Disaster Risk Management and Resilience: What Remains Untouched?

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Abstract

The contemporary generation of Disaster Risk Management (DRM) scholars is increasingly contributing to the ongoing debate of applying resilience into theory and practice. Nevertheless, theoretical foundations of resilience in DRM context are not yet sufficiently validated in empirical grounds. This paper produces a literature review in DRM and the concept of Resilience and recognizes unanswered questions in the body of disaster management and resilience literature. The paper proposes several future research implications based on several theoretical and empirical research gaps identified. In particular, how to achieve disaster resilience in a multi-stakeholder environment, and how to frame the concept of bounce forward requires further research. This paper also illuminates on research gaps unique to Sri Lanka to add further value to the context.

Keywords

Bounce Forward, Disasters, Disaster Risk Management, Literature Review, Resilience

Introduction

Even after several decades of scientific research advancement, human beings are still confronted by the rising rate of devastating impacts induced by natural disasters. However, most national-level disaster management policies and practices are still centered on "loss reduction model", which let communities remain vulnerable to natural disasters (Bhandari et al. 2010). Since the Hyogo Framework for Action (UNISDR 2005), most research in the area of disaster management transferred from "loss reduction" paradigm to resilience-based studies (Bhandari et al., 2010; Norris et al., 2008; Aldunce et al., 2014; Klein et al., 2003). While old thinking of "loss reduction" attempts just to prevent damage, resilience focuses on building strong communities that can sustain a disaster and rebound from the impact in a shorter

period. The concept of resilience is emerging as a paradigm that assists in developing disaster risk management strategies, and several research gaps are still evident in this field. The objective of this paper is to perform a comprehensive literature review on disaster risk management (DRM), resilience concept and amalgamation between the two. Firstly, this article recognizes current research directions of DRM, and what areas still require further research. As explained earlier, resilience is a prominent research theme that needs better explanations, and particularly in the field of disaster management a globally accepted definition is yet to be defined (Manyena, 2006; Cutter et al., 2008; Brand & Jax, 2007; Heazle et al., 2013). Secondly, this paper attempts to arrive at a working definition for disaster resilience, followed by recognizing research gaps when amalgamate DRM and resilience, particularly in the context of Sri Lanka. This paper contributes to filling the vacuum of insufficient review of resilience literature in the perspective of disaster management and suggests future research directions.

Defining Disaster Risk Management

In literature, definitions for a disaster are centered on few common key aspects. Most disaster scholars recognized a disaster as an 'event' or 'state' which exceeds the capabilities of natural processes (Quarantelli, 1988; Quarantelli, 2000; Stark & Erickson 1978; Dorasamy et al., 2013). "Disaster is a crisis situation that far exceeds the capabilities" defined Quarentelly (1988; p. 18). Further, Quarentelly (1998) argued that a disaster is an event in which emergency organizations need to expand and extend themselves to cope the vulnerabilities rose. Stark and Erickson (1978) illustrated that a disastrous event has a distinct beginning and a distinct end, with an extraordinary freak of nature, a perversion of the natural processes of life. On the other hand, scholars commonly recognized two inherent properties of a disaster: first, does a great deal of harm; second, it is sudden, unexpected and acute (Stark & Erickson, 1978; Dorasamy et al., 2013). Dorasamy et al. (2013) recognized following attributes of a disaster: sudden occurrence, the requirement for quick reactions, nature of uncertainty, nature of stress, threaten the reputation of the organization, and escalation of intensity.

The world health organization (WHO, 2002) defined a disaster as "an occurrence disrupting the normal conditions of existence and causing a level of

suffering that exceeds the capacity of adjustment of the affected community". United Nations Office for Disaster Risk Reduction (UNISDR, 2007) defined disaster as:

> "A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses that exceed the ability of the affected community or society to cope using its own resources"

The DRM of man-maid disasters and natural disasters have become a prominent theme for research in both the natural and social sciences (Lettieri et al., 2009; Ikeda & Nagasaka, 2011; Scolobig et al., 2015). UNISDR (2007) and Disaster Management Center (DMC), Sri Lanka (2005: p. 7) defined Disaster Risk Management as:

> "The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies, and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster."

The next section reviews a collection of DRM literature with the aim of recognizing research gaps that persist in the context.

Perceptible gaps in Disaster Management Literature

Recent DRM research published from the year 2010 to 2015 (retrieved from online research databases: Emerald Insight, Springer, Palgrave Macmillan, Science Direct, and Ebsco Host and filtered with the keyword 'Disaster Risk Management') is categorized into several common research themes (Table 1): 1) Decentralization of DRM institutes, 2) Disaster Resilience, 3) Methods, Practices, and Management, 4) Policy and Law; 5)Information Technology tools for Disaster Management, 6) Instruments to Assess and Indexes and 7) Community Perceptions and Economics.

Decentralization of DRM institutes is a common research agenda during recent years: 1) Scolobig et al. (2015) examined the transfer of DRM responsibility from the agencies in charge to the private citizens, 2) Ainuddin and Routray (2012) and Ainuddin et al. (2013) researched on engagement and coordination among top-down institutional arrangement, 3) Dixit (2013) examined initiatives adopted by both governmental and nongovernmental organizations, and 4) Kusumasari et al. (2010) and Becker (2012) studied different local government and other administrative stakeholders' involvement. The above researchers demonstrated the interest and recognized the importance of decentralization of DRM institutes, which is indicated as

a recent trend in DRM studies. However, most of the recent research are limited to exploring more practical implications rather than theoretical developments of decentralization of disaster management activities. For example, some research done in this domain is limited to understand how key government and non-government multi-level stakeholders operated during specific disaster events such as Kashmir 2005 earthquake (Ainuddin & Routray 2012; Becker 2012; Ainuddin et al. 2013), and in Kathmandu earthquake (Dixit et al. 2013). Hence, more theoretical developments are required to explain the local context and to understand the holistic framework of DRM among multilevel stakeholders.

Theme	Research Area	Authors
Decentralization of DRM institutes	Adoption of people-centered approaches, for transfer of DRM responsibility from the agencies to citizens.	(Scolobig et al. 2015)
	The decentralization of the disaster management institutions	(Ainuddin et al. 2013)
	Practitioners' engagement in top-down formal institutional arrangement	(Aldunce et al. 2015)
	Initiatives adopted by both governmental and nongovernmental organizations of Nepal to manage earthquake disaster risk	(Dixit et al. 2013)
	Capability requirements of local government institutions in pre-, during, and post-disaster activities	(Kusumasari et al. 2010)
	The potential for discrepancies between what stakeholders on different administrative levels in Fiji	(Becker 2012)
	Improving coordination between provincial and national agencies during disasters and seismic emergencies	(Ainuddin & Routray 2012)
Disaster Resilience	Suggesting a conceptual framework for examining multiple interpretations of resilience in DRM	(MacAskill & Guthrie 2014)
	Practitioners' engagement in the disaster resilience discourse associated with a top-down formal institutional arrangement	(Aldunce et al. 2015)
	Investigate how resilience is framed by researchers and DRM practitioners	(Aldunce et al. 2014) (Folke et al. 2010)
	Practical guidance methodologies for assessing resilience.	(Sudmeier-Rieux et al. 2013)
	Posits that resilience should be viewed as the ability to "bounce forward" than "bounce back"	(Manyena et al. 2011) (Houston

		2014)
	Systematically analyze the concept of resilience using an integrated review of literature	(Garcia-Dia et al. 2013) (Bhamra et al. 2011)
	To enhance the understanding of the multidimensional nature of resilience for measuring disaster resilience at sub-national levels	(Burton 2012)
	Development of a preliminary conceptual framework for assessing community resilience	(Longstaff et al. 2010)
Methods, Practices, and Management	An inquiry into practical solutions in the field of emergent disaster rescue methods and prevention management	(Chou & Chen 2013)
	A greater focus on preparedness through pre-disaster planning for more holistic approach to disaster management	(O'Brien et al. 2010)
	Scope for improvement in planning and training, for both actors and disaster victims, in the front line of disaster management in Malaysia	(Roosli & O'Brien 2011)
Policy and Law	DRM law support for vulnerable people	(Vink & Takeuchi 2013)
	Disaster risk and disaster management policies and practices in Pakistan	(Ahmed 2013)
	Policy suggestions for integrating risk management and increasing risk reduction measures and planning in Mexico	(Saldana-Zorrilla 2015)
	Explore the ethics of disaster management	(Geale 2012)
IT tools for disaster management	Earth observation, web-based and mobile data management tools, for disaster risk management	(Dyke et al. 2011)
	Role of an information management system for disaster management planning	(Islam & Chik 2011)
Instruments to assess and Indexes	Qualitative instrument for assessing institutional capacity for early warning and disaster management	(Fakhruddin & Chivakidakarn 2014)
	Evaluation index of highway flood disaster risk	(Ou-Yang et al. 2015)
	A methodology for disaster risk management officials to assess the total disaster risk posed	(Coetzee & Van Niekerk 2013)
Community Perceptions	Hazard and risk perception of communities	(Manen 2014)
Economy	Extended framework for the analysis of economic effects of natural disaster risk management	(Chen et al. 2012)

	Understand, manage and reduce the financial and fiscal impacts of natural disasters	(Courbage & Mahul 2013)

Table 1: Research published (2010 - 2015) in Disaster Risk Management Discipline

There is a growing interest in recent DRM research on the importance of decentralization of disaster management among various government agencies and other stakeholders (Scolobig et al., 2015; Ainuddin et al., 2013; Ainuddin & Routray, 2012; Aldunce et al., 2015; Dixit et al., 2013; Kusumasari et al., 2010; Becker, 2012). Ainuddin et al. (2013) emphasized that decentralization of disaster institutions reacted more positively to disaster response than centralized disaster management procedures. However, most of the studies are limited to exploring either few specific administrative levels or general categories of stakeholders though researchers have recognized the importance of decentralized procedures of disaster management from local grassroots level up to different administrative agency levels in the hierarchy ladder; Ex: Sub-national levels (Aldunce et al., 2015; Saldana-Zorrilla, 2015), governmental and non-governmental organizations (Dixit et al., 2013), local and government institutions (Kusumasari et al., 2010; Ahmed, 2013), private and public institutions (Desai et al. 2014), rural district councils (Manyena, 2006). Only a handful of researchers (Becker, 2012; Obrist et al., 2010; Ainuddin & Routray, 2012) considered the contribution of top to bottom and multi-level stakeholders for national disaster management.

Lindell (2013) highlighted that disaster literature has not maintained a balance between theoretical and practical sense. Majority of journal papers published between year 2010 and 2015 have a practical significance rather than theoretical significance (Dixit et al., 2013; Saldana-Zorrilla, 2015; Ou-Yang et al., 2015; Courbage & Mahul, 2013; Fakhruddin & Chivakidakarn, 2014; Aldunce et al., 2015; Dyke et al., 2011; Ahmed, 2013; Vink & Takeuchi, 2013; Ainuddin et al., 2013; Manen, 2014; Scolobig et al., 2015). Very few studies have addressed the theoretical aspects of DRM and that includes the work of Chen et al. (2012) and MacAskill and Guthrie (2014). Limited number of studies give a clear indication of the absence of literature theorizing DRM. On the other hand, Palliyaguru et al. (2014) argued that, though research on theoretical constructs effect positively on understanding the disaster phenomenon, “the disaster risk management process becomes less effective if theory and practice are set apart from one another” (p. 45). In their recent book, Lopez-Carresi et al. (2013) recognized that the gap between theory and practice, and academia and practitioners in the field of disaster management still exists.

Many practitioners, as well as theorists, have commonly recognized 'Resilience' as a new face of DRM research, and in recent years it has become a critical focus area of DRM (see Burton, 2012; Heazle et al., 2013; MacAskill & Guthrie, 2014; Manyena, 2006; Mayunga, 2007; Sudmeier-Rieux et al., 2013; Aldunce et al., 2015; Norris et al., 2008; Aldunce et al., 2014; Klein et al., 2003; Aldrich, 2011). Despite its prominence and acceptability as a key global policy of practice (Hyogo Framework for Action 2005 by United Nations) (UNISDR 2005), many researchers believed that the resilience concept still requires theoretical and practical development. For example, Mayunga (2007) recognized that there is limited theoretical understanding of the concept of resilience. Bhamra et al. (2011) argued that for the resilience theory to create value in the real world, more real world-based empirical research needs to be conducted to validate theoretical constructs. Brown (2011) also contended that resilience theory is limited in conceptualization and ambiguity remains regarding its applicability in DRM practice. MacAskill and Guthrie (2014) reasoned that as a guiding principle, resilience concept is context dependent and still open to elucidation. Hence, it is essential to understand how DRM and resilience concepts can be practically operationalized and how theoretical understanding helps to bring out the balance in the literature.

DRM research published between 2010 to 2015 (Table 2) indicates variation in the maturity of the research themes. For instance, methods, practices, and management themes of disaster research demonstrate maturity and discuss more scoped down precise and clear-cut research topics. This research includes topics like 1) disaster rescue methods (Chou & Chen, 2013), 2) pre-disaster planning for the holistic approach (O'Brien et al., 2010), 3) improvement in planning and training (Roosli & O'Brien, 2011). Policy, law, instruments to assess, indexes and economy research themes also signify the maturity of the research area. For example, such research themes include policy development in specific regions (Ahmed, 2013; Saldana-Zorrilla, 2015), ethics of disaster management (Geale, 2012), indices and assessment to evaluate disaster capacity and risk (Fakhruddin & Chivakidakarn, 2014; Ou-Yang et al., 2015; Coetzee & Van Niekerk, 2013), and economic effects (Chen et al., 2012; Courbage & Mahul, 2013). In contrast, most resilience research is yet to frame or define the concept in the body of disaster resilience literature appropriately. For example, recent resilience research includes: framing resilience (MacAskill & Guthrie, 2014; Aldunce et al., 2014; Folke et al., 2010; Manyena et al., 2011; Houston, 2014;

Garcia-Dia et al., 2013; Bhamra et al., 2011), forming of resilience frameworks (Longstaff et al., 2010), practical guidance methodologies for assessing resilience (Sudmeier-Rieux et al., 2013) . Thus, there is a need for more in-depth research to establish the concept of resilience in the context of disaster, including further research on the conceptualization of multi-institutional disaster resilience framework. Particularly in the Sri Lankan context there is a need for a holistic framework for building national disaster resilience. However, the concept of resilience had a presence in research arena for several decades, but the definition remains contested in literature (Manyena, 2006; Cutter et al., 2008; Brand & Jax, 2007; Heazle et al., 2013). Irrespective of the roots of resilience, Norris et al. (2008) argued that resilience concept is applied in various fields and has multiple definitions. In recent years, few researchers have illustrated the evolution of the resilience concept and outlined a diversity of meanings in various disciplines (Aldunce et al., 2014; Norris et al., 2008; Bhamra et al., 2011; Garcia-Dia et al., 2013). The next section attempts to arrive at a working definition of disaster resilience.

Defining Disaster Resilience

Most definitions of resilience commonly attribute to the following themes: ability to bounce back (Norris et al., 2008; Paton et al., 2001), without being deformed (Gordon, 1980), the speed which system returns to normalcy after a hazard (Bodin & Wiman, 2004), measure of ability to absorb the change (Holling, 1973), continue existence/persistence (Holling, 1973; Longstaff, 2005), strengthen community bonds, resources and the community's capacity to cope (Chenoweth & Stehlik, 2001), to take meaningful, deliberate, collective action to remedy the impact (Pfefferbaum et al., 2007), and find unknown inner strengths and resources (Ganor & Ben-Lavy, 2003). Pfefferbaum (2005) believes that resilience is better conceptualized as an ability or process.

Resilience definition in ecological literature has two strands in which both reflects on features of stability of systems (Gunderson, 2000). Holling (1973) argues that the behavior of ecological systems could be explained using two different properties: resilience and stability. The pioneering work of Holling (1973) in the resilience of ecosystems defines resilience as "the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist." (p. 17). On the other

hand, Holling (1973) characterized stability as the persistence of a system near or close to an equilibrium state (Gunderson 2000; Ives 1995). This indicates that stability is the ability of a system to return to an equilibrium state after a temporary disturbance (Gunderson 2000). Hence, the measure of resilience is that how far the system has moved from the equilibrium (in time) and how quickly it returns (ibid). Some scholars in the field of physics define resilience as the ability to store strain energy and deflect elastically under a load without breaking or being deformed (Gordon, 1980). In contrast to this view, engineering literature explains resilience as the behavior of dynamic systems far from equilibrium, and it is measured by the return time as a measure of stability (Holling, 1973; Gunderson, 2000). Holling (1973) called this as the engineering resilience.

As Gunderson (2000) further explained, the return time definition evolved from engineering traditions i.e. in engineering system perspective, "return time to a single, global equilibrium" (p. 435). However, the ecological resilience is postulated in the existence of multiple equilibriums or multiple stable states which facilitate transition among stable states (Holling, 1973; Gunderson, 2000). Hence, ecological resilience is seen as width or limit of a stable domain and defined by the magnitude of disturbance that a system can absorb before it redefines system structure by changing its stable states through modifying variables and processes that can control behavior (Holling, 1973; Gunderson, 2000; Ludwig et al., 1997). Additionally, Gunderson (2000) "believes that the processes contribute to system 'memory' of those involved could restore ecological resilience" (p. 436). The concept of resilience is also embraced by several other fields such as psychology, community studies, and disaster management. Table 2 indicates a list of selected resilience definitions in various disciplines from the year 2000 to 2014.

Transversely, these definitions have few general consensuses. First, resilience is recognized as a process rather than an outcome (Gunderson, 2000; Pfefferbaum et al., 2007; Norris et al., 2008; Besser, 2013; Houston et al., 2014). Secondly, resilience is defined as capacity or ability to absorb disturbances and/or bounce back/return from adverse situations to normalcy (Gunderson, 2000; Paton et al., 2001; Klein et al., 2003; Walker et al., 2004; Folke et al., 2010; Longstaff et al., 2010; Garcia-Dia et al., 2013). Thirdly, resilience is theorized as adaptability than as stability. At the beginning of the timeline from the year 2000, Gunderson (2000) argues resilience as the level of

stability of a system in which it can absorb disturbances. However, most definitions after that conceptualize resilience as adaptability or capacity to cope (Chenoweth & Stehlik, 2001; Ganor & Ben-Lavy, 2003; Pfefferbaum et al., 2007; Norris et al., 2008; Houston et al., 2014).

Field	Author(s)	Definition
Ecology A	(Gunderson 2000)	Width or limit of a stability domain and is defined by the magnitude of disturbance that a system can absorb before it redefines system structure by changing its stable states through modifying variables and processes that can control behavior.
Community Studies C	(Chenoweth & Stehlik 2001)	Communities can be considered as being resilient when they respond to crises in ways that strengthen community bonds, resources and the community's capacity to cope.
Disaster Management D	(Paton et al. 2001)	"The capability to bounce back and to use physical and economic resources effectively to aid recovery following exposure to hazards"
Disaster Management D	(Klein et al. 2003)	Resilience is the amount of disturbance a system can absorb and still remain within the same state or domain of attraction and the degree to which the system is capable of self- organization.
Community Studies and Disaster Management D	(Ganor & Ben-Lavy 2003)	"The ability of individuals and communities to deal with a state of continuous, long term stress; the ability to find unknown inner strengths and resources in order to cope effectively; the measure of adaptation and flexibility" (p. 106)
Ecology and Engineering A, B	(Bodin & Wiman 2004)	"The dynamic behavior of the system as it strives (if at all) to return to equilibrium, i.e., the extent to which, and the speed with which return occurs" (p. 34) *Bodin & Wiman believed that one ought to get back to the original definitions of stability and diversity in mathematics into ecology.
Ecology A	(Walker et al. 2004) (Folke et al. 2010)	"Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks - in other words, stay in the same basin of attraction." (p. 11)

Psychiatrists C	(Pfefferbaum et al. 2007)	"The ability of community members to take meaningful, deliberate, collective action to remedy the impact of a problem, including the ability to interpret the environment, intervene, and move on".
Community Studies C	(Norris et al. 2008)	"A process linking a set of adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance" (p. 130)
Community Studies C	(Longstaff et al. 2010)	"The capacity of a system to absorb disturbance, undergo change, and retain the same essential functions, structure, identity, and feedbacks" (p. 3)
Community Studies C	(Besser 2013)	Resilient communities are "as those that maintain or enhance residents' quality of life following a shock" (p. 117)
Psychiatrists C	(Garcia-Dia et al. 2013)	"Resilience is one's ability to bounce back or recover from adversity" (p.267)
Community Studies and Disaster Management D	(Houston et al. 2014)	"A community is resilient if it is able to "bounce forward" after an adverse event. Community resilience is generally considered a process that is indicated by community adaptation following a disaster or crisis." (p. 270)

Table 2: Some recent definitions of Resilience (Year 2000 - 2015)

While engineering field defines resilience in the temporal domain (categorized as type B in Table 2) i.e. the speed in which the system arrives at the equilibrium after disturbance occur (Bodin & Wiman, 2004), the field of ecology views resilience mostly in the spatial domain (categorized as type A in Table 2). Scholars from the field of ecology define resilience as the extent to which a system can absorb disturbances (Gunderson, 2000; Walker et al., 2004; Folke et al., 2010). In ecological settings, resilience has been used interchangeably in conjunction with the concept of "adaptation" of climate studies (Joerin et al., 2014). In contrast, community studies and psychiatrists, have integrated more social and/or psychology aspect into resilience while building on the capacity to adapt/cope as in ecological definitions (Chenoweth & Stehlik, 2001; Ganor & Ben-Lavy, 2003; Longstaff et al., 2010; Besser, 2013) (categorized as type C in Table 2).

On the other hand, resilience definitions in the field of disaster management closely coincide with definitions in community studies because disaster management

definitions also link to the capacity to adapt/cope (categorized as type D in Table 2). For example, Chenoweth and Stehlik (2001) recognize resilience as community's ability to cope when responding to crises. Chenoweth and Stehlik also explain about ways in which resilience shall be enforced i.e. strengthening community bonds and resources. Several other disaster management scholars suggest the following aspects in their definitions: efficient use of physical and economic resources (Paton et al., 2001; Ganor & Ben-Lavy, 2003), capability to self-organize (Klein et al., 2003), ability to find unknown inner strengths (Ganor & Ben-Lavy, 2003), and maintain or enhance residents' quality of life (Besser, 2013).

Several recent studies define resilience as bounce forward ability (Manyena et al., 2011; Houston et al., 2014) while early researchers theorized resilience as bounce back (Gordon, 1980; Paton et al., 2001; Bodin & Wiman, 2004; Tugade & Fredrickson, 2004; Garcia-Dia et al., 2013). As an example Manyena et al. (2011) explain, resilience as "the notion of bounce forward is to see disaster as an opportunity for local livelihood enhancement rather than as a simple return to status quo ante"(p.423). Having considered a disaster as an opportunity to change Manyena et al. (2011) further argue that resilience should be perceived as the ability to "bounce forward" and "move on" following a disaster rather than "bounce back." Manyena et al.'s (2011) concept of resilience came after considering several examples, such as how Japan's 2011 earthquake and subsequent tsunami and the destruction of Fukushima nuclear power plant led other countries to rethink their power-generation strategies. Paton and Johnston (2006) highlighted the gaps in the existing resilience definition with the concept of "bounce back." As they further explained, "bouncing back" does not portray the changed reality and new opportunities formed due to disaster. Such change assists in pre-disaster planning by adjusting to new post-disaster realities (Manyena et al. 2011). Explaining it further, Paton and Johnson (2006) argue that even though affected community want to return to the previous state, changes to the physical, social and psychological reality make bounce back unfeasible. Hence, this paper defines disaster resilience as ***the capacity of a system to adapt to the adversity of a disaster and bounce forward, strengthening community bonds and resources.*** The next section recognizes research gaps in the amalgamation of DRM and resilience.

Disaster Risk Management and Resilience: What is unanswered?

MacAskill and Guthrie (2014) explain that resilience has "emerged as a guiding principle" (p. 667) for DRM. However, there are several unanswered queries related to the link between resilience and disaster management. Lettieri et al. (2009) pointed out that most literature on disaster management theory commonly agrees on a common theoretical framework which is independent of the type of disaster. However, most of such frameworks focused on technical issues and neglected contributions from the organizational and psychological fields and therefore have led to difficulties in making these frameworks actionable (Lettieri et al. 2009). Though termed differently, most literature commonly agreed that systematic disaster management process framework is explained by three temporal and logical stages: pre-disaster, response, and post-disaster (Todd & Todd, 2011; Lettieri et al., 2009; Lindell, 2013; Mansor et al., 2004). These phases do not have a global acceptance, and their functions are not mutually exclusive. Also, the three phases may overlap in the temporal and logical space (Lindell, 2013) and make the recognition of the position of resilience in disaster management more cumbersome. As MacAskill and Guthrie (2014) explained, this ambiguity "is likely to be a factor as to why there are differences between academic or theoretical conceptions of resilience and application of the concept in practice" (p. 673). Also, there is no research evidence to explain how resilience is operationalized in each stage of the disaster management cycle. Hence, it indicates that scholarly work so far paid less attention to explain how to embed the process of resilience into the disaster management cycle.

Another typical research gap that many researchers have recognized is the absence of empirical validation of different aspects of resilience theory. For example, Bhamra et al. (2011: p. 5388) cited that "there appears to be a strong focus on building theories and definitions of resilience", but there is very little empirical research to understand how organizations can attain resilience in the face of disasters. Sudmeier-Rieux et al. (2013) also recognize that there is an empirical limitation in practical guidance methodologies for assessing resilience. Brown (2011) argues that though DRM practitioners and policy makers include the concept of resilience in policy documents frequently, such inclusions are not based on theoretical or empirical groundings. Manyena (2011) and Paton and Johnson (2006) suggest that disaster resilience is associated with the process of bouncing forward rather than bouncing back. However, empirical evidence of resilience as a bouncing forward process is

significantly limited. Janssen et al. (2006) argue that comparing case studies on resilience assessment of regional social-ecological systems is difficult because they do not follow the guidance of a resilience framework on structural changes. The next section throws light on research evidence and gaps especially found in the context of Sri Lanka.

Disaster Risk Management and Resilience from the lens of Sri Lanka

The widespread losses caused by Tsunami (2004) in Sri Lanka, reconfirmed the crucial requirement of a "multi-sectorial, inter-institutional, and multi-disciplinary" mechanism to handle disasters in the country (Disaster Management Center 2005). On this ground, several interim committees, legislative (Sri Lanka Disaster Management Act No. 13 of 2005) and institutional arrangements (DMC-Disaster Management Center, MODM-Ministry of Disaster Management) were established. In parallel, it can be observed that scholars have been increasingly contributing to DRM and resilience literature in recent years.

Relevant research in the context of Sri Lanka has been conducted in three knowledge domains: 1) Disaster mitigation and preparedness (Jayamanna, 2008; Mudalige, 2011; Yoshitani et al., 2007; Wickramaratne et al., 2012; Minamoto, 2010), 2) DRM plans and policies (Ranasinghe, 2011), and 3) Disaster resilience (Senanayake & Barthelot, 2013; Somasundaram & Sivayokan, 2013; Hettiarachchi et al., 2014; Malalgoda et al., 2013; Pathirage et al., 2012; Ingirige et al., 2008; Thanurjan & Seneviratne, 2009).

Several researchers focused their work on disaster mitigation and preparedness, for example, Jayamanna (2008) conducted a case study on flood mitigation and preparedness in Kalutara Urban Council area. Jayamanna illustrates the significance of actions by various stakeholders including community members. Mudalige (2011) explored the flood management systems in Sri Lanka and identified that Sri Lanka still lacks a real-time flood early warning system. Yoshitani et al. (2007) also conducted a study on Sri Lanka's natural and social characteristics and risks associated with water-related disasters. Wickramaratne et al. (2012) proposed a methodology for a priori classification of natural disasters that occur in Sri Lanka to support for preparing mitigation plans. A survey conducted by Minamoto (2010) with the participation of 187 households in eastern Sri Lanka, that suffered from 2004 Indian Ocean tsunami, found that linking social capital between survivors and national and international

nongovernmental organizations (NGOs) attested critical at rebuilding. Most research on disaster preparedness and mitigation in Sri Lanka, are based on a single location. Therefore, it can be argued that cross-sectional views and comparisons between locations would further strengthen the findings of research explaining disaster preparedness and mitigation in Sri Lanka. It is also evident that there is little research to assess or evaluate current DRM mitigation plans within Sri Lanka.

There is only a handful of research that focus on DMR plans and policies in Sri Lanka. Ranasinghe (2011) provided plausible suggestions to mainstream disaster risk reduction policies, programs and plans in Sri Lanka to build resilient cities. She suggests zoning of the areas according to the land capability, conservation, having building codes, having green belts, green lungs in cities, installation of early warning systems, and improving disaster awareness among community are imperative for resilience in cities. However, it is noted that most DRM plans and policies are still focused on loss reduction models. In Sri Lanka, the concept of resilience is yet to be integrated into the DRM policy research.

There is a growing interest among scholars contributing to the empirical literature on disaster resilience in Sri Lanka. For example, Senanayake and Barthelot (2013) studied the use of children as change agents to collect and disseminate grassroots level flood information using participatory flood mapping technique and improve the awareness the community on flood resilience in Batticaloa city, Sri Lanka. They suggest that children could act as change agents within the system to facilitate bottom-up as well as top – down information flow in the neighborhood. Ingirige et al. (2008) focused their study on how knowledge transfer impacts the effective and efficient delivery of post-tsunami housing in Sri Lanka. They found that knowledge transfer within this context required knowledge localization. Ingirige et al. (2008) suggested community engagement through participatory techniques among various stakeholders for innovation. Thanurjan and Seneviratne (2009) examined the degree of knowledge management in post-disaster housing reconstruction in the Sri Lankan context. Their study revealed that organizations use competencies and repositories as the primary sources of knowledge internal and external to the organization. Somasundaram and Sivayokan (2013) focused their research on understanding common psychosocial problems faced by families and communities in the context of rebuilding community resilience in post-war times. Since community members were significantly affected by post-trauma experiences, they propose the use of cultural practices and

awareness programs to revitalize resilience. A case study presented by the University of Salford and DMC Sri Lanka (2012), focused on providing a snapshot of local level resilience building activities associated with the city of Batticaloa, identified trends in the perceptions and approaches of local governments toward disaster risk reduction. Hettiarachchi et al. (2014) examined the nature and extent of degradation in a selected segment of the Colombo flood detention area (CFDA) wetlands and disaster resilience. They analyzed the gradual process of change in watersheds and the wetland ecology affecting flood control services. Hettiarachchi et al. found that gradual ecological change in this area, leads to a significant reduction in water-holding capacity of the wetland, thus increasing the flood frequency.

A handful of researchers explored the link between knowledge transfer and disaster resilience in the context of Sri Lanka. For example, Malalgoda et al. (2013) examined the role and challenges that the Sri Lankan local governments face in creating a disaster resilient built environment within Batticaloa city of Sri Lanka. Their study revealed that local governments are facing a considerable challenge due to the lack of knowledge of disaster risks and vulnerabilities. Hence, further research in this area is highly recommended in the local context. Even though the resilient concept is not directly addressed, Pathirage et al. (2012) examined key knowledge factors related to disaster management cycle and explored the challenges associated with them. However, these studies did not manage to build sufficient empirical knowledge on how knowledge can be efficiently transferred to build disaster resilience longitudinally. Also, most of the above-described research conducted in Sri Lanka consider resilience as a part of DRM, but there has been very less attention given to the theoretical developments of resilience.

Further Research Directions

As the concluding remark of this literature review, the authors suggest several future research directions to integrate resilience into DRM theory and practice. There is a theoretical and empirical gap on how to build disaster resilience in a multi-stakeholder environment. Although the Disaster Management Center in Sri Lanka has formalized a multi-stakeholder DRM framework, that initiative is not yet completely assessed theoretically or practically and also the resilience concept is hardly embedded in. This indicates that resilience studies should focus more on how the structural components (nodes and links) are arranged over time and how various network

characteristics such as connectivity and centrality operates in dynamic situations. The unevenness between the theory and practice is another research gap that persists in DRM literature. The majority of DRM literature focuses more on practice, and gives less attention to theory. Similarly, the concept of resilience still requires both theoretical as well as practical developments. Resilience still appears to be in a juvenile stage where researchers still attempt to frame it in the context of DRM. Thus, there is a need for more in-depth research firmly embedding the concept of resilience in the disaster literature. This includes further research to conceptualize multi-institutional disaster resilience frameworks, especially in the Sri Lankan context to develop a holistic framework for building national disaster resilience. Another area that needs further research in resilience is the concept of bounce forward. Most of the recent studies are limited to evaluating the empirical grounds of the resilience concept 'bouncing back'. But further research should be conducted to understand how to use a disaster situation as an opportunity to change and improve further. Another research gap in the literature is the absence of investigation to explain how to operationalize resilience in each stage of the disaster management cycle. So, further research is required to explain how to embed the concept of resilience more appropriately into the disaster management cycle.

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