

Peer Reviews for Making Cities Resilient

Jennifer Bealt^{a*}, Duncan Shaw^b, Chris M. Smith^c and Manuel López-Ibáñez^d

a, b, c, d Alliance Manchester Business School, The University of Manchester, Manchester UK

Alliance Manchester Business School, The University of Manchester, Booth Street West,
Manchester, M15 6PB

[*Jennifer.bealt@manchester.ac.uk](mailto:Jennifer.bealt@manchester.ac.uk)

Jennifer Bealt^{a*}

Dr Jennifer Bealt is a Research Associate at the Alliance Manchester Business School (AMBS) with research interests in building resilience to disasters. She is currently working on the Techno-Economic framework for Resilient and Sustainable Electrification (TERSE) project which aims to build resilient and sustainable energy networks for developing countries. Previously she has worked on the UScore2 Project which designed a practical city-city disaster risk reduction peer review tool for cities across EU member states and beyond via the UNISDR Making Cities Resilient campaign (MCR). Jennifer received her PhD in Humanitarian Logistics and Supply Chain Management from Brunel University, London (2017). ORCID: 0000-0001-9662-5520

Duncan Shaw^b

Prof. Duncan Shaw is Professor of Operations and Critical Systems at The University of Manchester (UK). He works in Alliance Manchester Business School and the Humanitarian & Conflict Research Institute (HCRI). He regularly works with local and national governments as well as NGOs and INGOs on emergency preparedness and response. He chairs a committee for the International Standards Organization on community resilience. He is currently working on an array of projects around disaster preparation and response including one funded by the European Commission on city peer reviews for disaster risk reduction. He has a Ph.D. in Management Science, a D.Sc, and is a Fellow of the Operational Research Society and of the Royal Society of Arts. ORCID: 0000-0002-8833-0527

Chris M. Smith^c

Dr Chris Smith is a Lecturer of Operations and Critical Systems at The University of Manchester in the Alliance Manchester Business School. His research interests focus on helping policy makers and emergency managers make decisions under uncertainty. Chris has worked with decision makers at local and national government level in the UK and Europe, focussing on disaster risk reduction and response. This includes a European Commission funded project on city peer reviews for disaster risk reduction. He has a Ph.D. from Warwick University for which he was awarded runner-up in the Operational Research Society doctoral prize (2016) for "Most Distinguished Body of Research leading to the Award of a Doctorate in the field of O.R.". ORCID: 0000-0001-8016-243

Manuel López-Ibáñez^d

Dr Manuel López-Ibáñez is a Lecturer in Decision Science at the Decision and Cognitive Sciences Research Centre at the University of Manchester, in the Alliance Manchester Business School. His research interest focusses on multi-criteria decision and optimization problems in management, business, manufacturing and logistics. He received a PhD from Edinburgh Napier University in 2009. He has published 21 journal papers in international scientific journals on diverse applications of decision science. ORCID: 0000-0001-9974-1295

Abstract

Peer reviews are a unique governance tool that use expertise from one city or country to assess the capabilities or intentions of another, with a view to strengthening those. Peer review tools are gaining momentum in disaster management and remain an important but understudied topic in risk governance. Methodologies to conduct a peer review are still in their infancy but are being developed in academia and exploited in practice. To enhance these developments, we conducted a systematic literature review (SLR) of academic and non-academic literature on city resilience peer reviews to provide useful insights for practitioners on structuring peer reviews as a tool for resilience building in cities. Through exploring conceptualizations of key resilience principles and peer reviews, 33 attributes of resilience are identified which provide useful insights to the ways in which research and practice can inform risk governance and utilise peer reviews to drive meaningful change. Moreover, it situates the challenges associated with resilience building tools within the risk governance field to support practitioners in developing interdisciplinary perspectives for integrated city resilience frameworks. Results of this literature review have been used in the development of a peer review methodology and an international standard on conducting peer reviews for disaster risk reduction.

Keywords

City resilience; city peer review; disaster risk governance.

Introduction

Adverse events and emerging risks have risen globally, leading to complex environmental and social impacts on populations and the need for effective management and response (Khunwishit et al., 2018). While trends indicate reducing mortality rates from disasters, they also show that risk management practices are unable to reduce risks faster than the population's exposure to risk increases (UNISDR, 2015) in part due to inequities resulting from cultural exclusion or poor governance, and inequalities related to unevenly distributed socio-economic prosperity (Meerow et al., 2016).

Exposure and vulnerability are particularly salient in cities, which now house the majority of the world's population (ibid). Thus, urban populations are more commonly relying on localised disaster risk governance strategies to adapt and respond to risk (Henstra, 2010).

Disaster risk governance encompasses all stages of disaster risk management and can promote an inclusive approach involving all stakeholders within a society; from government to communities (Shi, 2012). Effective disaster risk governance therefore builds capabilities to prepare for, and respond to, disasters (Somers and Svava, 2009), enabling cities to address sustainable development, and social and environmental vulnerabilities; public preparation and risk mitigation activities; and protective land use and urban planning measures which support infrastructure protection (Henstra, 2010). To assist cities in achieving these aims, the United Nations Office for Disaster Risk Reduction (UNISDR) developed the Making Cities Resilient (MCR) campaign to offer tools for local governments, civil society groups and urban professionals. Through 10 steps known as the '10 essentials' MCR aims to support cities in their disaster risk reduction (DRR) and resilience building by reducing the causal factors of disasters, lessening vulnerability and exposure to hazards, and improving preparedness (UNISDR n.d).

MCR, and other disaster resilience campaigns such as 100 Resilient Cities (100RC), claim to work with administrators to build resilience into city systems by increasing capabilities, sharing best practices, providing management tools, measuring resilience and setting targets (100RC n.d, par. 3). While 100RC has supported 100 cities since 2013, MCR has sought broader adoption; reportedly working with over 3,850 cities globally (Khunwishit et al., 2018).

Peer reviews provide evaluation mechanisms for such initiatives in the form of a governance tool where the disaster management systems of one country (Turkey, 2015; Finland, 2014; UK, 2013) or city (EMI, 2008) are examined by experts from another country or city. This process can be desk-based, or conducted in-country over a number of days to provide an independent view of resilience and DRR practices, and areas for development (Pagani, 2002). Peer reviews include perspectives from multiple stakeholders which gives insights to how organizations in various sectors individually and collectively monitor their risks; a feature of disaster management which should be central to contemporary governance (Boin and Lodge, 2016). Additionally, peer reviews allow for the experience of crisis management to be explored which provides further understanding regarding the values and actions of stakeholders (Stark, 2014). As a result, peer reviews are able to provide interdisciplinary insights across the two main spheres of disaster risk governance; the management sphere which focuses on decision making and implementation of actions, and the assessment sphere which focuses on knowledge generation concerning risks and vulnerability (Shi, 2012).

Given the many benefits of peer reviews for disaster risk governance and strengthening resilience within cities (Mitchell et al., 2015), it is timely to consider the research on city peer reviews. Despite the usefulness of peer reviews in incorporating multiple perspectives on city resilience, and calls for integrated approaches between international policy makers and local

governments (Schipper and Pelling, 2006), this SLR indicates limited research on peer reviews as a means to assess city resilience.

As a result of its widespread membership, we used MCR as an organizing framework to consider the legitimacy and prominence of MCR concepts in the wider literature and the similarities and differences between these. Such differences may be explained as a reflection of the generic nature of MCR in focusing on aspects that can be shared across most cities of the world without concern for contextual specificities that may negate its influence. This aligns with scholarly thinking relating to preparing and managing threats, which reflect the notion that risk tools should be based on identifying generic capacities which can be applied to numerous events (Boin and Lodge, 2016). However, the gaps between MCR and academic conceptualization and understanding of resilience, as demonstrated by the SLR, may cause challenges when implementing governance risk tools.

This paper provides the first SLR of peer reviews for risk governance. To ensure its alignment with practice and theory, the SLR methodology supports the identification of best practice in relation to methods and tools by analysing information from related studies (Gimenez et al., 2016). The SLR explored interdisciplinary resilience literature (Gibbs Springer, 2012) which enabled the exploration of existing applications and understandings of peer reviews in a comprehensive, rigorous and transparent way. It is acknowledged that resilience literature has received academic critique (Davoudi, 2012), but remains central to practitioner thinking (ibid) and so, the SLR captured both academic and practitioner literatures.

Analysis of the peer review literature from academic and non-academic sources provided theoretical and practical insights into building city resilience which can be used to support practitioners in the implementation of city resilience. Highlighted are conceptualizations of

MCR principles as a means of strengthening city resilience through increased understanding of the tools available to local government, and how multi-stakeholder engagement and understanding of risk is promoted. The results of this literature review have already informed the development of the International Standard ISO22392 “Conducting peer reviews for disaster risk reduction” which presents a methodology based on the results of this paper.

Next we discuss key concepts and our organizing framework. Then we report on the methodology of the review, summarise the findings on how the research contributes to critiquing MCR, the practicalities of its implementation, cross-cutting issues, and opportunities for future research.

1. City resilience and Peer Reviews

Resilience has been recognised as a key value against which city governance can be assessed (Khunwishit et al., 2018). Resilience building is increasingly understood as a multi-agency approach (ibid) which depends on local governments to coordinate and implement risk governance strategies (ibid). Local government engagement encourages effective and legitimate governance in systems which are increasingly, complex, connected and at risk (Duit 2016). To restore order in systems which have been adversely affected Boin and van Eeten (2013) argue that systems can return to a prior order or emerge as stronger systems; ones which ‘bounces back’ (ibid). MCR is one piece of the resilience toolkit for cities MCR and is not without its critics. MCR has been criticised for not providing clear standards which can be practically applied (Weichselgartner and Kelman, 2015), or reliable baselines due to the subjective nature of the tool (Lewis, 2013). Additionally, it recognised that resilience definitions go beyond the classic definition used by MCR (“the ability of a system exposed to hazards to resist, absorb, accommodate and recover”) (UNISDR, 2009). Resilience has multiple commonly agreed concepts in various literature and disciplines, some of which can

be contradictory (Lang, 2011). Most resilience thinking is rooted in a systems approach that addresses the “relationship between the system under observation and externally induced disruption or stress” (ibid: 16). Nevertheless, MCR’s resilience strategies aim to support systems to emerge stronger and MCR provides a strong advocacy tool to do this (ibid). Building resilience requires cities to learn (Boin and van Eeten, 2013) to improve their chance of resisting, absorbing and recovering from shocks. Peer reviews are an integral ways for such learning to be developed in a collaborative, informed and holistic way.

MCR’s view of resilience aims to promote learning by strengthening accountability for DRR, safeguarding ownership of action and supporting implementation (UNISDR, 2015).

Additionally MCR aims to: increase understanding of disaster risk; strengthen disaster risk governance; encourage city investment in DRR for resilience; and enhance disaster preparedness for effective response (ibid). This is operationalised through UNISDR’s Disaster Resilience Scorecard for Cities (UNISDR, 2017) which purports to facilitate cities in gauging their disaster resilience and progress at local level; enabled by peer reviews.

MCR offers ten ‘critical and independent steps’, called ‘10 Essentials’ (E1-10), for building and maintaining city resilience (UNISDR, n.d) which include:

- E1. Organise for disaster resilience;
- E2. Identify, understand and use current and future risk scenarios;
- E3. Strengthen financial capacity for resilience;
- E4. Pursue resilient urban development and design;
- E5. Safeguard natural buffers to enhance ecosystems’ protective functions;
- E6. Strengthen institutional capacity for resilience;
- E7. Understand and strengthen societal capacity for resilience;
- E8. Increase infrastructure resilience;

- E9. Ensure effective disaster response;
- E10. Expedite recovery and build back better.

The MCR framework covers structural aspects of resilience such as plans, policies and legislative frameworks, and softer attributes of organizational arrangements such as communication, knowledge exchange and resource mobilization (Kamh et al., 2016).

Exploring the literature on peer reviews for city resilience using MCR is one way in which practitioners can identify, assess, understand, and cope with risks (Christensen et al., 2016).

This research provided useful insights into a dominant DRR strategy compared to wider DRR literature which helps identify factors which strengthen city resilience and the form a resilient city may take (Duit, 2016). This contributed to the literature on conceptualisations of city resilience and aligned with discussions regarding the need for flexible and adaptable governance when dealing with risk (Stark, 2014).

Previous research states that evaluation for emergency management and resilience building is complex, and the tools applied to address these are often not appropriate (Henstra, 2010).

Peer reviews allow for more tailored approaches to assessing city resilience and DRR strategies, where stakeholders can ensure the issues most pressing can be evaluated.

As peer reviews are designed and implemented by the city or country engaging in the review, they can champion citizen engagement and understanding of risk. This develops cooperation as peer reviews aim to support the facilitation of meaningful resilience strategies for the local context. By analysing two key tools available to for resilience building, namely MCR and peer reviews, we attend to evaluating city resilience in a way which is applicable to practitioners.

2. Methodological Approach

We conducted a systematic literature review (SLR) which is useful for developing new knowledge applicable to policy and practice (Tranfield, 2003), and systematically and transparently locating the most relevant documents (Denyer and Tranfield, 2009). To support the SLR we established an international advisory board (IAB) of 13 emergency management practitioners to guide choices made during the process and support the bridging of academia and practice. The IAB included representatives from either the national [] or city [] governments of Belgium⁰, Finland⁰, France⁰, Iceland⁰, Italy⁰⁰, Portugal⁰⁰, South Africa⁰, Sweden⁰, and UK⁰⁰ as well as UNISDR. Each member was approached based on their reputation in disaster management and knowledge on peer reviews for DRR; having conducted peer reviews of cities in their country, or abroad.

We involved the IAB in email and teleconference exchanges to identify keywords based on the context, content and process of the investigation (see table 1), and to review the search strings used to search literature databases to identify potential documents for review (see table 2). The IAB also supported the identification of inclusion and exclusion criteria which ensure the reliability and replicability of data (Meline, 2006) (table 3). Papers published before 2005 were excluded as 2005 marked the introduction of the Hyogo Framework for Action; a 10-year plan to safeguard against natural hazards which launched a global focus on resilience building (Khunwishit et al., 2018). Although we recognise the score of academic thinking on resilience which has come before Hyogo, 2005 marks the start of a consolidated effort by practitioners to address resilience issues.

Search strings were developed and used in 'Publish or Perish' software as it enabled us to perform complex queries through Google Scholar to retrieve academic and non-academic literature (Harzing, 2007). Google Scholar indexes most academic databases and more than 87% of scholarly documents published in English (Khabisa and Giles, 2014), including non-academic literature which is important for our review. Though we recognised a risk that some

academic literature may only be referenced by other databases, this risk was low as searches were limited to works published after 2005. A more substantial risk was that non-academic literature which has not been referenced online cannot be found in Google Scholar (or any other academic database). For such literature, we relied on the IAB for suggestions and they provided three additional references which ensured the quality and rigour of the non-academic literature. Thus, the non-academic literature was analysed alongside the academic literature as the integrity of these documents had been verified.

Table 1 Final keywords for SLR

Context	Content	Process
Local-level <u>resilien</u> *	Disaster risk reduction	Peer-to-peer
Urban <u>resilien</u> *	Disaster manage*	Peer <u>self review</u>
City <u>resilien</u> *	Emergency manage*	Peer <u>self evaluation</u>
City plan*	Multi-risk	Peer <u>self assess</u> *
Town	Disaster risk reduction	Peer <u>self apprais</u> *
		Peer <u>self monitor</u> *
*: any string of letters. : or		

Table 2 Criteria used to identify papers related to city resilience peer review

Criterion	Rationale	Included	Excluded
Publication Type	Screening for publication type ensures the credibility and reliability of sources.	Scholarly Journals; Conference proceedings; Reports; Books	Editorials and Opinions; Theses
Language	Papers written in English were reviewed due to language limitations.	Papers written or translated into English	All other languages
Time Frame	2005 marked the launch of the Hyogo framework for Action (2005-2015).	Documents from 2005 onwards	Documents pre 2005
Paper Content	The objectives of peer reviews, and the types of peer reviews identified. This provided a guide for the inclusion and exclusion criteria.	Contributions to policy and action e.g. DRR, civil protection; Implementation of policy e.g. DRR; lessons learnt and good practice papers, assessment DRR and civil protection strategies; Assessment of guidelines for risk assessment and frameworks used; Methodologies used to assess risk management and impact.	Documents out of the scope of this research: emergency and development topics not related to resilience building or DRR, risk management or civil protection.

Table 3 List of ‘Publish or Perish’ Google Scholar Search Strings

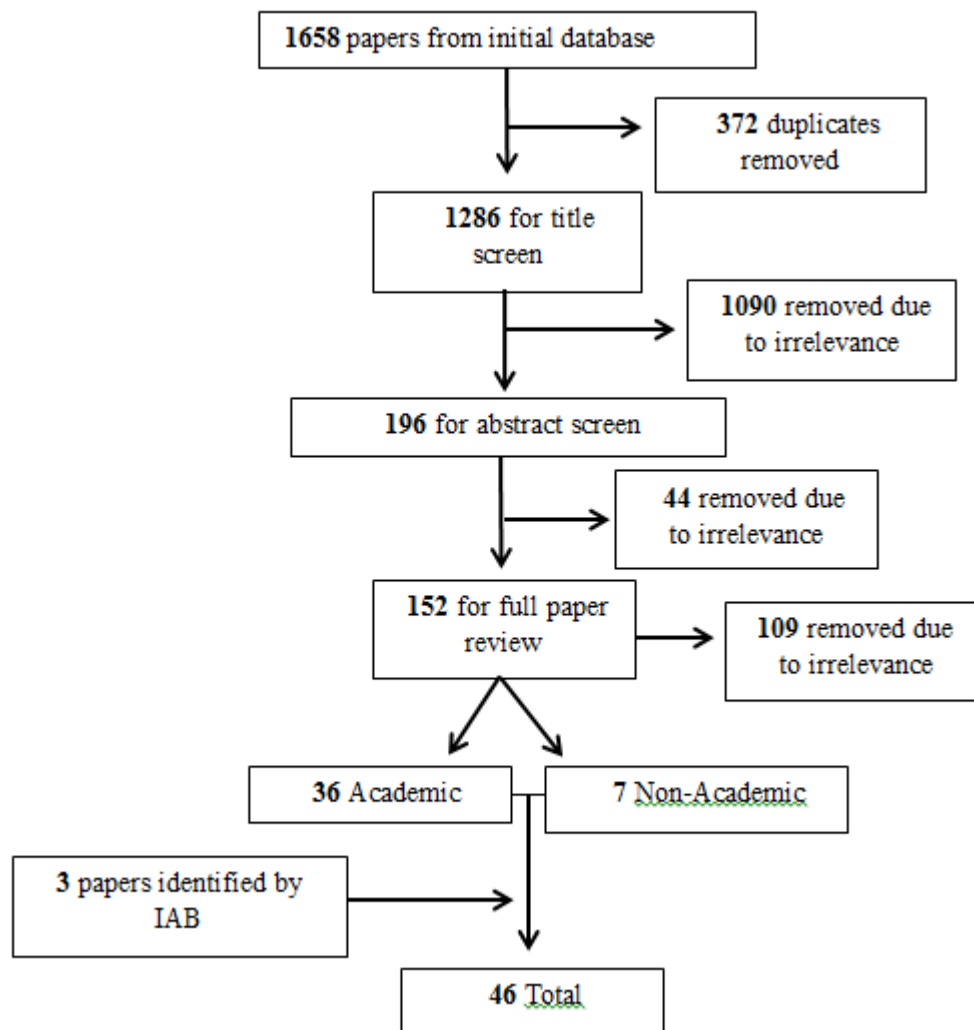
(local-level OR urban OR city OR town) plan* (disaster OR emergency) <u>manag</u> * ("peer review" OR "peer evaluation" OR "peer assessment" OR "peer appraisal" OR "peer monitoring")
(local-level OR urban OR city OR town) plan* "Disaster risk reduction" Peer-to-peer (review OR evaluation OR assess* OR <u>apprais</u> * OR monitor*)
(local-level OR urban OR city OR town) <u>resilien</u> * (disaster OR emergency) <u>manag</u> * ("peer review" OR "peer evaluation" OR "peer assessment" OR "peer appraisal" OR "peer monitoring")
(local-level OR urban OR city OR town) <u>resilien</u> * (disaster OR emergency) <u>manag</u> * ("self review" OR " <u>self evaluation</u> " OR " <u>self assessment</u> " OR " <u>self appraisal</u> " OR "self monitoring")
(local-level OR urban OR city OR town) <u>resilien</u> * (disaster OR emergency) <u>manag</u> * Peer-to-peer (review OR evaluation OR assess* OR <u>apprais</u> * OR monitor*)
(local-level OR urban OR city OR town) <u>resilien</u> * "Disaster risk reduction" Peer-to-peer (review OR evaluation OR assess* OR <u>apprais</u> * OR monitor*)
(local-level OR urban OR city OR town) <u>resilien</u> * "Disaster risk reduction" ("self review" OR " <u>self evaluation</u> " OR " <u>self assessment</u> " OR " <u>self appraisal</u> " OR "self monitoring")
(local-level OR urban OR city OR town) <u>resilien</u> * "Disaster risk reduction" ("peer review" OR "peer evaluation" OR "peer assessment" OR "peer appraisal" OR "peer monitoring")

We were aware of the limitations of using MCR as a framework for analysis as it provided only one perspective of resilience building and DRR and may not be representative of other practitioner or academic conceptualizations on this topic. However, the analysis was only presented using the structure of the 10 essentials, so our wider exploration of the literature mitigates this. Whilst other frameworks such as 100 RC exist, analysis of one framework ensured differing strategies for resilience building and DRR were not blurred. In addition, the wide take-up of MCR globally meant it represented populist practitioner thinking on DRR and resilience building.

In total, 1,658 publications were retrieved and after duplicates were removed 1,286 were eligible for analysis. Applying the criteria to the eligible papers resulted in 196 papers being further considered. We checked each paper met the criteria and was relevant to the research; either rejecting it based on the abstract (44 rejects) or after reading the full paper (109 rejects), which resulted in 43 papers on peer reviews for city resilience being selected for full analysis. The IAB suggested three additional non-academic papers not retrieved by Google Scholar, meaning we analysed 46 papers in total; 67 per cent of these were peer reviewed papers and 33 per cent were practitioner reports.

This process was undertaken by one researcher with support of three academics who provided critical commentary, challenge, and advice. Reliability of the process was enhanced with regular meetings of this team (Ritz et al., 2016) and IAB input. Figure 1 presents the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram (Ostadtaghizadeh et al., 2015) which details this process.

Figure 1 PRISMA Diagram



To identify unanswered questions for research and practice regarding how the literature addresses each essential, we organised the findings from the 46 papers using MCR’s 10 essentials framework. We used this approach as the 10 essentials have been broadly adopted by more than 3,850 cities (Khunwishit et al., 2018) and reflect a recognizable and usable format. We analysed each paper for two aspects: how the issues were conceptualised; and their prominence in MCR.

3. Findings from the SLR

Notions of resilience are well established in multiple disciplines; however, that only 46 papers were available for review indicated a dearth of research on peer reviews for DRR and resilience building in risk governance. This suggested a gap exists between research and practice and limited theoretical consolidation of this topic.

The SLR revealed a number of characteristics related to enhancing city resilience and helped develop understanding of conceptualizations found in the peer review literature. This information can be found in Appendix A. Each characteristic was assigned a code. In some cases, the literature demonstrated that the codes assigned to one essential also applied to other essentials; this information can be found in Appendix C. For example, the literature predominantly focused on division of responsibility (DiR) as a facet of strengthening institutional capacity for resilience (E6). However, DiR is also addressed as a component of organizing for resilience (E1) (Fleischhauer et al., 2012; Gilissen et al., 2016; Kim and Kakimoto, 2014).

Trends within the selected papers were summarized, and identified codes which applied to multiple essentials, and the frequency of essentials/characteristics addressed. Overall, the selected literature often focused on E1 (governance and organizational structures), E2 (identifying and understanding risk), and E7 (strengthening societal capacity for resilience). Less prominent were E3 (strengthening financial capacity) and E10 (placing those affected at the centre of recovery when building back better).

We analysed each essential using literature from the SLR starting by presenting MCR's definition of the essential to understand what it included. Then we examined how the essential was conceptualised in SLR literature and identified variances between MCR and the (predominantly) academic literature.

3.1 Essential 1: Organise for Disaster Resilience.

MCR defined E1 as strengthening institutional capacities for DRR and establishing structural aspects of coordination between city stakeholders, such as formalizing networks and legislative frameworks for implementing resilience (UNISDR, n.d, c). MCR took a more hierarchical approach by focusing on plans, legislation, strong leadership and single points of coordination. Structural aspects were not comprehensively addressed by the reviewed literature as, for example, the prioritization of resilience (Johansen, 2016), government investment (Basu et al., 2013), and implementation of timescales (Dunford et al., 2015) were treated in isolation from aspects of strengthening plans, and networks and partnerships (Fleischhauer et al., 2012). This impacts opportunities for policy implementation, learning, and trust within structural collaborations (ibid). Lacking in MCR, but prominent in the literature, were softer aspects of organization and stakeholder collaboration, specifically: communication, knowledge exchange and resource mobilization (Kamh et al., 2016), decentralised coordination (Gilissen et al., 2016) and inclusion through building alliances with communities, businesses and scientists to effect change in DRR decision making (Hamdan, 2012). Although MCR suggested engaging with all relevant stakeholder groups, its advocacy for knowledge exchange, learning, and resource mobilization with groups was limited.

3.2 Essential 2: Identify, Understand and Use Current and Future Risk Scenarios.

In MCR, E2 focused on improving decision making for resilience by exploiting knowledge of risk (UNISDR, n.d, d) including learning from cities with similar risk profiles to understand analogous risk and resilience (UNISDR, 2017a). Such aspects were considered in detail in the peer review literature through the discussion of social and structural dimensions of risk. The literature often framed social dimensions as the need to identify a population's exposure, vulnerability, susceptibility, and adaptive capacity (Birkmann et al., 2013) to allow better targeting of risk information to populations (Cardona and Carreño, 2011) and better targeting

of government attention to community resilience (Fleischhauer et al., 2012). Structural dimensions of risk were often framed as physical structures, the environment and institutional characteristics (Fox-Lent et al. 2015). This included how societies manage natural resources, responded to the effects of climate change, and controlled land use (Basu et al., 2013). The literature also highlighted the need for governments to consider a broader range of social dimensions including risks from social deprivation, vulnerability and low community inclusion (Birkmann et al., 2013) which was lacking in MCR. Also, less prominent was the impact of risk information on recipients' (e.g. government officials and citizens) knowledge of, and attitude towards, risks (McAllister, 2013) as well as their willingness to commit to resilience strategies (Twigg, 2009).

3.3 Essential 3: Strengthen Financial Capacity for Resilience.

E3 considered the economic impact of disasters and the need for investment in resilience which contributes to a city's wider economic strategy and resilience building (UNISDR, n.d, e). Such aspects were considered in detail in the peer review literature where financial capacity is often framed at citizen or city levels. For citizens, financial capacity related to the loss of personal assets and social deprivation (Johansen et al. 2016) and can be measured through the number of insured households (McAllister 2013) and access to finances (Johnson and Blackburn, 2014). For cities, it related to economic loss (McAllister, 2013), the organization of budgets (Kernaghan and Silva, 2014) and the need for financial commitments for scalable and adaptive social services and protection systems (Manyena, 2016). Less prominent in MCR, but highlighted in the literature, were the practicalities of protecting the economy through business continuity planning (Henstra, 2010), mutual aid (Sharifi and Yamagata, 2016), and development agreements (Birkmann et al., 2013).

3.4 Essential 4: Pursue Resilient Urban Development and Design.

E4 aimed to enhance resilience by assessing the built environment and minimizing disruption to critical infrastructure (UNISDR, n.d, f) in accordance with risks analyzed in E2. Such aspects were considered in detail in the peer review literature which advocated that city resilience is informed by the spaces that people inhabit and the services and structures within that space (Birkmann et al., 2013). Unlike the demarcated approach of MCR, the literature interlinked concepts of land-use and urban planning (Kamh et al., 2016); environmental management (Musa et al., 2015); physical structural issues (EMI, 2008); and habitable space, vulnerability and exposure (Birkmann et al., 2013). One aspect of reducing exposure is to ensure that urban design has the capacity to absorb and adapt to risks (Fox-Lent et al., 2015) utilizing vulnerability mapping, preparedness, and mitigation activities (Henstra, 2010). Less prominent in MCR, but strongly present in the literature, was the need for practitioners to link infrastructure resilience and institutional capacity with urban planning and design (Wiering et al., 2017) in a holistic conceptualization of inhabited spaces and the services that sustain them.

3.5 Essential 5: Safeguard Natural Buffers to Enhance Ecosystems' Protective Functions.

E5 aimed to build resilience through safeguarding and managing natural ecosystems that offer protection against hazards and the impact of environmental change (UNISDR n.d, g). Such aspects were detailed in the peer review literature, particularly through physical, political and natural aspects. Physical aspects included research on the effect of the built environment, land-use and the role of infrastructure on ecosystem functioning (Johansen, 2016). The literature on political aspects covered governance, urban development, and funding infrastructure projects on ecosystem protection (Basu et al., 2013). On natural aspects, research took a human focus to safeguarding natural buffers. The literature framed these issues in terms of societal resilience, response capacity and mobilization (Birkmann et al., 2013); and the attitudes towards, and social importance of, ecosystem protection (Leitch

and Inman, 2012). Less prominent in MCR, but highlighted in the literature was how social deprivation and land-use practices interact to jeopardise ecosystems (Birkmann et al., 2013), environment and land-use defenses (Kamh et al., 2016), and the need for a multi-stakeholder approaches to resilience building for holistic and sustainable solutions to ecosystem protection (Johnson and Blackburn, 2014).

Lacking in the literature were distinctions between DRR, climate change and sustainable development for ecosystem protection as well as the management of ecosystems to avoid their degradation.

3.6 Essential 6: Strengthen Institutional Capacity for Resilience.

E6 focused on the need for each institution to have the capabilities to effectively complete its resilience-related responsibilities (UNISDR, n.d, i). The literature on city peer reviews focused on strengthening institutional capacity from a legislative perspective, including: frameworks for learning (Gilisen et al., 2016); the character and adaptability of institutions (Parsons et al. 2016); and the division of responsibilities within institutions (Wiering et al., 2017). This included access to information and the dissemination and management of risk information together with managing expectations of the public, and ensuring government transparency (ibid). Less prominent in MCR, but highlighted in the literature, was the need to take a holistic view of institutional exposure to public resilience information and DRR awareness (Briceño, 2010). This was explored through issues relating to organizing for resilience through legislative initiatives (Kamh et al., 2016), understanding risk (Gillisen et al., 2016), and improving information flow to governments and the population (van Niekerk, 2015). Examples of gaps in strengthening institutional capacity included poor integration of exposure of people (E7) and infrastructure (E8) with vulnerability mapping, building local capacity, and data quality.

3.7 Essential 7: Understand and Strengthen Societal Capacity for Resilience.

E7 encouraged an ‘environment for social connectedness, which promotes a culture of mutual help, through recognition of the role of cultural heritage and education in disaster risk reduction’ (UNISDR, n.d, j, par. 1). These aspects were present in the peer review literature with societal capacity being addressed as community participation and education. Research on community participation included stakeholder representation in policy making (Fleischhauer et al., 2012), increased community engagement (Sarimento et al., 2017), and the use of community resources (Parsons et al., 2016). Discussions on education focused on information and awareness-raising, and aligned with MCR strategies on the role of education in supporting the development of local responses that understand local risk management and response (Kamh et al., 2016). Conversely, more prominent in the literature than MCR was the usefulness of business continuity planning as part of building societal capacity (Henstra, 2010), assistance from the private sector in community response and preparedness (Johnson and Blackburn, 2014), and relationships between societal capacity and economic status of households (Cardona and Carreño, 2011).

3.8 Essential 8: Increase Infrastructure Resilience.

E8 encompassed protecting and supporting infrastructure services, systems and suppliers which enable a city to run in times of normalcy, crises and recovery (UNISDR, n.d, k). Infrastructure resilience was conceptualised by the peer review literature as access to critical services and upgrading infrastructure protection (Johnson and Blackburn, 2014), technical capacity (Manyena, 2016), and the development of performance goals for infrastructure design and recovery (Briceño, 2010). Missing from the literature were aspects of building partnerships across infrastructure provision, for example, leveraging technical capacity and equipment through collaboration across cities. Less prominent in MCR but highlighted in the literature were societal perspectives on assessing infrastructure resilience through the

population's access to critical services (Fleischhauer et al., 2012) and availability of resources to vulnerable populations (Ostadtaghizadeh et al., 2015).

3.9 Essential 9: Ensure Effective Disaster Response.

E9 focused on disaster response planning informed by risks (from E2) being effectively communicated to stakeholders through organizational structures (from E1) (UNISDR, n.d, l). Such aspects were included in the peer review literature through engaging with, and communicating disaster plans to stakeholders, expecting that those with access to preparedness or response capabilities have higher levels of resilience (Ostadtaghizadeh et al., 2015). This also related to preparation activities in cities (Salami et al., 2017) which should consider: linking with vulnerable populations to identify their exposure, resilience and response capabilities (Basu et al., 2013); the effectiveness of early warning systems (Keating et al., 2016), and longer-term impacts (Dunford et al., 2015). Less prominent in MCR, but highlighted in the literature, was the need for financial support to tackle vulnerability through earmarked funds for response (Cardona, 2005). Additionally, MCR referred to liaising with voluntary organizations but less in relation to managing spontaneous volunteers and unsolicited donations which can complicate supply chain issues, pose security risks, and strain services and infrastructure (Harris et al., 2016).

3.10 Essential 10: Expedite Recovery and Build Back Better.

E10 did not clearly define what recovery and reconstruction were and how they differed but it clearly put the needs of affected citizens at the centre of processes and plans (UNISDR, n.d, m). MCR's definition was made more complex by overlaps between preparedness, response (E9) and recovery (E10). The literature was not entirely clear either, but classified recovery issues as short-term transitions or longer-term recovery. Transition incorporates immediate arrangements (such as damage assessment, temporary housing, debris removal), making

structures safe (Johansen et al., 2016), and psycho-social support (although this may continue long-term) (Henstra, 2010). Recovery incorporates the rebuilding of infrastructure, utilities, livelihoods, communities, the economy, and ecosystems to support long-term development (Fox-Lent et al., 2015). Here, important aspects include effective governance (Johnson and Blackburn, 2014) and distributing money for positive social impact (Fox-Lent et al., 2015). While transition is urgent and can take place without public consultation, research acknowledged the need to balance the speed and responsiveness of recovery with public involvement, safety, sustainability and affordability (Johnson and Blackburn, 2014). Lacking in MCR, but highlighted in the recovery literature, was the importance of financial incentives (Kernaghan and Silva, 2014), sustainability (Dunford et al., 2015), and access to energy (Kernaghan and Silva, 2014) which offer opportunities to ‘build back better’.

4. Discussion

This SLR highlighted similarities and differences between the literature and MCR, thus offering new insights into the practical application of tools to strengthen city resilience, and factors which can enhance resilience strategies and inform research agendas (Boin and van Eeten, 2013). This research also highlighted the usefulness of peer reviews which facilitate learning for risk governance.

The findings suggested MCR’s strengths lie in addressing the structural aspects of resilience such as designing plans and establishing policies, and legislative frameworks and finances, but it was comparatively weak on how context and culture affect structural arrangements. To appeal to a broad constituency MCR is designed to be contextually neutral, however additional attributes identified by the literature (such as social deprivation and access to information and services) show a need to address social challenges which hinder city-wide resilience.

4.1 Opportunities to enhance resilience frameworks

The findings demonstrated clear divides between top-down and bottom-up perspectives on resilience; MCR focused on administrators steering or managing resilience, while the literature highlighted the importance of facilitating resilience through improving attitudes, behaviour, and understanding at community level. Findings suggested that MCR's approach to resilience building is hierarchical; focusing on legislation, strong leadership and centralised coordination. This comparatively hierarchical approach may be the result of MCR's 'build back better' model which relies on a 'classic' definition of resilience (Lang, 2011) that emphasises the need for strong systems to emerge after a crisis (Boin and van Eeten, 2013).

Beyond the classic definitions of resilience used by MCR, resilience literature also suggests benefits from systems approaches (Lang, 2011). Accordingly, this research suggests a systems approach would provide a structured framework to better understand resilience strategies such as MCR. While many systems approaches exist, Beer's Viable Systems Model (VSM) (1979; 1981; 1985) presents a holistic approach that proposes that all viable organizations should have five systems that operate in a sustainable manner to ensure the organisation is viable. In the case of MCR and resilient systems this includes city governance; understanding risk; resource management; communication, coordination, collaboration; response and recovery capability. These five systems provide an organising structure against which to assess performance against the 10 essentials so can inform the design of a peer review methodology – as evident in ISO22392. For example, this can be used to assess how a city is performing against an essential according to the governance on the essential, how they understand risk, manage resources, coordinate activities, and deliver response and recovery capability.

VSM addresses system viability as ongoing endeavours that are able to support system performance in times of jeopardy. Thus, VSM would complement resilience frameworks such as MCR so the demands of complex and changing environments can be met. It would also ensure all aspects of the system were addressed to ensure consideration of inequities and inequalities that hinder city-wide resilience which may not be observed by the institutional focus of MCR. This is demonstrated by ecosystem protection where societal aspects were less prominent in MCR such as exposure due to deprivation (e.g. settlements on river banks), and land-use practices, such as deforestation. Addressing DRR from both regulatory and community perspectives may provide practitioners with more holistic, sustainable solutions which address multiple dimensions of risk and vulnerability.

Similarly, public-private partnerships (PPPs), as a means to harness expertise and resources within cities, were also overlooked in MCR as a result of limited analysis structures such as VSM. The SLR revealed a more decentralised approach, highlighting the importance of coordination and division of responsibility in PPPs especially to support a city's economic and financial strategies (Wiering et al., 2017). The literature suggested PPPs support organizing for resilience, financial capacity, societal capacity, and response through government coordination (E1), resources (E3), stakeholder representation, participation and resource availability (E7), and speed/responsiveness and adaptation (E9). These issues may be less present in MCR due to a traditional focus on the *management* of resilience, rather than on how strategies are *facilitated* by stakeholders (Gibbs Springer, 2012), which may result in collaborative partnerships with PPPs being overlooked.

MCR also made fewer references to the importance of attitudes in improving resilience. This suggests that MCR sought understanding of the risk itself, rather than a community's relationship with it. This undersells the opportunities and benefits of increased focus on public attitudes towards risks. Practitioners could benefit from increased focus on attitudes to

support adaptive change, reduce vulnerability (Leitch and Inman, 2012), and encourage new risk-reduction behaviours (Twigg, 2009) for improved city resilience.

The peer review literature minimally addressed financial topics and predominantly tackled social deprivation via long-term development. This suggested that, to invest in preventative measures and increase resilience through an economic strategy, risk governance strategies and practitioners should consider what contributes to deprivation. Addressing social deprivation through economic strategies for resilience provides opportunities to review resilience budgets, and highlights short and long-term impacts of deprivation on resilience. Fiscal issues central to response planning (E9) are less prominent in MCR, as are links with budgets and support from PPPs. Practitioners have opportunities to increase the efficacy of resilience strategy implementation through mapping relationships between essentials and signposting to MCR content; for example between E3 (strengthening financial capacity) and E9, to develop cooperation and improved understanding of stakeholder responsibilities (Gibbs Springer, 2012).

The academic literature addressed resilience and in an integrated way; taking into account cross-cutting issues. Topics such as urban planning (E4) and ecosystems (E5) overlapped with infrastructure resilience (E8) (Ostadtaghizadeh et al., 2015; Parsons et al., 2016). Similarly, legislative frameworks and building regulations overlapped with improving ecosystem functions. By working across literatures, the SLR demonstrated how connections between these topics give practitioners the opportunity to cut across policy areas and work towards integrated, flexible resilience strategies (Christensen et al., 2016).

MCR incorporated mapping of institutions to determine their vulnerability and strengthen them through establishing shared responsibilities, building local capacity and ensuring the consistency of data. The literature addressed legitimacy and trust as aspects of institutional

capacity which impact a government's ability to build local capacity, share responsibility and provide quality data (Fleischhauer et al., 2012) thereby giving opportunities to affect the implementation of a city's plans, policies and legislation to develop resilient institutions. Being overlooked by MCR may signal that government legitimacy and trust as too politically charged for a generic framework.

In the literature strengthening societal capacity (E7) aligns well with MCR and addressed opportunities for risk governance such as enhancing: community planning and understanding of risk (Parsons et al., 2016), agility of public administrations when engaging with communities about risk (Christensen et al. 2016), and the availability of community resources. Similarities between the literature and MCR suggested tangible, meaningful and operational links between research and practice (Johnson and Blackburn, 2014) which inform continued learning.

Though MCR made reference to liaising with voluntary networks, fewer considerations were made for managing spontaneous volunteers or the donation of unsolicited items. Influxes of goods complicate supply chains and spontaneous volunteers bring logistical challenges, potential security risks, and strain critical services and infrastructure (Harris et al., 2016). Part of managing these challenges is effective communication so that donors/volunteers complement the response (ibid). Practitioner consideration of these issues would be enhanced through the multi-stakeholder approach of peer reviews.

The peer review literature identified opportunities for resilience frameworks to incorporate benchmarks for infrastructure capacity to assess the adequacy of systems (Mitchell et al., 2015). This facilitates deeper understandings of systems that can withstand damage, those which are vulnerable, and the speed of recovery. Additionally, timeframes in which

vulnerable infrastructure should be supported via new alliances, retrofitting and contingency strategies are suggested (Dunford et al., 2015).

Finally, MCR overlooked the issue of citizen access to services after a disaster which may be impeded by social barriers such as deprivation; a topic under-represented in all 10 essentials. Here, the literature reinforced the opportunity of linking vulnerability mapping, local capacity building, data consistency, and the private sector in improving access to services. Interlinking the various issues raised in the literature can help develop comprehensive peer reviews with common points of reference to support governance systems in the formation and implementation of coherent policy (van Riet and van Niekerk, 2012).

4.2 Opportunities to enhance Research

There is scope for new research to address topics raised by MCR. *Prima facie*, there seems to be less research coverage on politically contentious issues or those requiring difficult-to-access information. For instance, the literature makes limited reference to fiscal issues including strategies for strengthening financial capacity. Some issues were comprehensively discussed in practitioner and government reports which give more scope for practice-based recommendations than research literature. For example, despite the literature agreeing that coordination is vital for city resilience, building networks and implementing plans and policies were relatively under-researched. Further research on alliance building with communities, governments and professionals could be beneficial for effective change in DRR practices.

Interestingly, network building and policy implementation shared little crossover within the literature reviewed. This identified a research gap, as collaborative partnerships were identified by the literature to have positive implications for applying resilience frameworks.

Additionally, structural aspects such as mapping institutional capacity, through establishing shared responsibilities and ensuring data consistency, were not wholly addressed by the reviewed literature which was predominantly concerned with softer attributes of governance. Research would benefit from exploration into how vision and stakeholder relationships can be balanced with coordination, management, operations and finances for effective investment in city resilience (Gibbs Springer, 2012).

5. Conclusion

Global commitment to the MCR campaign, and increased interest in peer review as a method of effectively evaluating DRR and resilience strategies, supported the need for an evaluation of the ways in which MCR is understood, conceptualised and utilised by practitioners and academics. Addressing these topics from a risk governance perspective unified issues of disaster management, governance, policy, city management, and risk governance tools such as peer reviews.

This SLR is timely as it integrates disparate literatures to consider city peer reviews, DRR and resilience building in urban environments. Whilst MCR provided a useful framework for local governments, it is important to assess its relationship with other bodies of literature as well as issues it gives less prominence to. The demarcated approach used by MCR focused on structural aspects of resilience such as provision, management and organization, while the literature focused on societal indicators as proxies of vulnerability. The clear distinctions made by MCR are not reflected by the literature which has implications for what is expected of practitioners, and the feasibility of addressing resilience as independent steps.

Additionally, such clearly demarcated approaches create ‘artificial distinctions between different aspects of the subject’ (Twigg, 2009: 13) leading to the neglect of cross-cutting

issues; a weakness which could be mitigated by multi-stakeholder approaches promoted by peer reviews.

In addressing peer reviews through the lens of the 10 essentials we attended to the strengths and weaknesses of MCR as a means to review city resilience. While the need to identify varying facets of resilience is acknowledged, we demonstrated the increased need for practitioner and research literatures to inform one another to bridge gaps in knowledge and understanding so that interdisciplinary approaches can most effectively support DRR and resilience in cities. We also note the potential of other organising frameworks to give additional structure the peer review, such as the viable systems model which provides a way to explore performance of each of the MCR 10 essentials.

References

- 100 Resilient Cities. (n.d). About Us, available from: <http://www.100resilientcities.org/about-u/>, (accessed: 6/07/2017).
- Basu, M., Srivastava, N., Mulyasari, F., and Shaw, R. (2013). Making Cities and Local Governments Ready for Disasters: A Critical Overview of a Recent Approaches Risk. *Hazards & Crisis in Public Policy* 4(4): 250–273.
- Beer, S. (1979). *The Heart of Enterprise*. John Wiley & Sons Ltd, Chichester.
- Beer, S. (1981). *Brain of the Firm*. John Wiley & Sons Ltd, Chichester.
- Beer, S. (1985). *Diagnosing the System*. John Wiley & Sons Ltd, Chichester.
- Birkmann, J., Cardona, O., Carreño, M.L., Barbat, A.H., Pelling, M., Schneidauer, S., Kienberger, S., Keiler, M., Alexander, D., Zeil, P., Welle, T. (2013). Framing vulnerability, risk and societal responses: The MOVE framework. *Natural Hazards* 67(2): 193–211.
- Boin, A. and M.J.G. van Eeten. (2013). The Resilient Organization. *Public Management Review* 15(3) 429–45.
- Boin, A. and Lodge, M. (2016). Designing Resilient Institutions for Transboundary Crisis Management: A Time for Public Administration. *Public Administration* 94(2): 289–298.
- Cardona, O. D. (2005). Indicators of Disaster Risk and Risk Management: Program for Latin America and the Caribbean: Summary Report, 43.
- Cardona, O. D., and Carreño, M. L. (2011). Updating the Indicators of Disaster Risk and Risk Management for the Americas. *Journal of Integrated Disaster Risk Management* 1(1): 27–47.
- Christensen, T., Lægred, P. and Rykkja, L. H. (2016). Organizing for Crisis Management: Building Governance Capacity and Legitimacy. *Public Administration Review* 76(6): 887–897.
- Davoudi, S. (2012). Resilience: A Bridging Concept or a Dead End? *Planning Theory & Practice* 13(2): 299–33.
- Denyer, D. & Tranfield, D. (2009). “Producing A Systematic Review”, in Buchanan, D. and Bryman, A. (Eds), *The Sage Handbook of Organisational Research Methods*, Sage Publications Ltd, London, 671-689.
- Duit, A. (2016). Resilience Thinking: Lessons for Public Administration. *Public Administration* 94(2): 364–380.
- Dunford, A. S., Lee, C., Jacobs, B., & Neirinckx, A. (2015). State of Australian Cities Conference 2015, Towards a Resilient Sydney project: from Collective Assessment to Strategic Frameworks State of Australian Cities Conference 2015, 1–13.
- EMI, (2008). *Enhancing City-to-City Sharing and Social Participation in Disaster Risk Reduction*. EMI Proceedings Report.
- Fleischhauer, M., Flex, F., Greiving, S., Scheibel, M., Stickler, T., Sereinig, N., Koboltschnig, G., Malvati, P., Vitale, V., Grifoni, P., Firus, K., (2012). Improving the active involvement of stakeholders and the public in flood risk management: Tools of an involvement strategy and case study results from Austria, Germany and Italy. *Natural Hazards and Earth System Science* 12(9): 2785–2798.
- Fox-Lent, C., Bates, M. E., & Linkov, I. (2015). A matrix approach to community resilience assessment: an illustrative case at Rockaway Peninsula. *Environment Systems and Decisions* 35(2): 209–218.
- Gibbs Springer, C. (2012). Resilience in Emergency Management Research. *Public Administration Review* 72(4): 548–549.

- Gilissen, H. K., Alexander, M., Matczak, P., Pettersson, M., and Bruzzone, S. (2016). A framework for evaluating the effectiveness of flood emergency management systems in Europe. *Ecology and Society* 21(4): 27-42.
- Gimenez R., Labaka L., Hernantes J. (2016) Building City Resilience Through Collaborative Networks: A Literature Review. In: Díaz P., Bellamine Ben Saoud N., Dugdale J., Hanachi C. (eds) Information Systems for Crisis Response and Management in Mediterranean Countries. ISCRAM-med 2016. 265, Springer.
- Hamdan, F. (2012). Intensive and Extensive Disaster Risk Drivers and Incentives for Disaster Risk Management in the MENA region, Disaster Risk Management Centre, Geneva, Switzerland, 2013.
- Harris, M., Shaw, D., Scully, J., Smith, C. M., & Hieke, G. (2016). The Involvement/Exclusion Paradox of Spontaneous Volunteering. *Nonprofit and Voluntary Sector Quarterly* 46(2): 352–371.
- Harzing, A.W. (2007). 'Publish or Perish', available from: <http://www.harzing.com/pop.htm>, (accessed: 30/05/2017).
- Henstra, D. (2010). Evaluating Local Government Emergency Management Programs: What Framework Should Public Managers Adopt? *Public Administration Review* 70(20): 236–246.
- Johansen, C., Horney, J., & Tien, I. (2016). Metrics for Evaluating and Improving Community Resilience, *Journal of Infrastructure Systems*, 1–11.
- Johnson, C., & Blackburn, S. (2014). Advocacy for urban resilience: UNISDR's Making Cities Resilient Campaign. *Environment and Urbanization* 26(1): 29–52.
- Kamh, Y. Z., Khalifa, M. A., & El-Bahrawy, A. N. (2016). Comparative Study of Community Resilience in Mega Coastal Cities Threatened by Sea Level Rise: The Case of Alexandria and Jakarta. *Procedia - Social and Behavioral Sciences*, 216 (October 2015), 503–517.
- Khabza, M., & Giles, C.L. (2014). The Number of Scholarly Documents on the Public Web. *PLoS ONE* 9(5): e93949.
- Keating, A., Campbell, K., Szoenyi, M., McQuistan, C., Nash, D., & Burer, M. (2016). Development and testing of a community flood resilience measurement tool. *Natural Hazards and Earth System Sciences Discussions*, (May), 1–39.
- Kernaghan, S., & da Silva, J. (2014). Initiating and sustaining action: Experiences building resilience to climate change in Asian cities. *Urban Climate* 7: 47–63.
- Kim, H., & Kakimoto, R. (2014). Resilient Cities: Plan Evaluation for Floods, (May), 20–22.
- Khunwishit, S., Choosuk, C., and Webb, G. (2018). Flood Resilience Building in Thailand: Assessing Progress and the Effect of Leadership. *International Journal of Disaster Risk Science* 9(1): 44–54.
- Lang, T. (2011). Urban Resilience and New Institutional Theory – A Happy Couple for Urban and Regional Studies? In B. Müller (Ed.), *German Annual of Spatial Research and Policy 2010: Urban Regional Resilience: How Do Cities and Regions Deal with Change?* (pp. 15-24). Berlin, Germany: Springer - Verlag.
- Leitch, A. ., & Inman, M. (2012). Supporting Local Government to communicate coastal inundation, Sydney Coastal Councils & CSIRO, October 2012.
- Lewis, D (2013) Reducing risk and building resilience in cities. *Natural Hazards Observer* 37(4): 10–13.
- Manyena, B. (2016). After Sendai: Is Africa Bouncing Back or Bouncing Forward from Disasters? *International Journal of Disaster Risk Science*, 7(1): 41–53.
- McAllister, T. (2013). Developing Guidelines and Standards for Disaster Resilience of the Built Environment: A Research Needs Assessment, 1–142.

- Meerow, S., Newell, J. P., & Stults, M. (2016). Defining urban resilience: A review, *Landscape and Urban Planning* 147: 38–49.
- Meline, T. (2006). Selecting Studies for Systematic Review: Inclusion and Exclusion Criteria. *Contemporary Issues in Communication Science and Disorders* 33: 21–27.
- Mitchell, T., Hall, J., & Muir-wood, R. (2015). Setting , measuring and monitoring targets for reducing disaster risk international policy frameworks, 44(0): 1–8.
- Musa, H. D., Yacob, M. R., Abdullah, A. M., & Ishak, M. Y. (2015). Delphi Method of Developing Environmental Well-being Indicators for the Evaluation of Urban Sustainability in Malaysia. *Procedia-Environmental Sciences* 30: 244–249.
- Ostadtaghizadeh, A., Ardalan, A., Paton, D., Jabbari, H., Khankeh, H.R. (2015). Community Disaster Resilience: a Systematic Review on Assessment Models and Tools. *PLOS Currents Disasters*, available from: <http://currents.plos.org/disasters/article/community-disaster-resilience-a-systematic-review-on-assessment-models-and-tools/>, (accessed: 12/06/2017).
- Parsons, M., Glavac, S., Hastings, P., Marshall, G., McGregor, J., McNeill, J., Stayner, R. (2016). Top-down assessment of disaster resilience: A conceptual framework using coping and adaptive capacities, *International Journal of Disaster Risk Reduction*, 19:1–11.
- Pagani, F. (2002). Peer Review as a Tool for Co-Operation and Change. *African Security Review* 11(4): 15–24.
- Peer Review Turkey, (2015). 2015-2016 Programme for peer reviews in the framework of EU cooperation on civil protection and disaster risk management.
- Peer Review Finland, (2014). Building resilience to disasters: Assessing the implementation of the Hyogo Framework for Action (2005-2015).
- Peer Review UK, (2013). Building resilience to disasters: Assessing the implementation of the Hyogo Framework for Action (2005-2015).
- Ritz, A., Brewer, G., & Neumann, O. (2016). Public Service Motivation: A Systematic Literature Review and Outlook. *Public Administration Review* 76(3): 414-426.
- Salami, R.O., Von Meding, J.K. & Giggins, H., (2017). Urban settlements’ vulnerability to flood risks in African cities: A conceptual framework’. *Jambá: Journal of Disaster Risk Studies* 9(1): 1-9.
- Sarimento, J.-P., Gelman, P., Jordao, G., & Bittner, P. (2017). Post-project review in urban disaster risk reduction. *Disaster Prevention and Management: An International Journal* 26(2): 148–161.
- Schipper, L. & Pelling, M. (2006). Disaster risk, climate change and international development: scope for, and challenges to, integration. *Disasters* 30: 19–38.
- Sendai Framework for (2015). Sendai Framework for Disaster Risk Reduction 2015 – 2030, United Nations, Geneva.
- Sharifi, A., & Yamagata, Y. (2016). Principles and criteria for assessing urban energy resilience: A literature review. *Renewable and Sustainable Energy Reviews* 60: 1654–1677.
- Shi, P. (2012). On the Role of Government in Integrated Disaster Risk Governance—Based on Practices in China. *International Journal of Disaster Risk Science* 3(3): 139–146.
- Somers, S. & Svara, J. H. (2009). Assessing and Managing Environmental Risk: Connecting Local Government Management with Emergency Management. *Public Administration Review* 69(2): 181–193.
- Stark, A. (2014). Bureaucratic Values and Resilience: An Exploration Of Crisis Management, Adaptation. *Public Administration* 92(3): 692–706.

- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards A Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management* 14: 207-222.
- Twigg, J. (2009). Characteristics of a Disaster- Resilient Community: a Guidance Note. Aon Benfield UCL Hazard Research Centre.
- UNISDR (United Nations Office for Disaster Risk Reduction), (2009). UNISDR Terminology on Disaster Risk Reduction, available from: http://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf, (accessed: 29/01/2018).
- UNISDR, (United Nations Office for Disaster Risk Reduction), (2015). Sendai Framework for Disaster Risk Reduction, available from: <http://www.unisdr.org/we/coordinate/sendai-framework>, (accessed: 16/11/2017).
- UNISDR (United Nations Office for Disaster Risk Reduction), (2017). Disaster resilience scorecard for cities, available from: <http://www.unisdr.org/we/inform/publications/53349>, accessed: 16/11/2017.
- UNISDR (United Nations Office for Disaster Risk Reduction), (n.d). Disaster Risk Reduction (DRR), available from: <https://www.unisdr.org/who-we-are/what-is-drr>, (accessed: 29/09/2017).
- UNISDR, (United Nations Office for Disaster Risk Reduction), Essentials 1-10, (n.d, c- m), Guidance Documents: The Ten Essentials, available from: <https://www.unisdr.org/campaign/resilientcities/home/toolkitblkitem/?id=1>, (accessed: 26/06/2017).
- van Riet, G., & van Niekerk, D. (2012). Capacity development for participatory disaster risk assessment. *Environmental Hazards-Human and Policy Dimensions* 11(3): 213–225.
- van Niekerk, D. (2015). Disaster risk governance in Africa A retrospective assessment of progress against the Hyogo Framework for Action (2000-2012). *Disaster Prevention and Management* 24(3): 397–416.
- Wiering, M., Kaufmann, M., Mees, H., Schellenberger, T., Ganzevoort, W., Hegger, D. L., & Matczak, P. (2017). Varieties of flood risk governance in Europe: How do countries respond to driving forces and what explains institutional change? *Global Environmental Change* 44: 15-2.
- Weichselgartner, J., & Kelman, I. (2015). Geographies of resilience: Challenges and opportunities of a descriptive concept. *Progress in Human Geography*, 39(3): 249–26.

Appendix A: Peer review characteristic codes

Essential	Characteristic	Definition	Code
E1	Coordination	Organisation and communication with stakeholders	Co
	Inclusion	Alliance building with stakeholders	I
E2	Vulnerability	Exposure of population as the result of socio-economic status, geographical location etc	V
	Environment	Exposure/risk of environmental impacts such as floods	E
	Physical structures	Exposure/ risk to buildings, homes, health facilities etc	Ps
	Attitudes	Views and behaviours linked to perceived risk and understanding of that risk	A
E3	Government resources	Budgets, capacity and resources of government	Gr
	Loss of personal assets	Economic considerations relating to insurance payments, government subsidies, loss of property etc	Pa
	Social deprivation	Economic considerations relating to poverty, unemployment, education levels	Sd
E4	Exposure	Susceptibility and vulnerability associated with poor urban design	Ex
	Habitable space	Safe and sustainable space for land development	Hs
	Design Adaptation	Capacity of urban design to absorb and adapt to risks	Da
E5	Land-use	Sustainable management of the environment and human settlements	Lu
	Legislation	Legal frameworks designed to protect ecosystems	L
	Societal resilience	Ability of society to adapt to natural environments, mitigating risks and benefiting from ecosystem protection	SoR
	Urban Design	Impact of development and legislation on the natural environment	Ud
E6	Institutional characteristics	Trust, legitimacy, longevity of institutions and those working in them	Ic
	Division of Responsibility	Devolution of knowledge and decision making to support vulnerability mapping, skills and information	DiR
	Information Management	Data gathering and dissemination, improvements in data consistency	Im
E7	Stakeholder representation	Representation of civil society groups in formal systems of governance	StR
	Community engagement	Building relationships and dialogue with community	Ce
	Resource/ Information availability	Assets, funds and information distributed amongst civil society groups to reduce vulnerability and increase resilience	Ria
	Risk awareness	Understanding of risk and information available to communities	Ra
	Community participation	Active involvement of community in resilience activities	Cp
E8	Upgrading infrastructure	Retrofitting and safety measures for infrastructure to ensure usability of services such as hospitals	Ui
	Technical capacity	Proficiency in safe and efficient infrastructures gained from coordination with experts	Tc
	Performance goals	Targets for effective and efficient operation of critical infrastructure and resources	Pg
E9	Information	Broadcasting of risk information, public health	Id

	dissemination	information, early warning systems	
	Resilience/ exposure levels	Recognizing impacts of varying exposure and resilience levels on adequate response and access to support	Re
	Speed/ responsiveness	Timeliness and quality of response operations	SpR
E10	Sustainability	Long-term consideration of needs, costs and environmental objectives	Sus
	Affordability	Consideration of associated recovery costs	Aff
	Needs	Consideration of what population requires during recovery	N

Appendix B: The essentials addressed by the literature*

	E1 **	E2	E3	E4	E5	E6	E7	E8	E9	E10
Armas and Gavris 2013		V; Ps		Ex; Hs			Ria; Ra; Sd	Ex; Ui		
Basu, et al. 2013	Co; I	V	Gr	Ex; V	Lu; Ud	Im; DiR	Ce; Ria; Ra	Lu	Im; Gr	L; Gr
Beccari 2016	Co; Im	Ra ; E; Ps	Gr	Re ; Hs	Re ; SoR; Lu	Re; SoR	Ex	Ui; Tc	N ; Re	SoR
Birkmann et al. 2013	I	V; Ps	Pa; Sd	Ex; Hs	SoR; Lu	Ic	Ex	Ex	SpR; Re	
Briceño 2010	Co	V; E; Ex								
Cardona 2005	Co	V; Ps	Gr; Sd	Ex	SoR	Re ; Ic	Ria; Ra; Ex	Ui; Tc		
Cardona & Carreño 2011		A; Ps	Gr; Sd	Ex	SoR; Lu; Re	Ic	Ria; Ra	Ui; Pg		
Dunford et al. 2015	Co; I	V; E; Ps	Sd	Ex; Da	Lu	Ic; DiR	StR; Ce; Cp	Ui	SpR	
Elias et al. 2013	Co; L	V; E								
EMI 2008	Co; I	V; E Ps	Co ; Gr; Pa; Sd	Ex; Hs	Lu	Ic; Im	SoR ; Cp; Ria; Ra			
Fleischhauer et al. 2012	Co; DiR ; Im	A	Gr				StR; Ria; Ra; Ce			
Fox-Lent et al. 2015	Co; I	E; Ps; A		Da	Lu; SoR Ud	Ic; DiR; Im	StR; Ria; Ra; Cp	Ui; Tc; Pg	SpR; Id	Sus; N
Gilissen et al. 2016	Co; DiR	Gr					Ra; Cp		Id; Im	Sus; N
Hackl et al. 2015		V; E; Ps				Im; DiR		Ui; Ic	SpR; Im	
Hamin et al. 2013	Co; DiR ; L	V; E								
Hamdan 2013	Co; I	V; Ra	Gr; Pa; Sd	Ex	Lu; SoR; L	Ic; DiR; im				
Henceroth et al. 2015	Co; I	V; E	Gr; Sd	Ex	Lu; SoR	Lu ; Ud	Ria; Ra; Ce	Ui ; Tc; Pg	SpR; Id; Re	Sus; Aff; N
Henstra 2010	Co; I	V; E; Ps	Gr	Ex; Hs	Lu; L	Ic; Im	Cp; Ce	Ui	SpR; Id; Re	Sus

Johansen et al. 2016	Co; I	E; A; Ps				Ic; Im	StR; Ria; Cp; Ce	Ui; SpR		
Johnson & Blackburn 2014	Co; I	Ps	Gr	Hs; Da	Lu; Ud; L	Ic; Im	Ce; Ra	Ui	Re	Sus; Aff; N
Kamh et al. 2016	Co; I; Gr	V; E	Sd; Pa	L	L	Ic	Ra; Cp	Ui; Tc	Id; Re	N
Keating et al. 2016	Co	V; Da	Gr	Ps ; Da; Ex	SoR; Lu		Cp; Ra		SpR	Sus; N
Kernaghan and da Silva 2014	Co; I		Gr; DiR				StR; Ce			
Kim & Kakimoto 2014	Co; DiR	V	Pa		L; Lu	Ic; Im		Ui; Tc		Sus; Re
Leitch and Inman 2012		V; E; A					Ria; Ra; Ce			
Lumbroso et al. 2016	Ic	Im; Tc					Ria; Ra		Ria; N; Id	
Manyena 2016	Co; Ic		Gr	Ex	Lu: L			Tc		
McAllister 2013	Co	V; E; Ps		Ex; Da; Pg	Pg ; Lu; Ud	Ic; Re		Ui; Tc; Pg	SpR	
Menteşe et al. 2015	Co	V; E; Ps					Sd ; Ra		SpR; Re; Id	Sus; Aff; N
Mitchell et al. 2014		V; E; Ps						Pg	SpR; Re	
Musa et al. 2015				Ex	Lu: Ud			Ui		
Ostadtaghizadeh et al. 2015	Co	V; E; A	Gr	Ex; Da	L; Lu	DiR; Im	Ce; Ria; Ra; Cp	Ui	SpR; Re; Id	N
Parsons et al. 2016	Co; L	Id		Ex; Da	Lu; Ud		Sd ; Ce			
Peer Review Turkey 2015	Co; I	V; E; A; Ps	Gr; L	Ex; Da; Hs	Lu; Ud; L	Ic; DiR; Im	Str ; Ria; Ra; Ce	Ui; Tc; Pg	SpR; Id	Sus; Co
Peer Review Finland 2014	Co; I	Co ; DiR ; A	DiR ; Gr; Pa	Hs	Lu; Ud; L	Ic; DiR; L	Ria; Ra; Ce	Ui; Gr	Re; Id	
Peer Review UK 2013	Co; I	Im ; DiR ; Id ; Re	Gr	Hs	Lu; Ud; L	Ic; DiR; Im	Ce; Cp; Co	Ui	Id	Sus

Pursiainen 2016		V; Ps					SoR; Ra; Ce	Tc	SpR	
Salami et al. 2017	Co; I	V; E; A; Ps		Ex; Da	Lu; SoR; Ud	Ic	Re; Ra	Ui	SpR; Re	
Sarimento et al. 2017	Co; I	V; Sd ; N		Ex; Da	Lu; Ud; L	Ic; Im	StR; Ce; Cp	Ui; Tc; Pg		
Sharifi et al. 2009	Co				Lu; L	Ic	Sd ; A; Ra	Ui		
Simonovic & Peck 2013		V; Ps		Da	Lu		A; Ria; Ra	Ui; Pg	Re	
Twigg 2009	Co; I	V; A; L		Ex; Da	Lu; SoR; L	Ic; DiR; Im	StR; Ce; Cp	Tc	Id; Gr	Sus; N
UNISDR 2008	Co; I	V; E; Ps	Gr; Sd	Ex; Hs	Lu	Ic; DiR;	StR; Ria; Ra; Cp	Ui; Tc; Pg	Id	Sus; Pg
van Niekerk 2015	Co; I	Gr; Ria					Co; StR; Ria; Ce		SpR; Id	Sus; N
van Riet & van Niekerk 2012	Co; I; Ic	V; A	Gr; Sd			Ic; DiR; Im	StR; Ra; Cp	Tc; Pg		
Wiering 2017	Co; I; DiR	V; E; A; Ps	Gr	Ex; L	Lu; SoR; Ud	Ic; DiR; Im	StR; Ra	Ui; Tc	Re	Sus

*Full references for articles documented in this table but not cited in the text can be found in Appendix C.

**E1: organise for disaster resilience; E2: identify, understand and use current and future risk scenarios; E3: strengthen financial capacity for resilience; E4: pursue resilient urban development and design; E5: safeguard natural buffers to enhance ecosystems' protective functions; E6: strengthen institutional capacity for resilience; E7: understand and strengthen societal capacity for resilience; E8: increase infrastructure resilience; E9: ensure effective disaster response; E10: expedite recovery and build back better.

Bold: codes associated with essentials other than those under which they were originally classified.

Appendix C: Supplementary references from SLR findings in Appendix B

- Armaş, I., & Gavriş, A. (2013). Social vulnerability assessment using spatial multi-criteria analysis (SEVI model) and the Social Vulnerability Index (SoVI model) – a case study for Bucharest, Romania, *Natural Hazards and Earth System Science*, 13:6, 1481–1499.
- Beccari, B. (2016). A Comparative Analysis of Disaster Risk, Vulnerability and Resilience Composite Indicators. *PLoS Currents*, 8, ecurrents.
- Briceño, S. (2010). Investing today for a Safer Future: How the Hyogo Framework for Action can Contribute to Reducing Deaths During Earthquakes. In M. Garevski & A. Ansal (Eds.), *Earthquake Engineering in Europe*, 441461. Dordrecht: Springer Netherlands.
- Elias, Z., Hamin, Z., & Othman, M. B. (2013). Sustainable Management of Flood Risks in Malaysia: Some Lessons from the Legislation in England and Wales, *Procedia - Social and Behavioral Sciences*, 105, 491–497.
- Hackl, J., Adey, B.T., Heitzler, M., Iosifescu-Enescu, I., and Hurni, L. (2015). A process for the assessment of infrastructure related risk due to natural hazards, 5th International/11th Construction Specialty Conference, Vancouver, British Columbia, 8-10 June 2015.
- Hamin, Z., Othman, M. B., & Elias, Z. (2013). Floating on a Legislative Framework in Flood Management in Malaysia: Lessons from the United Kingdom, *Procedia - Social and Behavioral Sciences*, 101, 277–283.
- Henceroth, J., Friend, R., Thinphanga, P., & Tran, P. (2015). Lessons from Applying the UNISDR Local Government Self-Assessment Tool within Urban Climate Resilience Programs in Southeast Asia, The “State of DRR at the Local Level” A 2015 Report on the Patterns of Disaster Risk Reduction Actions at Local Level, 1–9.
- Lumbroso, D., Brown, E., & Ranger, N. (2016). Stakeholders’ perceptions of the overall effectiveness of early warning systems and risk assessments for weather-related hazards in Africa, the Caribbean and South Asia, *Natural Hazards*, 84:3, 2121–2144.
- Menteşe, E. Y., Konukcu, B.E., Kiliç, & Khazai, B. (2015). Megacity Indicator System for Disaster Risk Management (MegaIST): Integrated Assessment of Physical Risks in Istanbul, in *Disaster Management and Human Health Risk IV: Reducing Risk, Improving Outcomes*, S.M. Sener, C.A. Brebbia, O. Ozcevik (eds), WIT Press, Southampton.
- Pursiainen, C. et al. (2016). Report of criteria for evaluating resilience, Improved Risk Evaluation and Implementation of Resilience Concepts to Critical Infrastructure, May 2016.
- Simonovic, S. P., & Peck, A. (2013). Dynamic Resilience to Climate Change Caused Natural Disasters in Coastal Megacities Quantification Framework, *British Journal of Environment and Climate Change*, 3, 378–401.
- UNISDR (United Nations Office for Disaster Risk Reduction), (2008). *Indicators of Progress: Guidance on Measuring the Reduction of Disaster Risks and the Implementation of the Hyogo Framework for Action*. United Nations secretariat of the International Strategy for Disaster Reduction (UNISDR), Geneva, Switzerland.