Enhancing capacities for disaster mitigation and reconstruction in the built environment: a case study from Sri Lanka

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Abstract

Throughout the recent decades, natural and man-made disasters have demonstrated the fragility of the built environment and its vulnerability to hazards. The destruction of the built environment caused by disasters impedes the regular functioning of the society while hindering all the other activities due to its strong linkages with other sectors. This emphasises the need of a disaster resilient built environment. Capacity enhancement within different sectors in the society such as governments, institutions and communities, in relation to the built environment enables to identify constraints and to plan and manage construction activities of the built environment effectively, efficiently and sustainably. Identifying capacity gaps in the context of disaster mitigation and reconstruction in the built environment is vital to identify any required capacity enhancement. In this context, this paper discusses such capacity gaps in Sri Lanka through a literature review. Sri Lanka is commonly prone to natural hazards like floods, cyclones, landslides, and droughts and has experienced low-frequency but high impact disasters also such as the Indian Ocean tsunami in 2004. The paper identifies the capacity gaps in different sectors in the country such as national and local governments, non state actors and the private sector, local communities, policy and regulatory environment and human resource development in relation to disaster mitigation and reconstruction in the built environment. Problems in the regulatory structure, deficiencies in necessary laws and regulations including problems in their implementation, and lack of required resources and skills have been identified as the major capacity gaps in the paper.

Keywords: built environment, capacity gaps, disaster mitigation, reconstruction, Sri Lanka

1. Introduction

1.1 Background

Recent natural and human-induced disasters have highlighted the fragility of the built environment and its vulnerability to hazards (Bosher *et al*., 2007a). Disasters are not the necessary result of hazards but occur only when these hazards intersect with the built environment, particularly poorly located and poorly constructed development (UNDP cited Duque, 2005). The built environment comprises the substantive physical framework for human society to function in its many aspects—social, economic, political, and institutional (Geis, 2000, page 8). Thus, due to its linkages with other sectors, the destruction of the built environment by disasters hinders the regular functioning of any social and economic context.

Since the ability of the built environment to withstand the impacts of hazards plays a direct role in determining the casualties and monetary costs of disasters (Mileti, 1999), it is important to reduce the vulnerabilities within the built environment and enhance its capacity for disaster mitigation and reconstruction to achieve resilience to disasters. It is indicated that the hazards cannot be managed and it is the characteristics of the built environment that can be managed (Duque, 2005). Therefore, it is essential to identify capacity gaps in the built environment and enhance the necessary capacities in order to make it less vulnerable to the impacts of disasters.

Sri Lanka is commonly prone to natural hazards like floods, cyclones, landslides and droughts and has experienced low-frequency but high impact disasters also such as the Indian Ocean tsunami in 2004. The devastation caused by these disasters, specially the massive destruction caused by the tsunami on 26th December 2004 drew the country's attention towards many capacity gaps in the built environment related to disaster mitigation and reconstruction. Thus, this paper gives an account of disaster mitigation and reconstruction related capacity gaps in the built environment of Sri Lanka. Further, the paper gives a general overview of capacities and capacity gaps of disaster mitigation and reconstruction prior moving to discuss gaps in the Sri Lankan context. The possible remedies that can bridge the identified gaps are briefly discussed at the end of the paper before the conclusions.

1.2 Aim and objectives

Identifying capacity gaps in the context of disaster mitigation and reconstruction in the built environment is vital to identify any required capacity enhancement. In this context, this paper focuses on discussing related capacity gaps in the built environment in Sri Lanka. Further, it attempts to give an overview of the capacities and gaps in disaster mitigation and reconstruction in the built environment and outline the possible means of addressing the identified gaps.

1.3 Method

This paper is based on a literature review. It reviews academic articles, electronic sources and various reports and other publications to give a general introduction to capacities and capacity gaps in the built environment in relation to disaster mitigation and reconstruction, and to identify related capacity

gaps in Sri Lanka. Possible means for bridging the identified capacity gaps are also examined in the paper through various sources of literature.

2. Capacities and capacity gaps in disaster mitigation and reconstruction- a general overview

2.1 What are capacities?

Capacities exist in different forms in the world such as knowledge, skills, technology and resources. According to UN/ISDR (2009), capacity is the combination of all the strengths, attributes and resources available within a community, society or an organisation that can be used to achieve agreed goals and they can exist in the forms of infrastructure and physical means, institutions, societal coping abilities, human knowledge, skills, and collective attributes such as social relationships, leadership and management. According to Honadle (1981), ability to anticipate and influence change, make informed and intelligent decisions about policy, develop programs to implement policy, attract and absorb resources, manage resources and evaluate current activities to guide future action can be defined as capacity.

Apropos, the capacities necessary for effective disaster mitigation and reconstruction in general could be represented through comprising a society with organisations particularly deal with disaster issues, well-developed disaster plans and preparedness, coping mechanisms, adaptive strategies, memory of past disasters, good governance, ethical standards, local leadership, physical capital, resilient buildings and infrastructure that cope with and resist extreme hazard forces, etc. (Benson et al., 2007). Capacities that are required for post disaster reconstruction are explained here onwards.

2.2 Capacities for disaster mitigation and reconstruction in the built environment

In a study on post tsunami recovery process in Andaman and Nicobar Islands, Gupta and Sharma (2006) state governance, networking between different stakeholders and community based approaches as important elements in post disaster recovery. Good governance is the exercise of economic, political and administrative authority to manage a country's affairs at all levels through bringing together the actions of state, non-state and private sector actors (UNDP, 2004). Therefore, the characteristics of good governance i.e., participation, rule of law, transparency, responsiveness, consensus orientation, equity, effectiveness, efficiency, accountability and strategic vision are essential for a country for its sustainable development and disaster risk reduction (UNDP, 2004). Accordingly, the authorities, institutions and plans to manage disaster mitigation and reconstruction activities and coordinate its stakeholders, policy and legislation to regulate disaster mitigation and reconstruction, and human resources to manage the authorities and implement the policies and legislation become necessary capacities for disaster reconstruction under good governance. In this context, governments and local governments have an important role to perform by ensuring all the necessary capacities are in place (UNDP, 2004).

Further, the experience and participation of local and international community are extremely important in disaster mitigation and reconstruction in the built environment. Many studies have recognised the need to include local community's participation into disaster reconstruction (Pardasani, 2006; Owen and Dumashie, 2007; Jayaraj, 2006) since disaster reconstruction is about building back homes and infrastructure to become more resilient to the next disaster, and fit for purpose for the community (Owen and Dumashie, 2007). According to Lawther (2009), involvement of the beneficiaries and the wider community in the re-construction can lead to more sustainable outcomes of projects. The more people are engaged in the process, the greater the level of stakeholder engagement is, the more they are able to influence and take ownership of the outcomes (Lawther, 2009). In this context, knowledge and experience of a local community can input some important information for the construction process such as locations that are less vulnerable to potential disasters, locally available material that can be used for construction, and special community needs that are necessary to be integrated into reconstruction. Incidentally, capacities and experiences of international community in the field of disaster mitigation and reconstruction are vital mainly because, in many developing countries, the lack of knowledge, resources and expertise can be overcome by adequate global cooperation in tackling natural disasters (El-Masri and Tipple, 2002). The supportive role of international agencies can assist countries in disaster mitigation and reconstruction by applying their existing knowledge and resources (El-Masri and Tipple, 2002).

Incidentally, building codes, land-use planning, environmental risk and human vulnerability monitoring and safety standards are important in improving the design and construction of buildings, agricultural structures, infrastructure and other facilities to reduce their susceptibilities (Nateghi-A, 2000). However, as Nateghi-A (2000) emphasises, building codes, land use policies or design standards are, unlikely to result in more resilient built environment unless the professionals in the built environment who have to implement the codes, standards and policies accept their importance and endorse its use, understand the code and the design criteria required of them and unless the code is fully enforced by authorities checking and penalising designs that do not comply. This highlights the importance of availability of proper human resources in the built environment for disaster mitigation and reconstruction. In this context, education and training are vital in developing necessary human resources. Bosher et al. (2007a) state that risk and hazard training should be systematically integrated into the professional training and professional development of architects, planners, engineers, developers, etc. and it is important to encourage cross disciplinary training for construction professionals and emergency managers (Bosher et al., 2007a). In particular, the following list demonstrates the property and construction skills that can contribute towards disaster mitigation and reconstruction in the built environment (Lloyd-Jones, 2006).

- Aiding local government land administration, cadastral mapping
- Knowledge of land and property legislation, providing support on land rights and claims
- Knowledge of local regulatory frameworks and ways they could be improved
- Training and knowledge transfer

- Disaster risk assessment
- Links with other built environment professions; inter-disciplinary and team working
- Contacts with local business and industry; networking
- Knowledge of appropriate forms of disaster-resistant construction and engineering

However, it is not only the professional development necessary for the disaster mitigation and reconstruction in the built environment but developing skills and knowledge of non professionals in the built environment such as contractors, construction supervisors, trade workers is vital as well. Having identified the major capacity needs for disaster mitigation and reconstruction in the built environment, the paper moves to discuss the common capacity gaps in the next section.

2.3 Capacity gaps in disaster mitigation and reconstruction in the built environment

Capacity gaps in the field of disaster management in general are common to disaster mitigation and reconstruction within the built environment as well. Thus the most common capacity gaps in relation to disaster mitigation and reconstruction can be mentioned as lack of necessary policies and legislation for mitigation and reconstruction, poor implementation of policies and legislation, (Nateghi-A, 2000; Mileti, 1999) problems in disaster management planning structures and coordination of stakeholders (El-Masri and Tipple, 2002), lack of disaster management related awareness, lack of proper education and training, lack of skilled and trained human resources for mitigation and reconstruction, (Bosher et al., 2007b) deficiencies in state of the art technology for disaster mitigation and rapid and sustainable reconstruction, deficiencies in information management (Laverack, 2005), and lack of community involvement in reconstruction (Lawther, 2009).

3. Capacity gaps in disaster mitigation and reconstruction- A case study on Sri Lanka

3.1 Disaster profile of Sri Lanka

Sri Lanka is an island situated in the Indian Ocean, located to the south of the Indian subcontinent. Duryog Nivaran (2009) details the countries geographical characteristics and meteorological factors briefly as follows.

“Sri Lanka is separated from the Indian subcontinent by a trip of shallow water, the Palk Strait, which at its narrowest is about 40 km wide. It has the Gulf of Manner to its west, the Indian Ocean to its south and the Bay of Bengal to its east. With a total land area of 65,525 square kilometers inhabited by 19.5 million people, the country is among the most densely populated in the world, ranking 19th in the order of high density. Sir Lanka is mountainous in the central region and all rivers originate from the central hills and flow down to the sea. Sri Lanka has a tropical climate fed by two monsoons born

in the Indian Ocean and two brief inter-monsoon periods. There is considerable variation in rainfall and evaporation as the topography changes from highlands to coastal plains."

Sri Lanka is prone to various natural disasters caused mainly by floods, cyclones, landslides, drought and coastal erosion with increasing instances of environmental pollution related hazards (Disaster Management Centre, 2005). Floods and landslides are more localised and seasonal whilst droughts and cyclones are more widespread and occasional (Duryog Nivaran, 2009). Table 1 details the most common disaster types in Sri Lanka. However, the devastation caused by the Indian Ocean tsunami of 2004 has highlighted that Sri Lanka is also vulnerable to low-frequency, high impact events which cause extensive damage and reverse years of development gains (Disaster Management Centre, 2005).

Table 1: Frequent disaster types in Sri Lanka (adopted from: Duryog Nivaran, 2009)

Hazard	*Description*	*Causes*
Floods	*Floods are an annual occurrence bringing tremendous damage to life and livelihoods. Whilst the wet zone suffers periodic river breaching the country's vast dry zone plains are not spared calamitous flooding.*	*Heavy seasonal rainfall* *Deforestation* *lack of flood protection schemes* *unplanned development activities*
Landslides	*Landslides occur in areas that receive 1000-4000mm of annual rainfall. Eight of Sri Lanka`s 25 districts are prone to landslides. Some 12,000 square kilometers of the country are designated as vulnerable to landslides.*	*Heavy rainfall* *Geology* *Unsafe land use and construction practices* *Deforestation*
Droughts	*Severe droughts are reported in Sri Lanka approximately once a decade. Apart from severe droughts, there is a slow, constant drought suffered by a large portion of the dry-zone population. Each year, somewhere in Sri Lanka people face droughts of short duration and local significance.*	*Inadequate rainfall* *Deforestation*
Cyclones	*Sri Lanka`s definition of a cyclone refers to wind speeds of over 118km/h, whilst a cyclonic storm has wind speeds of 62-117 km/h. Sri Lanka lies in the periphery of the tropical cyclone belt and the impact of cyclones is lesser than on the other nations in the region. Cyclonic storms occur mainly during north-east monsoon conditions, the overwhelming majority of these (85%) during the month of December.*	*Monsoon activity* *Severe weather changes in the Bay of Bengal*

3.2 Capacity gaps

As mentioned in an earlier section as well, capacity gaps in the field of disaster management in general are common to disaster mitigation and reconstruction within the built environment as well. In

this context, the following gaps identified in disaster risk reduction (DRR) in Sri Lanka (Chandradasa, 2008) can be related to the built environment as well.

- Laws and regulations which hinder speedy and smooth functioning of the DRM (disaster risk management) mechanism
- Unavailability of necessary legal mandates for some of the major stakeholders for carrying out required DRR functions
- Deficiencies in legislation for integration of DRR in all development projects
- Problems in national level regulatory structure (eg: existence of more than one nodal ministry at national level to look after all phases of disaster management cycle)
- Inadequate funds for DRR activities
- Difficulties in resettling people living in identified high risk disaster prone areas due to social and political issues
- Deficiencies in the EIA process which lead to an inadequate attention towards disaster impacts
- Lack of community participation in DRR activities and community ignorance (eg: even with threat to their lives some communities do not heed to the alerts and resist evacuations)
- Difficulties in sustaining the interest of trained volunteers at village level
- Problems in early warning systems

Complying with most of the points in the aforementioned list of gaps, Duryog Nivaran (2009) identifies some main gaps in the disaster management system in Sri Lanka such as poor coordination between various agencies; lack of training and education for officials and the public which results in poor awareness; absence of proper warning systems; inadequate emphasis on disaster preparedness; lack of finances and delays in relief distribution.

It was emphasised in an earlier section that the building codes, land-use planning policies and construction standards are important in improving the design and construction activities within the built environment. However, according to Gunaratnam (cited DMC-SL, 2010), the safe building guidelines have not been practiced properly owing to various gaps within the system in Sri Lanka in spite of they have been in existence for decades. Further, it has been pointed out that landslides often take place in Sri Lanka in its mountainous regions and in urban areas in particular, due to wrong practices, unavailability of retaining structures, improper cutting and filling operations etc. (Disaster Management Centre, 2005).

Incidentally, the tsunami on 26th December 2004 drew the attention of the government and the society towards many capacity gaps in the disaster management system of Sri Lanka. According to (Jayawardena, 2006), the massive destruction caused by the tsunami reconfirmed the need for multi-sectoral, inter-institutional and multi-disciplinary approaches to manage disaster risks in Sri Lanka. The findings of a study on reconstruction capacity gaps in Sri Lanka following the 2004 Tsunami highlight several capacity gaps that have hindered reconstruction efforts in the built environment after the tsunami (Haigh et al., 2007). The capacity gaps are highlighted under five major themes as national and local government; non-state actors and the private sector; communities; the policy environment; and, human resource development in the study and following list elaborates the major gaps among them.

- Inexperience and lack of capacity at national and local government level
    - lack of plans for post-disaster response and coordination,
    - inadequacy of ad-hoc structures introduced following the Tsunami
    - confusion over responsibility
    - involvement of too many government agencies
    - lack of leadership and direction
    - poor horizontal communication between national and regional government
    - inappropriate land to build upon and poor coordination between housing and required infrastructure
    - lack of basic project management skills
    - poor management and coordination capacities of government entities established for post Tsunami recovery
- Lack of transparency, inadequate supervision of local contractors, one-sided contracts and competition between agencies in donor driven schemes
- Deficiencies in core trades
- Lack of capacity within the private and non state actors to handle large scale reconstruction

In this context, the subsequent section focuses on discussing the possible remedies for aforementioned capacity gaps.

4. Discussion

According to the earlier sections, it is evident that there are many capacity gaps related to disaster mitigation and reconstruction in the built environment in Sri Lanka. Problems in the regulatory structure, deficiencies in necessary laws and regulations including problems in their implementation, and lack of required resources and skills are prominent among them. However, the Sri Lanka Disaster Management Act No 13 of 2005 was enacted providing a solid legislative and institutional arrangement for Disaster Risk Management in Sri Lanka after the 2004 tsunami followed by establishing the Disaster Management Centre and a separate ministry for disaster management

(Jayawardena, 2006). Incidentally, the following activities which have been put forward by the policy document, “Towards a safer Sri Lanka- Road Map for disaster risk management” published by the Disaster Management Centre in 2005 focus on bridging the aforementioned gaps in the built environment.

- Review and revise the building approval procedures adopted by local government agencies to reduce the impact of natural disaster events.

- Integrate disaster risk mitigation into development processes through disaster mitigation plans, and specific allocation for mitigation in all development budgets.

    - Provide training and awareness raising on integrating DRM into development plans

- Mitigate impact of landslides and reduce risk through improvements and recommendations for structural mitigation.

- Protect against and control floods through improvements and new protection systems.

- Reduce disaster risk in all physical planning processes by integrating DRR in decision making on national land use and physical planning policies.

    - Protect against storm surges/ sea/ coastal flooding through green belt and incorporation of disaster risk considerations in coastal zone management
    - Increase disaster resilience in housing and other critical infrastructure through revisions in building codes and by laws
    - Reduce dam-related hazard risks through appropriate dam safety regulations.

- Undertake research activities through universities and other institutes to arrive at the most suitable methods of construction in disaster prone areas.

However, Nateghi-A (2000) emphasises that disaster-resistant building codes are, unlikely to result in resistant buildings unless the engineers who have to implement the code accept its importance and endorse its use, understand the code and the design criteria required of them and unless the code is fully enforced by authorities checking and penalising designs that do not comply. Thus, land use planning, construction approval processes and construction procedures need to be supported by the construction professionals and authorities in a way that they meet their desired goal. Apropos, Chandradasa (2008) suggests amendments to the prevailing disaster management act to enable a speedy and smooth functioning of the disaster risk management mechanism.

In order to address the issues in training, education and awareness building related to disaster mitigation and reconstruction in the built environment, several activities have been proposed in Sri Lanka. In this context, the necessity of including "Building Guidelines for Infrastructure at Risk of Natural Disasters” in to the tertiary level curriculum has recently been pointed out as an important need (Gunaratnam cited DMC-SL, 2010). Further, to fulfil a long felt need in the curriculum of

vocational training and higher education institutions in the country, the Disaster Management Centre of Sri Lanka in collaboration with the country's UNDP Disaster Risk Management Programme has commenced working towards incorporating Disaster Risk Reduction concerns into the Civil Engineering curriculum of Technical Colleges. After the 2004 tsunami experience, almost all the Universities in the country have increased their interest on conducting research and development, providing policy assistance, carrying out data collection, storage and dissemination, and conducting continuing professional development courses in relation to disaster management (Jayawardena, 2006).

Similarly, the community involvement in disaster mitigation and reconstruction activities is attempted to increase through various programmes such as community based organisations and community-driven post-disaster reconstruction (Homeless International; Asian Disaster Preparedness Centre, 2003). The aforementioned factors indicate the major efforts towards minimising key problems related to disaster mitigation and reconstruction in the built environment in Sri Lanka. However, there are number of issues in bridging the capacity gaps which occur due to various political, social and cultural reasons.

5. Conclusions

Capacity gaps in the field of disaster management in general are common to disaster mitigation and reconstruction within the built environment as well. The tsunami on 26th December 2004 has drawn the attention of the government and the society of Sri Lanka towards many capacity gaps in the country's disaster management system.

Problems in the regulatory structure, deficiencies in necessary laws and regulations including problems in their implementation, and lack of required resources and skills are the major capacity gaps related to disaster mitigation and reconstruction within the built environment in Sri Lanka. Integration of disaster risk reduction into construction activities and new developments through adhering to regulations is not conducted as required converting the country's built environment to a more vulnerable status to disasters. Literature highlighted the loopholes in land use policies, building approval process, implementation of safe building regulations and practice of correct construction activities in the country. Further, lack of community involvement in mitigation and reconstruction activities, deficiencies in necessary skills and resources for safe and correct practices within the built environment and, lack of awareness on mitigation measures and reconstruction efforts are prevailing capacity gaps in the country.

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