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ScienceDirect

Procedia Engineering 212 (2018) 575–582

Procedia Engineering

www.elsevier.com/locate/procedia

7th International Conference on Building Resilience; Using scientific knowledge to inform policy and practice in disaster risk reduction, ICBR2017, 27 – 29 November 2017, Bangkok, Thailand

Building Urban Resilience for Disaster Risk Management and Disaster Risk Reduction

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Abstract

Disaster Risk Management (DRM) and Disaster Risk Reduction (DRR) emerged as systematic approaches to reduce the impact of climate change on the built environment. However, post 2015 United Nations (UN) disaster management and emergency policies failed to capture the dynamics of hazards, exposure and vulnerability essential for building urban resilience. As part of an ongoing PhD study, this paper aims to identify common principles for DRM and DRR in the context of urban resilience, towards building coherence between the 2015-2030 Sustainable Development Goals (SDGs) for the built environment and the Sendai Framework for Disaster Risk Reduction (SFDRR). The paper adopts a constructivist position to investigate the historical emergence of DRM and DRR in pre-and-post the year 2015. Learning lessons, identifying gaps and future challenges, a correlational study of the three-stage disaster preparedness process of recovery, rehabilitation and reconstruction in DRR and DRM is conducted, against the indicators of Target D for the SFDRR, and Goal 11 for the SDGs three main constructs: disaster damage, critical infrastructure and disruption of basic services. The outcomes of this study show the absence of indicators to monitor progress on evolving disasters and underlying risk drivers. A Preparedness Framework is developed in this paper with recommendations to integrate the UN Habitat Urban System Model Approach for urban resilience, and develop risk-resilient DRM and DRR frameworks for sustainable built environments.

Peer-review under responsibility of the scientific committee of the 7th International Conference on Building Resilience.

Keywords: Built Environment, Disaster Risk Management, Disaster Risk Reduction, Sendai Framework, Sustainable Development Goals, Urban Resilience

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1877-7058
Peer-review under responsibility of the scientific committee of the 7th International Conference on Building Resilience
10.1016/j.proeng.2018.01.074

1. Introduction

The disastrous impact of climate change on urban livelihoods and natural biodiversity systems has long been observed worldwide. Shaped by the type of hazards and degree of exposure, extensive disaster risk derived by urbanisation, environmental degradation, socio-economic inequality, and poor urban governance is witnessed to accumulate larger losses in mortality, economic and physical damage. (Shaw, Pulhin et al. 2010:198).

Over the past ten years, approximately 700 thousand people have lost their lives, over 1.4 million have been injured and 23 million have been made homeless because of disasters. At the same time, the Hyogo Framework for Action (HFA) 2005-2015: building the resilience of Nations and communities to disasters was adopted by the World Conference on Disaster Reduction, but the layer of extensive risks was 'not captured by global risk modelling, nor are the losses reported internationally'. (UNISDR 2015:90). 'Climate change may not be responsible for the recent skyrocketing cost of natural disasters, but it is very likely that it will impact future catastrophes' (NASA 2016). The variations of risk drivers between the countries globally reflect the uneven social, economic and governance construction of hazards, risk and vulnerability.

There have been various attempts in the year 2015 to address challenges related to development, climate change and disaster risk losses. The Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030 was endorsed by the UN General Assembly and adopted by 187 countries as a 15-year, voluntary, non-binding agreement with four priorities and global seven targets, which aim at the reduction of disaster risk and losses in lives, livelihoods and health. The year 2015 also witnessed the adoption of the Sustainable Development Goals (SDGs) and the Paris Climate Change Agreement (COP21), followed with the 2016 New Urban Agenda (NUA) Quito Declaration on Sustainable Cities and Human Settlements for all.

However, Peters et al (2016) stated that 'delivering this global vision by 2030 in a sustainable and inclusive way, requires that we act upon all the major frameworks negotiated and agreed throughout 2015 and 2016'. Considering that the term 'resilience' is addressed coherently across the SFDRR, SDGs and HABITAT III frameworks, the roadmap for action is formulated in different contexts and scales. That would require joined-up monitoring mechanisms for indicators to achieve progress on the reporting process, and enable a track on building resilience. (ODI, 2016:10).

As part on an ongoing PhD, this paper aims to identify common principles for DRM and DRR in the context of urban resilience, towards building coherence between the 2015-2030 Sustainable Development Goals (SDGs) for the built environment and the Sendai Framework for Disaster Risk Reduction (SFDRR). Adopted at the United Nations Conference on Housing and Sustainable Urban Development in October 2016 (Habitat III), NUA indicates in paragraph (9) that its implementation will contribute to 'the implementation and localization of the 2030 Agenda for Sustainable Development in an integrated manner, and to the achievement of the Sustainable Development Goals and targets, including Goal 11 of making cities and human settlements inclusive, safe, resilient and sustainable'. (UN HABITAT 2016:3).

Section 2 of this paper will introduce the methodology applied to frame the research design structure. Followed with Section 3, the historical emergence of DRM and DRM ideologies in UN frameworks is investigated pre-and-post the year 2015. A correlational study between DRR and DRM is explained in Section 4 to identify the shared principle of disaster preparedness, recovery, rehabilitation and reconstruction. In Section 4.1, a constructivist approach is applied to understand how the three stages of preparedness process take place against the three main constructs of Target D for the SFDRR, and SDG Goal 11, Target 11.5.2 (disaster damage, critical infrastructure and disruption of basic services). The constructs of the indicators terminologies will be analysed to understand how data losses are collected across disaster risk timeframe, scale, and assessment process. Section 5 will introduce the UN Habitat Urban System Model Approach for urban resilience, by presenting resilience socio-economic dimensions and wider city disaster plan for risk management as an integrated approach to bridge the gap in SFDRR, SDGs. The paper concludes with Section 6, learning lessons, identifying gaps and future challenges.

2. Methodology (Research Design)

This paper is part of an ongoing PhD research that aims to develop an Urban Resilience toolkit, to support the implementation of Disaster Risk Reduction in the Middle East and North Africa (MENA) Region. However, this paper is primarily focused on identifying the gaps in reporting data losses from underlying risks, and recognising the challenges for achieving the global targets, in an attempt to unravel the objectivist ontology of DRR in the contexts of the 2015-2030 SFDRR and SDGs.

The literature review include data from primary resources, refereed journals and government policy reports. Secondary data from existing research, trade journals and magazines are collected to undertake an inductive theoretical perspective towards building urban resilience. This is applied by conducting a systematic literature review of DRM and DRR across the history of UN General Assembly frameworks. The method applied will advise on the research analytical process, and provide constructive recommendations to fill the gaps in the terminology provided by the UN general assembly 2016 working groups. Considering the complexity of the indicators variables, the outcomes of this paper will be updated following the Global platform for DRR that is planned to take place in Cancun, Mexico, May 2017.

3. **Historical Review**

Disaster Risk Management and Disaster Risk Reduction

The United Nations Office for Disaster Risk Reduction (UNISDR) states that the term disaster management encompasses several activities of organization, planning and application that addresses measures for preparing, responding to and recovering from disasters. (UNISDR 2016:14). Disaster management focuses on implementing strategies that may not lead to eliminating the risk of disasters.

This topic was debated as early as 1961 (Duncan 1961), as cited by Kroll-Smith and Couch, identifying the physical factors of disaster. On the contrary, Quarantelli (1985, 1987) suggested the social norms of disasters in relation to the demand of action and capability of response beyond geophysical terms. (Kroll-Smith and Couch 1991). The UNISDR defined disaster as ‘a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts’, disasters social and physical scopes are considered, with focus on the scale of impact. This is recognized in the differentiation between emergency response and recovery actions. (UNISDR 2016:13)

Emergency management was first initiated during the First World War in 1935, following the bombing of civilian areas, and the establishment of the Civil Defence Service by the Home Office of the United Kingdom. With focus on protecting the population against nuclear destruction, a shift towards protection against natural hazards such as floods, storms and earthquakes arose by the end of the Cold War.

In the early 1960s, The United Nations General Assembly (GA) started adopting measures regarding severe disasters, to inform the Secretary-General of the type of emergency they are in the position to offer. This came into effect following when the Buyin-Zara earthquake struck Iran and killed more than 12,000 people. This is followed by the creation of the United Nations Disaster Relief Office (UNDRO), to promote the study, prevention, control and prediction of natural disasters and assist in providing advice to governments on pre-disaster planning. The period 1990-1999 is considered ‘the International Decade for Natural Disaster Reduction’, were the GA recognizes the importance of reducing the impact of natural disasters for all people with focus on developing countries. This was endorsed by Yokohama Strategy and Plan of Action at the World Conference on Disaster Reduction, that was held at Yokohama, Japan from 23 to 27 May 1994. (UNISDR 2017).

The 3rd Millennium witnessed the international community movement towards early warning to take timely actions in advance of hazardous events. This was triggered with El Niño phenomenon's acute impact and climatic changes affecting the equatorial Pacific region and beyond, aimed to review the Yokohama Strategy, identify gaps and challenges. The early warning system movement was consolidated with the establishment of the International Strategy for Disaster Reduction (ISDR) and emphasis on shift form Disaster Risk Management (DRM), to Disaster Risk Reduction (DRR), with efforts to integrate the Johannesburg Plan of Action agreed at the World Summit on Sustainable Development (WSSD).

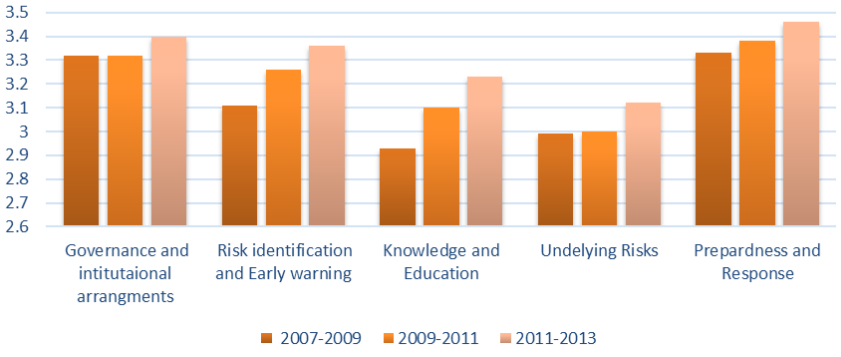
The ISDR endorsed the Hyogo Framework for Action (HFA) 2005-2015: building the resilience of Nations and communities to disasters, adopted by the World Conference on Disaster Reduction held at Kobe, Hyogo, Japan, to facilitate disaster reduction strategy into national plans. Focusing on the reduction of disaster losses, Priority for Action 4 of the HFA calls to 'Reduce the underlying risk factors'.(UNISDR 2015)

Since 2007, 146 governments have participated in at least one cycle of the HFA review using the online HFA Monitor. In 2011-2013, 136 countries submitted reports, and governments have reported growing levels of HFA implementation over time. Nevertheless, HFA monitoring mechanism focused on reporting data losses form large scale intensive disaster (eg: earthquakes and cyclones), and overlooked the underlying risks of mortality, physical damage and economic losses from small scale extensive disasters (eg: floods, landslides) derived by poor urban governance and planning. (Figure 1). These notions have been elaborated by Dodman et al (2009), in the light of scale, frequency and impact, divided into biological, chemical, and physical hazards. (Dodman, D., Hardoy, J.and Satterthewaite 2009).Thus, the notion of risk is identified here, to understand the impact of reporting mechanisms on global targets and risk measuring mechanisms for disaster risk management.

Recognised in two settings, acceptable risk and residual risk, for DRM acceptable risk is associated with single risk 'used to assess and define the structural and non-structural measures that are needed in order to reduce possible harm to people, property, services and systems' (UNISDR 2016:14). On the contrary, residual risk is associated with DRR sequential risks 'that remains even when effective disaster risk reduction measures are in place, and for which emergency response and recovery capacities must be maintained'. Accordingly, this research will investigate the accountability of both acceptable and residual risks, to measure damage and losses for critical infrastructure and disruption of basic services, and support the holistic approach building urban resilience in addressing the dynamic of hazards, exposure and vulnerability for preparedness, response and recovery.

An evolution from managing disasters to managing risks was affiliated with the launch of the Sendai Framework for disaster risk reduction (SFDRR). Evidence from the 2015 Global Assessment Report on Disaster Risk Reduction recognise that 'most resources continue to be invested in strengthening capacities for disaster management, and there has been limited success in applying policies, norms, standards and regulations to manage and reduce risk across development sectors' (UNISDR 2015:118). This articulates the importance of differentiation between DRR and DRM tools and mechanisms to address the underlying risk drivers, not tendencies to mitigate challenges in post-disaster recovery only.

Figure 1: Progress in implementing the HFA 2007-2013 (Source: Adapted from the UNISDR 2015 Global Assessment Report on Disaster Risk Reduction), (Part II-p.114)

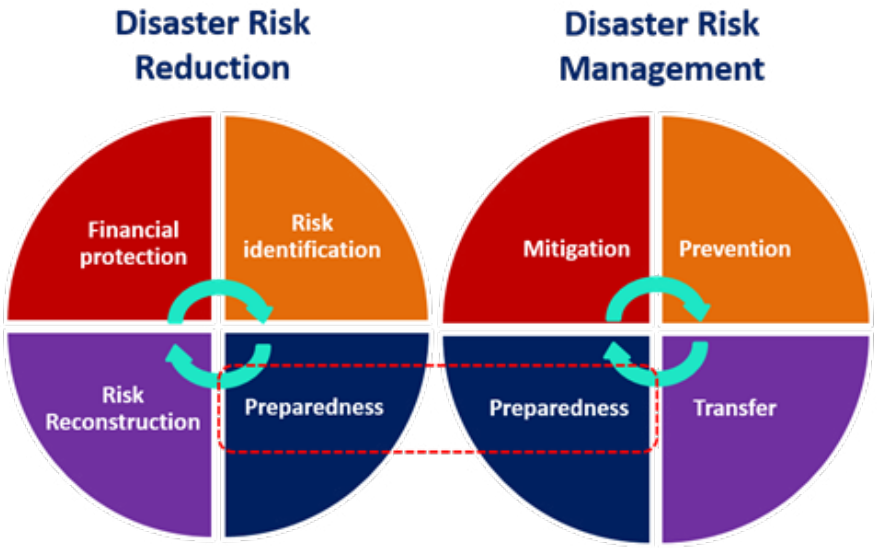


4. Correlational Study

Preparedness in DRM and DRR

It has been argued by Kirschenbaum (2002), that preparedness factors are driven by social factors that vary according to disaster management agencies, and community based collective behaviours, reflecting the components of 'provisions', 'planning' and 'protection' (Kirschenbaum 2002:14). This concept points towards a more integrated approach to identify preparedness links between DRM and DRR. Figure (2) highlights the contrast elements of DRR: financial protection, risk identification, preparedness and resilient construction. Including preparedness, DRM considers managing disasters by risk prevention, mitigation and transfer as core elements. Preparedness for building urban resilience will be analysed based on Priority 4 'enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction' (UNISDR 2015).

Figure 2: The interrelationship between DRR and DRM (Adopted UNISDR, 2015, PreventionWeb).



4.1 *Preparedness for building urban resilience in the SDGs and the Sendai Framework for Disaster Risk Reduction*

The constructs of the indicators terminologies used in Target D for the SFDRR Target (d) 'Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030', and SDG Goal 11, Target 11.5.2 'Direct disaster economic loss in relation to global GDP, including disaster damage to critical infrastructure and disruption of basic services' are presented in Table 1 to understand how data losses is collected across disaster risk timeframe, scale, and assessment process. This will help identify the level of interruptions or damages per sector in critical infrastructure and basic service, on extensive and intensive risks for all hazards. As noted by Luiijf et al (2008), gaps in data losses caused by cascading effects due to infrastructure interdependencies are identified as a key challenge for critical infrastructure protection (Luiijf et al 2008:303).

Terminologies	Duration	Assessment Process	Scale
Damage	Physical harm, not structural or architectural, which may continue to be habitable, although they may require some repair or cleaning that happen during the event or within the first few hours after the event	Assessed soon after the event to estimate recovery cost and claim insurance payments.	These are tangible and relatively easy to measure.
Critical infrastructure	The physical structures, facilities, networks and other assets that support services that are socially, economically or operationally essential to the functioning of a society or community.	Number of times interruption or damage occurs per population and sector	By country, event, hazard type, sub-national administrative unit, asset
Disruption	Disturbance and interruption of services, activities, or process that may affect different segments of the population with differing degrees of severity, including cases in which service delivery continues.	Disruptions of services can be measured in smaller units of time, for example hours or even minutes or seconds	Disruption of services may occur at irregular periods of time (or) can also be due to lower levels of quality
Basic services	Services that are needed for all of society to function effectively. This include water supply, sanitation, health care, education, housing, and food supply. They also include services provided by critical infrastructure such as electricity, telecommunications, transport, finance or waste management that are needed for all of society to function.	Duration of service disruption and the number of people who did not receive basic services	By destroyed/ damaged, transportation mode, service sector (duration: short, medium and long; an affected scale in terms of household numbers)

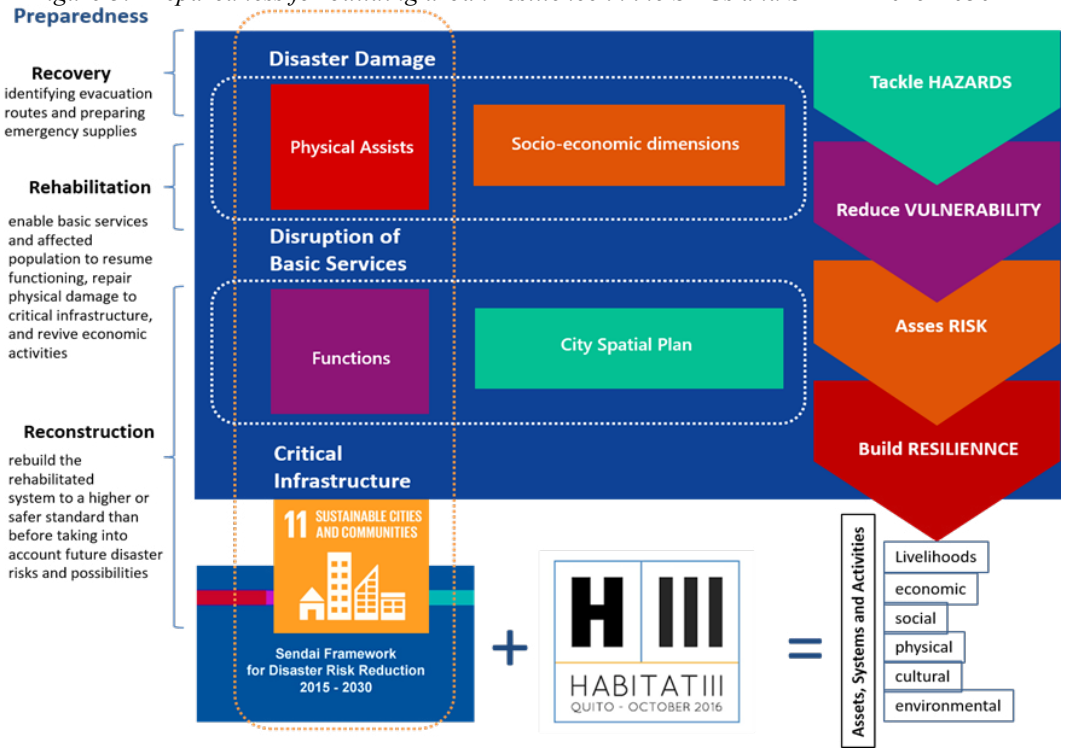
Table 1: Data disaggregation and statistical processing - SDG 11.5.2 and SFDRR Target(d)

The indicators addressed here to measure global progress in the implementation of the SFDRR and SDGs provide guidelines on how and why the indicators are constructed within the boundaries of disaster timeframe and level of damage. Boundaries of what are to be listed under the terminologies (Direct), (Basic) and (Critical) for basic services and infrastructures cannot be identified in the context of small scale and slow-onset disasters. This overlook the underlying risks associated with socio-economic dimensions at the recovery and rehabilitation phase. The reconstruction process also is confined to the scope of infrastructure and services that cannot be managed without considering the wider scale of the city spatial plan. Accordingly, this paper proposes a Preparedness Framework figure (3) with the integration of the Habitat III model. This is applied as tool to fill the gap and accommodate the dynamics of all hazards in measuring resilience for the SDGs and SFDRR indicators. Further details on this model are outlined in Section 5.

5. HABITAT III Urban System Model Approach

The New Urban Agenda (NUA), adopted by the third United Nations Conference on Human Settlements in 2016, set out a series of development goals, targets and objectives for the next 20 years. The NUA preparatory document (HABITAT III Issue Paper 15 – Urban Resilience) issued in 2015, acknowledged that the building urban resilience for the built environment will consider the dynamics of extensive risks, using the HABITAT Urban System Model Approach. This is defined as the 'ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management' (HABITAT III 2015). The 'urban system' here is understood across functional (e.g. municipal revenue generation), organizational (e.g. governance and leadership), physical (e.g. infrastructure), and spatial (e.g. urban plans and designs) scales'.

Figure 3: Preparedness for building urban resilience in the SDGs and SFDRR 2015-2030



6.Conclusions: Lessons Learned, Gaps and Future Challenges

Based on exploring the interpretive paradigm for urban resilience, and learning lessons from the HFA, identifying gaps and future challenges is significant to improve global preparedness and national coordination for disaster preparedness, post-disaster recovery and reconstruction plan to 'Build Back Better'. (UNISDR, 2015).

The subjectivist view of preparedness in DRM and DRR is challenged in this paper to identify the relationship between the pre-and-post 2015 UN frameworks data loss indictors, and philosophical paradigms of disaster damage to critical infrastructure and disruption of basic services. The outcomes of this correlation study are aimed at addressing underling risk drivers to build urban resilience for DRR-DRM (preparedness), and have more reliable data that consider variables of exposure and vulnerability.

This questions disaster risk reduction at the level of national governments; and challenges the interpretation of global indicators metadata to report on data losses for Target D for the SFDRR, and Goal 11 for the SDGs. The ontology of Urban Resilience is investigated against the epistemology of risk dynamics by using the HABITAT III Urban System Model Approach. This will equate to shift 2015-2030 agendas to integrate the paradigm of risk-resilience and collecting consistent data on extensive hazards, exposure and vulnerability of critical infrastructure, for measuring the achievement of global targets, but also for DRR strategy planning, awareness raising, risk assessments and the development of DRM related policies.

In the context of building urban resilience, national and local governments would require identifying local DRM techniques to mitigate climate change impact by reporting on small-scale onset, and frequent hazardous events that are not registered in international disaster loss databases. Taking into account the issue of consistency in monitoring data losses over the upcoming period up to 2030, it is important to obtain a consistent report on data losses for all hazards and underlying risks. This will have the potential to be compared to the Hyogo framework of last decade (2005-2015), to develop evidence based record on the implementation of SFDRR and achievement of 2030 SDGs global targets.

Lack of transparency, weaknesses of urban governance, limitations of financial and human capacities may cause socio-economic assessment biases, and will remain as challenges for the application of the Habitat III Urban System Model findings into extensive hazards. Thus, this paper will help pave the way for further research on DRM Investments and financial losses in the context of risk governance; humanitarian action organisational learning, identification of the DRR community based early warning systems, and GIS risk mapping mechanisms for vulnerable populations. This supports the notion of building urban resilience to secure risk aware spatial planning policies for the built environment and critical infrastructure, adding a new dimension in the contexts of socio-ecological reconstruction or, and civil society cultural vitality.

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