Disaster, Resilience and Security in Global Cities

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Abstract

Today the majority of the globe's inhabitants live in urban areas, and according to all prognoses, cities will continue to grow in the coming decades. Global cities are also becoming increasingly connected as a result of economic, political, cultural and demographic globalization. In the context of urban security management, the growing complexity these connections bring may present a double-edged sword: global cities can be both the most secure and the most dangerous places to be when disaster strikes. Developing appropriate mechanisms to prepare for and cope with complex crises in cities will, in the future, be a key aspect of security policy-making. In this article we explore current trends in research and practice concerning the management of disasters in eight global cities, particularly focusing on aspects of preparedness, response, urban resilience and cooperation. The results of the study indicate that cities must improve the capacity to predict new or unforeseen risk by diversifying capabilities for risk assessment and improving inter-agency collaborations. In addition, cities must adopt new approaches to disaster management that are sufficiently flexible to adapt to a changing risk environment and to safeguard urban security.

Introduction

By 2008, for the first time in history, more of the world's inhabitants lived in cities than in rural areas. The United Nations Population Fund (UNFPA) predicts the number of people living in cities will rise from 3.6 billion in 2011 to five billion in 2030.[1] In addition, the UNFPA estimates that almost all of the world's population growth from 2010 to 2030 will take place in urban areas. There are many reasons for the rapid growth of urban areas around the world: large cities offer a variety of economic benefits, they present cultural and social connectivity to their inhabitants, and they centralize services and increase accessibility to these services, creating places of high dynamism and constant change. In recent decades, accelerated globalization has connected cities like never before. In fact, the "global city"[2] has become a major hub for "multiple, interdependent flows of a greater variety of goods, services, people, capital, information and diseases" between regions and continents.[3] As a consequence, in recent years cities have been increasingly described as open and complex systems. How to best prepare these complex urban spaces for potential major disasters, remains a considerable challenge.[4]

This article argues that the complexity of the global city may present a double-edged sword in the context of urban disaster – one that strategic security specialists must closely manage. On the one hand, the characteristics of the global city, like high population density, ethnic heterogeneity, constant migration, and complex, interconnected infrastructure systems could increase the vulnerability of the city to disaster. On the other hand, most urban environments offer considerable strengths in terms of economic production and distribution, human resources and the availability of services, which can all be used to significantly reduce disaster risk and vulnerability. Yet, a remaining problem lies in organizing these dispersed resources and services to prepare urban systems for major disasters. While risks are becoming increasingly connected, the political and administrative responsibilities to address urban risks are too often scattered across various institutional bodies that struggle to find common responses to these risks. In order to find appropriate mechanisms to plan for and manage disasters in global cities, all relevant actors (including mayors' offices, police and fire departments, emergency services, as well as private businesses) must work closely together to develop approaches that make use of the opportunities that urban complexity brings, while at the same time mitigating the undesired negative complications presented by complexity.

This article examines current practices concerning the management of disasters in global cities in order to understand how complexity and urban security interrelate. The article particularly focuses on understanding cities' contemporary approaches to risk management, exploring aspects of disaster preparedness and risk assessment, response and countermeasures, and the institutions and collaboration involved in current processes of

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[1] United Nations, *State of World Population 2007: Unleashing the Potential of Urban Growth* (New York: United Nations Population Fund, 2007), available at: *http://unfpa.org/public/home/publications/pid/408.*

[2] Global cities are multicultural, geographically distinct and dynamic places that function as structured and organized human systems. They are places of both diversity and centralization, where cross-border economic, social, cultural and technical processes flourish. Sassen, Saskia, *The Global City: New York, London, Tokyo* (New York: Princeton University Press, 1991); Saskia Sassen, "Globalization and Cities: Locating Cities on Global Circuits," *Environment and Urbanization* 14:1 (2002): 13-30, available at: *http://eau.sagepub.com/content/14/1/13.full.pdf+html.*

[3] Willem van Vliet, "Cities in a Globalizing World: From Engines of Growth to Agents of Change," *Environment and Urbanization* 14:1 (2002): 31-40, available at: *http://eau.sagepub.com/content/14/1/31.full.pdf+html*; Lewis M. Branscomb, "Sustainable Cities: Safety and Security," *Technology in Society* 28:1-2 (2006): 225-234, available at: *http://www.sciencedirect.com/science/article/pii/S0160791X05000564.*

[4] Branscomb, "Sustainable Cities."

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disaster risk management. Within this context, the article explores how disaster in the urban environment may influence the delivery of critical social and technical services, how the urban system responds to shock and disturbance, and thus explore the contingent relationship between disaster (social, technical, natural) and urban security.

The article begins by reviewing recent trends in the literature of urban disaster management, focusing on the implications of resilience thinking for disaster management approaches in the context of global cities. Using interviews conducted with city disaster managers from a selection of cities, the research then explores how urban disaster management practices are currently being adapted to the challenges of complexity. Based on the findings, the article then discusses implications for the necessarily contingent practices of disaster management and for urban security more generally.

The Global City: Connecting Disaster Resilience and Urban Security

Global cities are multicultural, geographically distinct and dynamic places that function as structured and organized human systems. They are places of both diversity and centralization, where cross-border economic, social, cultural and technical processes flourish.[5] In this sense, the global city represents the reality of accelerated globalization, which has degraded national boundaries and facilitated the interconnectedness of urban centers and nations in the global economy.[6] The globalization of companies, economies, communication, transport, labor and migration has propelled the interconnection of urban spaces around the globe.[7] For example, where city services supporting society were once locally derived, they are now characterized by private sector delivery, which is ever more international in scope, operations and financing.[8] The new interrelationships and interdependencies within cities, between cities and regions, nationally and internationally have significantly increased the systemic complexity of urban spaces. The city's pivotal position as a focal 'node' or 'hub' in the global society places them at the centre of discussion about disaster, disruption and the mechanisms for avoiding or mitigating disaster consequences and assuring public safety and security.[9] Thus, weighing the benefits of urbanism against the potentially disastrous consequences of complexity is a major challenge for city disaster managers.

In the context of disaster management, there are two schools of thought regarding the increasing complexity of the global city. Firstly, complexity increases the robustness of service systems (particularly critical infrastructures) because increased connectivity creates redundancy; thereby, overcoming issues associated with random faults and disruptions or targeted attacks.[10] On the other hand, complexity may be a problem for the city and its services if those services rely on all the supporting interdependencies remaining constantly viable, which may not be the case in times of disaster or disruption or given the dynamic nature of the global city.[11]

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[5] Sassen, *The Global City*; and "Globalization and Cities: Locating Cities on Global Circuits."

[6] Richard G. Smith, "World City Topologies," *Progress in Human Geography* 27:5 (2003): 561-582, available at: *http://phg.sagepub.com/content/27/5/561.short*. .

[7] Branscomb, "Sustainable Cities."

[8] Saskia Sassen, "Globalization and Cities."

[9] United Nations, *How to Make Cities More Resilient: A Handbook for Local Government Leaders* (Geneva: United Nations, 2012).

[10] Enrico Zio, "From Complexity Science to Reliability Efficiency: A New Way of Looking at Complex Network Systems and Critical Infrastructures," *International Journal of Critical Infrastructures* 3:3/4 (2007): 448-508.

[11] Batty, Michael, *Cities and Complexity* (Cambridge: The MIT Press, 2005); Charlotte Benson and Edward J .Clay, "Disasters, Vulnerability and the Global Economy," *Disaster Risk Management Series* 3 (2003): 3-30;

Although there are arguments for robustness, complexity has heightened the vulnerability of the city system. Moreover, since the global city is not a closed and self-sustaining system that could withstand disruption independently, but rather an open system that is increasingly characterized by its external connections and interdependencies, disaster in highly interconnected urban space can create 'downstream' or 'contagion' effects.[12] In recent years, the open and dynamic nature of urban systems has been increasingly acknowledged in pre- and post-disaster planning and management. A move away from traditional centralized, top-down, 'command and control' models of management is illustrative of this acknowledgment.[13]

Given the innate complexity of the modern global city, and the need for new management approaches, the concept and practice of 'being' resilient or 'building' resilience has gained significant traction. Resilience is a trending concept in modern approaches to disaster studies and urban security used in the last decade to denote a general state of an entity like a city, or city system component. Not limited to these disciplines by any means, the concept has defied traditional disciplinary boundaries, passing between fields as diverse as engineering, ecology, psychology, disaster studies, and security studies, and others. The notion and practice of resilience has permeated many aspects of academic, private sector and government activities, and such wide application has defied a consistent definition.[14] Haimes and colleagues note that a resilient city can be viewed as a sustainable network of physical systems and social communities that are both strong and flexible, and organized around technologies, businesses,

Kevin A. Borden, Mathew C. Schmidtlein, Christopher T. Emrich, Walter W. Piegorsch, and Susan L. Cutter, "Vulnerability of U.S. Cities to Environmental Hazards," *Journal of Homeland Security and Emergency Management* 4:2 (2003); James K. Mitchell, "Megacities and Natural Disasters: A Comparative Analysis," *GeoJournal* 49:2 (1999).

[12] Mitchell, "Megacities and Natural Disasters."

[13] Rüdiger Korff and Eberhard Rothfuß, "Urban Revolution as Catastrophe or Solution? Governance of Megacities in the Global South," *Die Erde* 140:4 (2009); Louise K. Comfort, "Risk, Security, and Disaster Management," *Annual Review of Political Science* 8:1 (2005).

[14] Crawford S. Holling, "Resilience and Stability of Ecological Systems," *Annual Review of Ecology and Systematics* 4 (1973):1; John W. Handmer and Stephen R. Dovers, "A Typology of Resilience: Rethinking Institutions for Sustainable Development," *Organization & Environment* 9:4 (1996): 482-511; W. Neil Adger, "Social and Ecological Resilience: Are They Related?," *Progress in Human Geography* 24:3 (2000); 347-364; Suniya S. Luthar, Dante Cicchetti, and Bronwyn Becker, "The Construct of Resilience: A Critical Evaluation and Guidelines for Future Work," *Child Development* 71:3 (2000): 543-562; Richard J. T. Klein, Robert J. Nicholls, and Frank Thomalla, "Resilience to Natural Hazards: How Useful Is This Concept?," *Global Environmental Change Part B: Environmental Hazards* 5 (2003):1–2; Brian Walker, Crawford S. Holling, Stephen R. Carpenter, and Ann Kinzig, "Resilience, Adaptability and Transformability in Social--Ecological Systems," *Ecology and society* 9:2 (2004); Jon Coaffee and David M. Wood, "Security Is Coming Home: Rethinking Scale and Constructing Resilience in the Global Urban Response to Terrorist Risk," *International Relations* 20:4 (2006): 503-517; Paton, Douglas and Johnston David, *Disaster Resilience: An Integrated Approach* (Springfield: Charles C Thomas Pub Ltd, 2006); Fran H. Norris, Susan P. Stevens, Betty Pfefferbaum, Karen F. Wyche, and Rose L. Pfefferbaum, "Community Resilience as a Metaphor, Theory, Set of Capacities, and Strategy for Disaster Readiness," *American Journal of Community Psychology* 41:1-2 (2008): 127-150; Yacov Y. Haimes, "On the Definition of Resilience in Systems," *Risk Analysis* 29:4 (2009): 498-501; Nadine Marshall, "Understanding Social Resilience to Climate Variability in Primary Enterprises and Industries," *Global Environmental Change* 20:1 (2010): 36.43; Hongjian Zhou, Jing'ai Wang, Jinhong Wan, and Huicong Jia, "Resilience to Natural Hazards: A Geographic Perspective," *Natural Hazards* 53:1 (2009); 21-41; Jeremy Walker and Melinda Cooper, "Genealogies of Resilience: From Systems Ecology to the Political Economy of Crisis Adaptation," *Security Dialogue* 42:2 (2011): 143-160; Michael Ungar, "Social Ecologies and Their Contribution to Resilience," in Michael Ungar (ed), *The Social Ecology of Resilience: A Handbook of Theory and Practice* (New York: Springer Science+Business Media, 2012); Rolf Pendall, Kathryn A. Foster, and Margaret Cowell, "Resilience and Regions: Building Understanding of the Metaphor," *Cambridge Journal of Regions, Economy and Society* 3:1 (2010).

organizations, infrastructures, and socio-demographic characteristics.[15] While each of these components of the system has likely been designed and developed, or is evolving independently, and operates autonomously, in order to be resilient they must be managed, organized, and controlled in a distributed and contingent fashion that incorporates flexibility. An exploration of how to build or foster resilience in technical, social and economic systems, and the challenges of doing so, is not the objective of this article, and currently the subject of significant academic attention.

Yet, depending on the institutional perspective, the central objectives in building resilience into risk management and planning in cities can differ substantially. On the one hand, security management in urban contexts is often preoccupied with the maintenance of day-to-day community activities and functions of society, as well as the welfare of individuals and consequently regards them as the main goals of urban security.[16] In contrast, disaster management is often focused on low-probability, high-impact events and processes. In this vein, Godschalk suggests the resilient city is "capable of withstanding severe shock without [suffering] either immediate chaos or permanent harm."[17] He goes on to point out that "while [resilient cities] might bend from hazard forces, they would not break" and that "resilient cities would become stronger by adapting and learning from disasters."[18]

Although there are several concurring conceptions of resilience in the context of urban security, all assume that the vulnerability of physical and social systems cannot be fully (or accurately) predicted, making the ability to accommodate change without devastating failure critical. Recent discourse surrounding the actual or prospective application of the 'resilience approach' in disaster management and security highlights a shift in focus away from centralized state protection and threat prevention, encouraging citizens to take measures that increase their personal security, and contribute to the security of the society.[19]

Although the ubiquity of resilience is conspicuous, what factors influence urban resilience, and conceptions about how to integrate resilience thinking into urban security practices

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[15] Yacov Y. Haimes, Kenneth Crowther, and Barry M. Horowitz, "Homeland Security Preparedness: Balancing Protection with Resilience in Emergent Systems," *Systems Engineering* 11:4 (2008).

[16] Handmer and Dovers, "A Typology of Resilience"; Coaffee and Wood, "Security Is Coming Home."

[17] David R. Godschalk, "Urban Hazard Mitigation: Creating Resilient Cities," *Natural Hazards Review* 4:3 (2003): 136.

[18] Ebid, 137.

[19] Godschalk, "Urban Hazard Mitigation;" Gwyndaf Williams, Stuart Bathos, and Lynne Russell, "Responding to Urban Crisis: The Emergency Planning Response to the Bombing of Manchester City Centre," *Cities* 17:4 (2000); Graham A. Tobin and Linda M. Whiteford, "Community Resilience and Volcano Hazard: The Eruption of Tungurahua and Evacuation of the Faldas in Ecuador," *Disasters* 26:1 (2002); Douglas Paton, John McClure, and Petra T. Bürgelt, "Natural Hazard Resilience: The Role of Individual and Household Preparedness," in Douglas Paton and David Johnston (eds.), *Disaster Resilience: An Integrated Approach* (2006); Committee on Disaster Research in the Social Sciences: Future Challenges and Opportunities, National Research Council, Facing Hazards and Disasters: Understanding Human Dimensions, (Washington, D.C.: The National Academies Press, 2006), available at: *http://www.nap.edu/catalog/11671.html*; Susan L. Cutter, Lindsey Barnes, Melissa Berry, Christopher Burton, Elijah Evans, Eric Tate, and Jennifer Webb, "A Place-Based Model for Understanding Community Resilience to Natural Disasters," *Global Environmental Change* 18:4 (2008); Bernard Manyena, Geoff O'Brien, Phile O'Keefe, and Joanne Rose, "Disaster Resilience: A Bounce Back or Bounce Forward Ability?," *Local Environment* 16:5 (2011); Coaffee and Wood, "Security Is Coming Home;" Haimes, Crowther, and Horowitz, "Homeland Security Preparedness;" Jon Coaffee and Peter Rogers, "Rebordering the City for New Security Challenges: From Counter-Terrorism to Community Resilience," *Space and Polity* 12:1 (2008); David Chandler, "Resilience and Human Security: The Post-Interventionist Paradigm," *Security Dialogue* 43:3 (2012); Chris C. Demchak, "Resilience and Cyberspace: Recognizing the Challenges of a Global Socio-Cyber Infrastructure (Gsci)," *Journal of Comparative Policy Analysis: Research and Practice* 14:3 (2012); Department of Homeland Security, "Risk and Resilience: Exploring the Relationship," (Washington, D.C.: Homeland Security Studies & Analysis Institute, 2010).

present considerable challenges. As Godschalk points out "[while] we have learned a great deal about the behavior of various urban systems in recent years, there are still many gaps in our knowledge about how physical and social systems within cities respond to extreme stress."[20] In order to better inform strategies to cope with complex challenges such as natural, technical or social disasters in urban contexts, we examine current developments in all components of urban disaster management: from risk assessment, to disaster response planning, the recovery, institutional adaptation and collaboration.

Methodology

The study consisted of three methodological steps. Firstly, eight global cities were identified that are subject to a diverse range of natural and anthropogenic hazards: Frankfurt, Hamburg, Rotterdam, Vienna, London, Singapore, Los Angeles, and Sydney.[21] Secondly, for each city a detailed city profile was constructed using information from online sources, grey, and peer-reviewed literature. Lastly, the city profiles were used to develop city-specific semi-structured interview schedules based on information determined to be missing from the city profile, and on issues that may have been identified in the profiles, but that the interviewers deemed necessary to explore more deeply in an interview. Interviewees were asked to describe processes of risk assessment, disaster preparedness and countermeasures, and institutional collaboration and/or partnerships. Where appropriate, interviewees were also asked to describe the relationship between disaster management and urban security planning in their jurisdictions.

The interviewees were city officials (or in the case of Rotterdam, a regional official) capable of discussing the city's disaster and urban security management planning processes and practices. These officials were identified either by the authors or by research collaborators from the Swiss Federal Office for Civil Protection (FOCP). Each potential interviewee was contacted first by email with a detailed description of the project and how information they provided would be used. Once each official agreed to be interviewed, they were sent the specific interview schedule for their city prior to their interview being conducted, and asked to nominate a suitable time for the research team to conduct the interview. Where referred to in the article, all interviewee responses are attributed to the city they represent only in order to maintain the anonymity of the interviewee.

Interviews lasted between 45 minutes and two hours. Prior to commencing the interview, interviewees were asked if they agreed to the interview being recorded, and this was done when the response was affirmative. In all interviews detailed notes were taken, and this included in the city's profile. Where a recording was available, it was used to add detail to the interviewer's notes. All interviews were conducted by the authors. Once completed, all recordings were fully transcribed. Interviews and the city profiles were coded and analyzed qualitatively using Atlas.ti text analysis software. Finally, interviewees were given the opportunity to comment on a draft research report to verify reported trends and to add detail where possible or appropriate.

The study is explorative in nature and therefore does not aim to assess or compare the quality of the various practices or policies in the cities under study. Rather, it is drawing on the variety of strategies, techniques and structural arrangements observed to describe how

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[20] Godschalk, "Urban Hazard Mitigation," 141.

[21] The study was originally conducted to inform urban disaster risk management in Switzerland, and cities from developed countries were chosen for their better comparative nature. Clearly an extended study would benefit from an analysis of urban disaster and security management processes in developing countries, where disasters are unfortunately much more common.

practices in disaster management and urban security can be adapted to challenges of complex in different geographical, political and social contexts.

Results

This section summarizes the main findings from the interviews with city officials, and the examination of the city profiles. The section is structured along the different steps of urban disaster management processes: First, current developments in urban risk assessment are discussed. Thereafter, we outline the approaches cities take to increase disaster preparedness and improve crisis communication. Next, we review disaster response and recovery practices in different city contexts. Finally, we discuss how new institutional arrangements and collaborations are developing around disaster management and urban security planning in cities.

Risk assessment
Risk assessment remains a fundamental component of disaster management in global cities. However, in order to identify and assess potential future threats to urban systems at the earliest stage possible, urban risk assessment is becoming increasingly systematic. While traditional risk assessments were based on historical experiences, current risk assessment practices strongly rely on quantitative risk analyses, either by in-house staff or with support from specialist external experts. Depending on the city context, risk analyses focus either on man-made threats, that for instance criminals or terrorists pose, or on natural or technical hazards, but they must also assess the city's vulnerability to each type of risk. These established quantitative risk analysis procedures are increasingly being complemented with semi-qualitative methods like horizon scanning and scenario exercises. These complementary techniques are used to pre-empt risks or threats and institute proactive mechanisms to deal with these issues well before their potential threat might be realized in a disaster event. This suggests that in gaining an understanding of risk or threats in cities, disaster managers are responding to the need to address the growing complexity and connectivity characterizing city systems.

We found that the strength of coordination mechanisms between various organizations differs substantially, and the results suggest that four different approaches to urban risk assessment are being used (Table 1). In *centralized systems*, risk assessments are conducted by a single authority with far-reaching responsibilities. In Singapore, for example, assessments are undertaken by upper levels of government with limited contributions from municipal or civil actors. By contrast, London employs a more *integrated approach*, drawing on contributions from different actors with specific responsibilities and capabilities in their risk assessments. In Rotterdam, risk assessments are conducted using a *distributed approach* where several organizations conduct individual risk assessments, often focusing on particular hazard types and developing issue-specific strategies. Finally, Los Angeles and Sydney employ a *networked system* of risk assessment. This approach reflects the hazard and geographic specificity of the distributed approach, but draws on strong links between the organizations conducting the risk assessments, enabling a far more coordinated approach to risk assessment. Importantly, this approach has not been restricted to risk management professionals, but also involves social stakeholders, like local community representatives.

Figure 1: General Approaches to Risk Assessment (RA).

		Inter-organizational coordination	
		low	*high*
Subsidiarity	*low*	Centralized RA	Integrated RA
	high	Distributed RA	Networked RA

An overarching trend is a multiplication in the number of intergovernmental and supra-national institutions that reinforce cross-border risk assessment. This trend is directly connected to the broadly shared insight among city disaster managers that many risks no longer stop at national borders. In recent attempts to cope with trans-boundary risks, international organizations such as the Organization for Economic Co-operation ad Development (OECD) and the European Union (EU) are playing more active roles in urban risk assessment. For example, the EU Directive (2007/60/EG) has led to unification of the different approaches in European flood risk assessment to ensure the cross-comparability of risk estimates. In other instances, international collaborations in risk assessment are organized bilaterally. For example, Singapore is fostering and relying on international risk assessment and management collaboration with neighboring South East Asian countries in the control and management of pandemic threat and terrorist activity. According to the city's representative, these collaborations have greatly benefited both the city-state's disaster management practices and outcomes. At the same time, although the need for comprehensive and collaborative risk assessments is broadly recognized as a key to urban security, in reality, breaking down institutional barriers are seen as tough challenges by many officials.

Preparedness and crisis communication
Complementing the established methods of risk assessment, modern disaster preparedness and planning is increasingly characterized by the need to adapt to uncertainty and unpredictability. As a consequence, flexible strategies aimed at increasing social resilience are gaining ground in the preparedness practices of many cities (*e.g.* Sydney, Los Angeles, Singapore, and London). These typically complement, rather than replace, existing and traditional approaches to risk mitigation, social or structural disaster countermeasures.

A strong push toward using the resilience approach to deal with potential risks that may negatively impact urban security largely reflects the realization that dealing with disasters is a shared responsibility between governments, the private sector, and civil society. This is especially the case for weather-related natural disasters like floods, storms, wildfires and drought, which are predicted to become more severe (and in some cases more frequent) with climate change in some geographic regions. Importantly, more frequent and more severe disasters will stretch already limited disaster preparedness resources and practices, so a distributed whole-of-community approach has become very attractive to city disaster managers.

For example (and contrary to their approach to risk assessment), Singapore has strongly followed the resilience approach particularly in relation to the threat from terrorism by establishing the Singapore United initiative which aims to increase communication within communities by encouraging community leaders to draw members of the community together to discuss approaches to minimizing risk and increasing resilience.[22] Within this initiative, the

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[22] Singapore United Community Engagement Program, *http://www.singaporeunited.sg/cep/*.

community is involved "in response plans that will be activated when a crisis, e.g. a terrorist incident, *does* occur" [emphasis added]. In London, the disaster and security managers aim to build resilience on the very local level of boroughs, but also increase coordination in response and planning up through hierarchies. In Vienna too, attempts to build resilience through close cooperation with partners outside the classic disaster management community have been initiated. Yet where this approach is deployed, instead of dissolving their role into a 'network of irresponsibility', governmental disaster management actors were found to have redefined their role in urban disaster preparedness from one of command and control to one focusing on coordinating planning processes, synchronizing responses, and encouraging joint exercise and preparation.

In general, open dialogue, public involvement, and support for self-organization in disaster preparedness and security management, important elements in a functional resilience approach, are still underdeveloped in the cities examined. Recent efforts to adapt public risk and crisis communication to the complexity of contemporary information and communication systems serve as a case in point. Most cities are only cautiously exploring opportunities by novel two-way disaster communication technologies that support disaster preparation and response (like the use of social media and SMS warning systems). However, in some cities, such as Los Angeles and London, new Information and Communication Technologies (ICT) are already seen as a "game-changer" in crisis communication. The Los Angeles interviewee noted specifically that the advent of social networking was a positive development since it has enabled the city to change its approach towards public warning – providing information that is timely, personal, and closely context specific. The use of social media in crisis communication and preparedness presents both opportunities and challenges for disaster and urban security managers.[23] Even so, officials recognize that communities increasingly expect to participate in decisions about and the handling of the risks they face, so must be, and new communication techniques must be employed to support this participation.

In particular, these novel disaster and security management communication processes are being used to help target disaster preparedness information at vulnerable sub-populations within cities. More focus is now being directed to addressing specific vulnerabilities among the poor, the elderly, disabled, or chronically ill, and in cultural or ethnic minorities, as these groups are often the 'weakest link' in a city's mitigation capacity. Providing information to, organizing and meeting the different needs of such groups requires a strong understanding of their vulnerabilities, and the underlying causes of these vulnerabilities. In Los Angeles, disaster management authorities are paying particular attention to the heterogeneity of the population's socioeconomic situation. In all urban areas, elderly and handicapped persons require particular consideration in disaster planning, and delivering the optimal support to these groups in disaster situations is an important challenge in many cities. One of the most commonly reported minority groups that must be considered in disaster management are ethnic groups, and in Hamburg authorities have introduced mechanisms to acknowledge and respect cultural and religious identities in disaster planning in order avoid potential problems. Experiences in different cities show that a structural and long-term improvement of the situation for vulnerable groups can hardly be accomplished without additional resources, for example, by building a steady dialogue between authorities and vulnerable groups, or by fostering the multi-language capabilities of emergency organizations.

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[23] Giroux, Jennifer and Florian Roth, "Conceptualizing the Crisis Mapping Phenomenon: Insights on Behavior and the Coordination of Agents and Information in Complex Crisis," (Zurich: Center for Security Studies (CSS), 2012).

Response and recovery

An important shift in city disaster management and urban security practices has been growing institutionalized support for long-term recovery following an incident or emergency. Historically the lion's share of disaster response resources has been directed to initial (crisis) response to disasters or disturbances that aimed at bringing the affected entity (city, community, *etc*.) back to 'normality' quickly. However, the functional interdependence of components in the global city system mean effectively recovering socio-technical systems (to 'normality') is a fundamentally more demanding proposition than where interdependence does not exist. A stronger governmental investment of resources towards longer-term (up to ten years) recovery consequently reflects the difficulty and necessity of bringing 'systems of systems' back online following an emergency or disaster in the global city, and in the modern risk environment.

To better understand recovery needs, like resources, delivery methods, and institutional support, a State Emergency Recovery Controller has recently been appointed to undertake community needs assessments following future disasters in Sydney. Also in Frankfurt, it is well recognized that the need to increase resilience in communities affected by disaster cannot be accomplished at "zero cost." However, the capacity to direct dedicated and substantial resources at long-term recovery has been hampered in Europe particularly by recent budget austerity measures that limit the ability of disaster managers to invest in 'non-essential' disaster management practices.

Institutional adaptation

In order to adapt to the changing risk environment of global cities, disaster risk managers and planners are increasingly thinking and planning outside of the traditional jurisdictional boundaries that characterized their historical operational 'territory'. While geography remains the basis for planning (cities are after all spatially distinct, though expanding), closer consideration of issues beyond traditional planning boundaries is now a fundamental feature of disaster planning. The need to incorporate beyond-border contexts in modern disaster planning is particularly evident in places that share geographic, cultural or political closeness. For example, Singapore actively cooperates with neighbors Malaysia and Indonesia in its disaster planning and security threat assessment processes. Countries in the European Union may be bound to shared agreements that encourage cross-border disaster planning or incident response training – for example between Germany and Austria. In Europe also, a major consideration must be cross-border critical infrastructure crisis planning and management – a significant issue for countries that may be dependent on the quality and capacity of international management practices (often undertaken by the private sector) for the continuance of critical services like energy and water, for instance. Cities like Sydney, which are geographically isolated compared to other cities in the study, nevertheless draw on the international disaster community to improve practice. In the context of wildfire, a hazard that both Sydney and Los Angeles face, personnel, researchers, and techniques are often shared. As these cases illustrate that while globalization and complexity may complicate disaster responses, it also connects disaster managers.

City representatives emphasized that in order to match the complexity of contemporary security challenges, new cooperation and coordination mechanisms were imperative for future disaster management. Disaster planning and response in urban spaces was traditionally the remit of specialized actors, often organized along historically evolved administrative divisions, yet disconnected organizational structures have proven increasingly ill-suited to the management of major disasters in urban spaces. As risk managers face ever more complex,

severe or frequent incidents that highlight their growing incapacity to deal with these situations in a solo fashion, 'command and control' attitudes to risk management are diminishing and new structures are emerging. In this context, government actors are taking on new, mainly coordinating roles in the planning and management of disasters in cities, enabling greater horizontal and vertical integration of disaster management processes and institutions. Deepened and broadened integration reflects both the growing complexity of the city system, and the changing nature of the risk environment in which the city exists (increased severity, frequency and complexity of disruptions or disasters).

Conclusion and Implications

At a time of accelerated globalization, urban disaster management is becoming increasingly complex. City officials are responding to the shifting nature of these disasters with dynamism and adaptability. The results of this study suggest that cities should adopt a double-track strategy in response to the decreased predictability of potential disasters. On the one hand, cities must improve the capacity to predict new or unforeseen risk possibilities. To this end, cities should step up and diversify their capabilities for risk assessment processes, as well as improve inter-agency collaborations. On the other hand, cities must acknowledge the limits of disaster prediction and prevention. New approaches to disaster risk assessment should permit management processes to adapt to changing risks and new risk environments. Among such adaptation measures are efforts to increase the flexibility of response and longitudinal nature of disaster recovery. Initiatives that focus on fostering the self-efficacy of communities, or that strengthen existing networks between actors involved in disaster management across administrative and territorial boundaries are representative in this context. Such strategies are expected to significantly increase the disaster resilience of urban spaces and thereby contribute to urban security more generally.

In the case of natural hazards facing cities, the ability to plan and enact preparations, both social and structural, are considered powerful operational adaptive capacities that increase resilience and reduce vulnerability by mitigating exposure and reducing sensitivity, and by increasing response capacity.[24] Resilience is considered a useful concept in respect to both disaster management and maintaining urban security because it is largely achieved through bottom-up organization and action (even though most resilience activities involve facilitation or targeted intervention of some form).[25] People mostly come together in response to disaster, and contrary to perceptions, and popular reports from media and in movies, social order does not generally degrade after disasters occur.[26] Under these circumstances, social cohesion in informal networks, trust and collective efficacy are known to yield substantive benefits to communities in planning and responding to disaster, which will become increasingly important complementary aspects in formal planning and disaster response processes and practices in the future.[27]

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In addition, the study suggests that the distributed nature of services in global cities, with cross-border interdependencies, calls for dynamic and integrated risk management and planning processes. Consequently, one of the future challenges will be the identification of governance mechanisms that can accommodate differences in legal structures, data availability and compatibility, institutional path-dependencies, and a raft of other multi-city considerations.[28]

In the context of disaster planning and preparedness, the increasing complexity of the city, and the distributed nature of services raises questions about where urban disaster planning should stop. What will be the future role of governmental authorities in urban disaster management, and what role will they play in also managing disaster-related security issues (if at all)? With little doubt, the increased focus on flexible and adaptive approaches for coping with urban disasters will have a major influence on the organization of disaster management, and on the way concerns about the connection between disaster and urban security can begin to be addressed.

In the long-term, with the increasing influence of complexity on urban security and disaster management, authorities must also become institutionally adaptable. Whether adapting to new risks or taking on new roles in disaster or security management, today's disaster managers must be capable of changing to match tomorrow's challenges as they develop, or before they develop. Traditionally hierarchical institutional operations are no longer suitable for managing disaster in global cities. Novel approaches in communication, risk management, preparedness, and collaboration, which foster shared responsibility between governments, the private sector and members of civil society for disaster management and the maintenance of urban security, will become imperative.

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