment authority over geographic areas offers a unique opportunity to finance comprehensive resilience upgrades. Local governments have widely used value capture mechanisms and borrowing

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against future tax revenues, such as tax increment financing, to incentivize if not finance investments in blighted areas (i.e., areas with high private investment risk).

A municipality, a local development corporation, or utility company may offer loans to thousands of building owners to retrofit their buildings against known risks. In exchange, the utility would secure the right to charge building owners a monthly loan repayment on regular utility bills, or the municipality could apply surcharges on property tax bills to recover their loan. In both instances, they would likely charge interest to the building owners on the loaned balances (Brugmann, 2011).

Insurance mechanisms are critical instruments for reducing the extent of possible losses to those who would otherwise want to invest and hold assets in a risky city district or urban infrastructure system. In this sense, insurance is an important financial instrument when seeking to mobilize additional capital for any kind of city building.

A new entrant in the financing category is the resilience bond. These are an innovative variation on the catastrophic bonds. For instance, if a city wants to build high-value infrastructure to reduce impacts from potential risks (e.g., build higher seawalls or fix levees) but does not have access to funds. It could go for a parametric catastrophic bond, in which case the insurer would take the expected impact of that planned investment into account and lowers the premium the city has to pay. With that cost saving in the budget, the municipality now has the money to invest in its risk reduction infrastructure.

Lastly, but not as the last resort, government-secured debt and grants from international organizations are also another means of filling the financing gap.

However, in overall terms, financing for urban resilience is currently inadequate, and it needs significant improvements in terms of both quality and accessibility. Kellett and Caravani (2013) recommends that the role of financing should be clearly understood by the local governments to differentiate between what it should it be funding and what it should not be funding. Further, the efficient model of financing that ensures the equity at all levels should be adopted by a city. Thus, financing for resilience is not just about more money but rather about targeted management and suitable coordination.

Conclusive Discussion

The urban population is increasing exponentially, particularly in South Asia and sub-Saharan Africa, where it is expected to double by 2030 (IDMC, 2015). However, most of the cities in developing countries absorb the growing population only by informal settlements, which are highly vulnerable and exposed to disasters. Different regions have seen their urban populations grow more quickly, or less quickly, although virtually no region of the world reported a decrease in urbanization so far. Further, the complex composition of cities increases the multidimensional challenges to their population if unprepared. This emphasizes the need for disaster resilience that builds up the capacity of the multiple involved communities to anticipate and respond to disasters.

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Mayors, local government officials, and decision makers are at the forefront of dealing with the impact of disasters—ranging from small and medium to less frequent large-scale events—that arise from natural or human-made hazards. Climate change and extreme weather events are likely to increase the city's exposure to hazards and risk. Less obvious is the fact that business-as-usual development practices may also generate complex environmental changes and contribute to increased risk unless these are anticipated and remedial measures are taken.

Locally and regionally, urban expansion also causes detrimental effects on ecosystems (Srinivas, 2003) that further aggravate the magnitude of the impact of hydro-meteorological hazards. Environmental degradation caused by the pressure of urbanization, deforestation, or inappropriate agricultural management can lead to increased risk for cities that depend on surrounding and distant ecosystems. Furthermore, climate change is expected not only to affect the intensity and the frequency of extreme climatological and hydro-meteorological events but also to increase "risks from heat stress, storms, extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, water scarcity, sea-level rise, and storm surges" in urban areas, especially for those "lacking essential infrastructure and services or living in exposed areas" (IPCC, 2014). For instance, the catastrophe modeling firm AIR Worldwide estimates the insured replacement value of coastal properties is expected to increase by 7% per year, which means that the value at risk is forecast to approximately double every decade. Making development risk sensitive is therefore a key priority to ensure that growth of future economic losses is managed.

Resilience and urban resilience require the involvement of multiple stakeholders including multiple departments within the government, private organizations, civil society organizations, and communities. Thus, resilience planning and implementation is complex and needs the quality and capacity of the city governance. In order to accelerate urban resilience, international discussion outputs and operational frameworks are made available for better implementation. The Sendai Framework for Disaster Risk Reduction: 2015–2030 is an international governance framework that lays out the priorities of action necessary to be undertaken at both national and local level in order to reduce mortality and direct disaster economic losses.

Given this framework, countries and cities are expected to adopt efficient disaster resilience strategies by 2020 (to attain the global target "E" set out under the Sendai Framework) with an emphasis on localizing the global governance to the ground-level stakeholders. Further, the disaster governance needs ownership and partnership across sectors while providing focus to disaster risk reduction to make it everyone's business. This can be reinforced by adequate financing from embedded and standalone funding, depending on the level of development, exposure, and risk for disasters. Local governments should follow the efficient model of financing that ensures equity at all levels. In essence, the resilience of a city is the resistance, transformation, coping capacity, recovery, adaptive capacity, and responsibility of everyone.

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According to Sachs (2015) there are many ways in which ongoing climate change and other environmental changes are interacting with rising populations and more crowded cities to create new risks. It is important for every city to assess those changing risks in a detailed and rigorous way. There is not a fixed blueprint. Each city has distinctive topography, population density, and vulnerabilities. Each city needs to assess its particular challenges. Hazards such as flooding, earthquakes, air pollution, and extreme weather events are on the rise. Cities must also plan for a future of rising ecological shocks resulting from human-induced climate change and other environmental change. This is consistent with the idea that humanity has entered a new era: the age of sustainable development. City officials need forward-looking planning that combines ecology, engineering, and public policy to keep our cities resilient and desirable places to live in the 21st century. The good news is that it is possible for cities to overcome these crises.

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