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# Disaster Risk Reduction in the Built Environment in Sri Lanka- An overview

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## Abstract

Natural disasters have long-term implications on sustainable development. They mainly destroy the built environment thereby hindering economic and social development, and causing environment degradation. Reducing the risk of natural disasters within the built environment is therefore critical for ensuring sustainable development. The paper in this context, aims to assess the current state of disaster risk reduction in the built environment in Sri Lanka. Empirical data was collected employing semi-structured in-depth interviews which were conducted with a group of professionals who were involved in disaster risk reduction in the built environment in Sri Lanka. The data was analysed following thematic analysis. The paper reveals the current state of disaster risk reduction in the built environment requires to be improved to achieve a satisfactory level of success whilst highlighting a number of barriers that hinder the desired progress. Deficient funds and weak regulatory framework are identified as major barriers for successful implementation. Central and local government authorities are identified as the primarily responsible parties for disaster risk reduction in the built environment in Sri Lanka in the paper. The paper further presents various recommendations on how to improve the current situation.

**Keywords:** Built Environment, Disaster Risk Reduction, Sri Lanka

# **1. Introduction**

## **1.1 Background**

### **1.1.1 Natural Disasters**

Disasters are commonly defined as sudden events, which bring serious disruptions to society with massive human, material and economic or environmental losses or impacts, which exceed the ability of the affected society to cope with using its own resources (UN/ISDR, 2009a; Kelman and Pooley, 2004; Shaluf and Ahmadun, 2006). They are commonly divided into two main categories identified as natural and man-made (Eshghi and Larson, 2008). Shaluf (2007) identifies a third category as hybrid disasters that occur as a result of a combination of natural and man-made events. The largest category of disasters is related to natural events (Warren, 2010). Geophysical/geological, meteorological, hydrological, climatologically and biological disasters are all categorised as natural disasters.

Sri Lanka is prone to various natural disasters. The most frequent natural disasters in the country are floods, cyclones, landslides and droughts (DMC, 2005). Floods and landslides in the country are more localised and seasonal whilst droughts and cyclones are more widespread and occasional (Duryog Nivaran, 2009). However, the devastation caused by the Indian Ocean tsunami in 2004 highlighted that Sri Lanka is even vulnerable to low-frequency, high impact events which reverse years of development gains by causing extensive damage within a very short period of time.

According to the 2009 Global Assessment Report on DRR, the highest economic exposure, i.e., the amount of potential loss to the GDP due to natural hazards in Sri Lanka is in tsunami prone areas followed by flood zones (UN/ISDR, 2009b). The highest human exposure, the modelled number of people present in hazard zones that are subject to potential losses, is in drought zones. The Risk Profile of Sri Lanka for tropical cyclones, floods and landslides shows that landslides contribute to the highest score on vulnerability index (estimated number of people killed per year) (PreventionWeb, 2012).

### **1.1.2 Damages from natural disasters**

Natural hazards have caused an enormous amount of death and destruction around the world (UN/ISDR, 2012; Wickramaratne et al., 2012; IPU, 2010; Smith and Petley, 2009). In particular, natural hazards such as earthquakes, droughts, floods, storms and tropical cyclones, wild fires, and volcanic eruptions have caused major loss of human lives and livelihoods, the destruction of economic and social infrastructure, as well as environmental damage (UN/ISDR, 2001). According to statistics, the 2004 Indian Ocean tsunami was the most disastrous, individual event in the recent history of Sri Lanka. It killed 35,399 people adding up to more than 95 percent of the total deaths during 1980-2010 in the country whilst the estimated economic damage resulting from the event was US\$ 1316.5 million which was more than 75

percent of the total economic damage caused during the aforementioned thirty years (EM-DAT, 2012). Table 1 illustrates the damages caused by natural disasters in Sri Lanka during the period of 1980-2010.

Table 1: Damage by natural disasters reported during 1980-2010 in Sri Lanka

Recorded Damages	
No of events	62
No of people killed	36,982
Average killed per year	1,193
No of people affected	17,457,668
Average affected per year	563,151
Economic Damage (US\$ x 1,000)	1,674,364
Economic Damage per year (US\$ x 1,000)	54,012

It is evident that the majority of human and economic losses from natural hazards occur as a result of damage to the built environment (Max Lock Centre, 2009; Benson and Twigg, 2007, Ofori, 2002). The losses from the 2004 tsunami in Sri Lanka included more than 100,000 completely destroyed or damaged houses (UN-HABITAT, 2012), and damages to nearly 200 educational facilities, 100 health facilities, hundreds of kilometres of roads and railway tracks and about 500 various tourism related facilities such as hotels and coastal restaurants (TAFREN, 2005). Thus, the ability of the built environment to withstand the impact of hazards plays a direct role in determining the casualties and monetary costs of disasters (Duque, 2005; Mileti, 1999). In other terms, disaster risk reduction in the built environment (DRR in the BE) is critical in reducing the overall risk of natural disasters.

### 1.1.3 Disaster risk reduction in the built environment

Disaster risk reduction (DRR) in general has been defined as “the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events” (UN/ISDR, 2009a, p.10). The close links between characteristics of the built environment and risk of natural disaster through the definitions since the definition indicate factors such as reduced exposure, lessened vulnerability of property wise management of land and the environment. The built environment is identified as the interdisciplinary sector which is responsible for planning, design, construction, maintenance and regulation of human made buildings and structures in the paper. It encloses processes as well as products within its scope.

According to Amaratunga and Haigh (2013), the products and processes of the built environment can support the society in combating the threat of natural disasters through six different modes, namely; construct, develop, stimulate, facilitate, protect and nurture. In this

context, the aforementioned supportive role or the ability of the built environment to withstand the impacts of natural hazards can be enhanced by designing, developing and managing context sensitive buildings, spaces and places that have the capacity to resist or change in order to reduce hazard vulnerability and enable society to continue functioning, economically and socially, when subjected to a hazard event (Haigh and Amaratunga, 2011). Accordingly, DRR in the BE is defined in the paper as the systematic efforts to plan, design, construct, maintain and regulate context sensitive buildings, spaces and places, that are least susceptible to natural hazards and have the capacity to minimise the exposure of the society to natural hazards.

#### **1.1.4 Progress of disaster risk reduction in the built environment in Sri Lanka**

The Indian Ocean tsunami in 2004 urged Sri Lanka to shift from a response based disaster management approach to a more proactive approach to disaster management (DMC, 2005). In particular, it highlighted the need for mainstreaming DRR into the country's development activities. Having identified the significance of a disaster resilient built environment, the Roadmap for Disaster Risk Management, which was published by the Disaster Management Centre (DMC) in 2005 in the aftermath of the 2004 tsunami, identified landslide mitigation in risk-prone areas, flood protection for major cities, disaster mitigation action plans, integration of DIA (Disaster Impact Assessment) into all development projects, integration of disaster risk considerations into national land use and physical planning policy, integration of disaster risk considerations into coastal zone management, and disaster risk and vulnerability reduction by adopting mitigation measures in planning and construction of buildings and infrastructure facilities as the main steps towards mainstreaming DRR into development within the built environment (DMC, 2005).

However, there are problems in the implementation of the aforementioned steps and therefore, mainstreaming DRR into BE is still at a progressive level in Sri Lanka. According to a publication by the Asian Disaster Preparedness Centre (ADPC, 2009) on Mainstreaming DRR into the Sri Lankan Housing Sector, various technical guidelines and manuals that have been developed for housing construction following the 2004 Indian Ocean Tsunami were not much used due to the lack of awareness and legal enforcement (ADPC, 2009).

Furthermore, the extent of public consultation regarding DRR is not satisfactory in the country. According to a report by the Asia Pacific Forum on Women, Law and Development (APWLD, 2005) which analysed the response, recovery and rebuilding efforts of Sri Lanka seven months after the 2004 tsunami paid special attention to the lack of consultation with affected people and their preferences in the construction of permanent housing, including housing design, building materials, etc. The report noted that shifting from a process of telling people what they could have to one in which people were asked what they wanted was a task that most officials, government and non-governmental were ill prepared to implement. It was further suggested that aspects such as the layout of resettlement communities, i.e. the distance between houses etc., should evolve from a process of consultation with the community and with experts in the field (APWLD, 2005).

However, Sri Lanka is gradually recognising the importance of listening to the views and suggestions of people for implementing DRR proposals. ADPC (2011), in its report for Mainstreaming DRR into the housing sector in Sri Lanka- Phase 2, admits that the site selection for housing development projects in Sri Lanka are generally undertaken on the basis of the availability of land, rather than suitability, and taking into considering the views of beneficiaries. The National Housing Development Authority (NHDA) has instituted meetings with house owners, to obtain their views and suggestions, as an important step in the planning stage of its programme for mainstreaming DRR into selected housing projects (ADPC, 2011). It is emphasised in the report that these meetings are important as the people who are going to live in the houses are aware of the prevailing hazards, surrounding conditions and traditional ways of construction.

## **1.2 Aim**

Having identified the important role the built environment performs in reducing the risk of natural disasters, assessing the progress of DRR in the BE in Sri Lanka was recognised as a timely need. Accordingly, a research problem was raised as ‘what is the status of DRR in the BE in Sri Lanka?’ The paper aims to address the aforementioned problem and examine the status of DRR in the BE in Sri Lanka.

## **2. Research methodology**

The research design of the study was qualitative in nature. It incorporated a social constructivism view point to look at the research problem and associated with ontology of constructionism and epistemology of interpretivism. A comprehensive literature review was conducted to establish the knowledge of the associated concepts and their relationships pertaining to the study prior moving to primary data collection. The following sub-sections describe the methods and rationale of method selection for primary data collection and data analysis.

### **2.1 Primary data collection**

According to Kvale (2007), conversation is a superlative mode of getting to know about other people’s experiences, feelings and expectations of the world in which they live. Thus, an interview conversation facilitates a researcher in asking what other people think about the focus of the research problem. Easterby-Smith et al. (2008) suggest that it is important not to structure the interpretation that the interview participants attach to the issues and situations in context, in advance of the researcher. However, it is not advisable to allow the interviewee to talk without any interruption or intervention by the interviewer because it might direct the interviewee to base his views or opinions on too many assumptions leading to poor data which is difficult to interpret (Easterby-Smith et al., 2008). Further, interviews without a structure or a

specific direction can consume a significant amount of time. Hence, it is preferable to have the interviews structured to a certain degree in a research study. Therefore, semi-structured interviews were selected as the data collection method for this study.

The interviews were conducted in two rounds in the research study. The first round, which was executed as a pilot study, facilitated refinement of the interview guideline and familiarising with the interview process. It contained six semi structured in-depth interviews which were conducted with professionals composed of policy makers and practitioners involved in DRR in the BE in Sri Lanka. The second and the main round of interviews comprised of ten semi structured in-depth interviews. The interviews were designed to obtain the respondent's views on the status of DRR in the BE in Sri Lanka. Table 2 provides details of the interviewees with the abbreviations used to differentiate them in the writing up of the data analysis.

Table 2: *Interviewees' details*

Category	Number of Interviewees	Organisations
Policy Makers	03	Disaster Management Centre (DMC) National Building Research Organisation (NBRO)
Academics	03	University of Moratuwa University of Peradeniya
Practitioners	04	United Nations Development Programme (UNDP)- Sri Lanka Sri Lanka Red Cross Society International Federation of Red Cross and Red Crescent Societies (IFRC) Sri Lanka Delegation

## 2.2 Data analysis

It is suggested that the most common approach to qualitative data analysis is the analysis of themes (Bryman, 2008; Braun and Clarke, 2006; Ely et al., 2005). Therefore, thematic analysis was selected as the most appropriate analytic technique for the study. The underlying mechanism of thematic analysis is a search for themes that emerge as being important to the description of the phenomenon (Fereday and Muir-Cochrane, 2006). Braun and Clarke (2006) provide a detailed account of the process of thematic analysis categorising it into six phases. Table 3 summarises the six phases.

Table 3: Phases of thematic analysis (Source: Braun and Clarke, 2006)

Phase	Description of the process
Phase 1: Familiarising with the data set	Transcribing data (if necessary), reading and re-reading the data, noting down initial ideas
Phase 2: Generating initial codes	Coding interesting features of the data in a systematic fashion across the entire data set, collating data relevant to each code.
Phase 3: Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme.

Phase 4: Reviewing themes	Checking if the themes work in relation to the coded extracts (Level 1) and the entire <i>data set</i> (Level 2), <i>generating a thematic 'map' of the analysis.</i>
Phase 5: Defining and naming themes	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
Phase 6: Producing the report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back to the analysis of the research question and literature, producing a scholarly report of the analysis.

NVivo9 software was used to aid the data analysis process. Using computer software to aid the data analysis process ensures the analyst works more methodically, more thoroughly and more attentively (Bazeley, 2007). NVivo offers two significant features over the other qualitative data analysis software, namely, facility to store analytic memos produced by the researcher while interacting with data, and the ability to provide a visual display of the coding system in the form of a hierarchical tree structure (Easterby-Smith et al., 2008).

The study followed thematic analysis and combined inductive reasoning and abductive reasoning in order to build systematic, explanatory accounts from concepts and meanings embedded in the interview responses.

The interview responses illustrated various dimensions of the status of DRR in the BE in Sri Lanka. Accordingly, the data was categorised into five main groups following thematic analysis with their associated sub groups as illustrated in Figure 1. The five main data categories were state of progression, drawbacks, implementation procedures, improving DRR in the BE and responsible parties for DRR in the BE. As visible from the figure, there are four data categories in the theme that have been sub-divided into additional categories of data. The subcategories were created to present different types of the same data category with the intention of improving the clarity and detail of data. The following sub-sections summarise the data analysis of each category of interview responses.

### 3. Findings

Following four sub-sections summarise the findings of the analysis of interview data under the aforementioned five categories.

#### 3.1 What is the current situation of DRR in the BE?

The interviewees provided mixed opinions about the current state of DRR in the BE in Sri Lanka. Some of the respondents stated that they are satisfied about the progress whilst other suggested that DRR in the BE has not yet achieved a satisfactory degree of success. However,



most of the interviewees agreed that DRR in the BE is continuously improving. Simultaneously, the interview response indicated that the progress of DRR is slow in the country despite its continuous advancement.

### **3.2 What are the ways of implementing DRR in the BE?**

This category identified data that provided an understanding about various procedures and practices which facilitate DRR in the BE in Sri Lanka.

The Environmental Impact Assessment (EIA) process in Sri Lanka was the most commonly cited individual procedure of the interviewees for integrating DRR into the built environment. The respondents considered the EIA procedure, which is adopted to check the impacts of environmentally

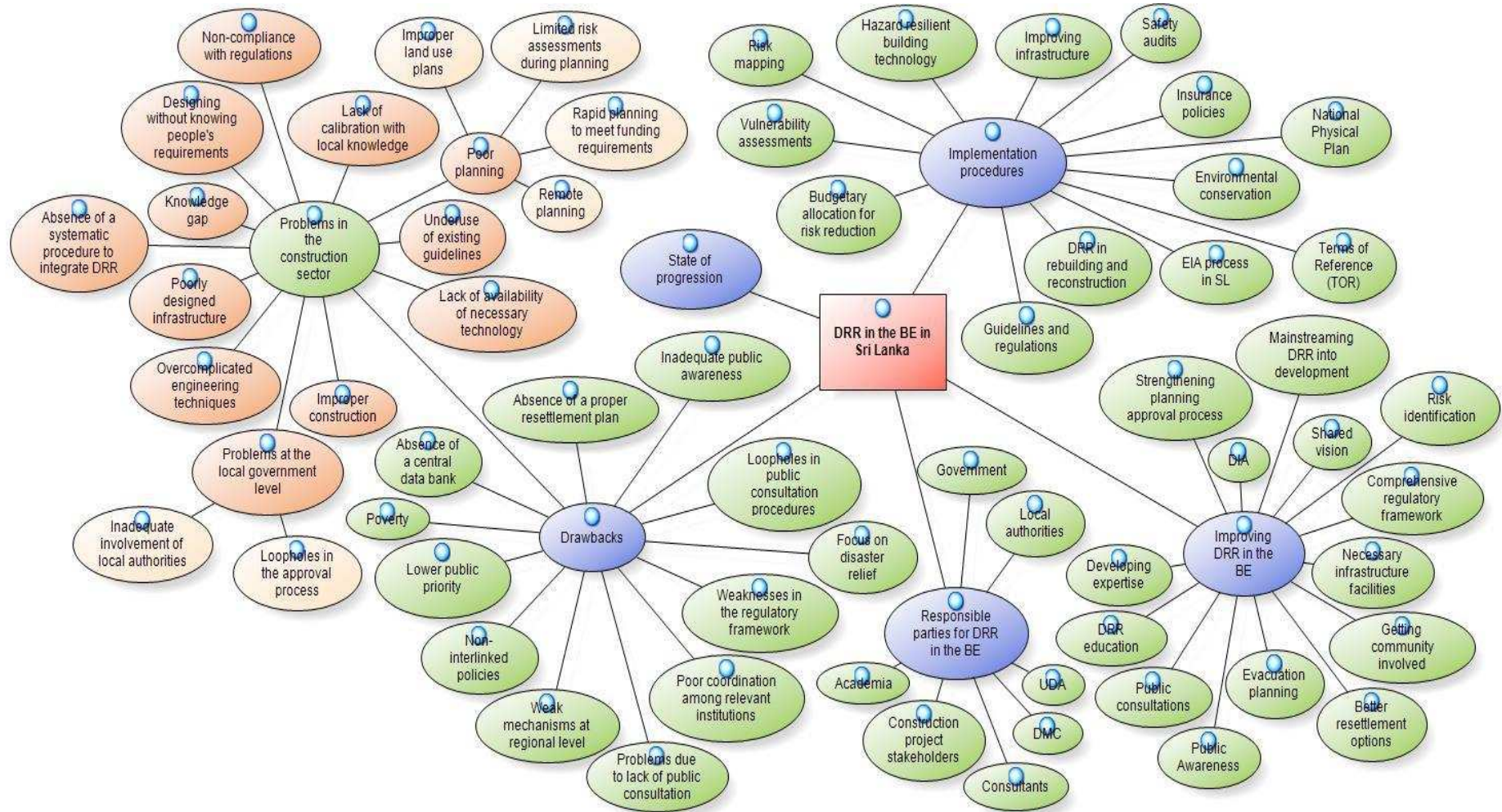


Figure 1: Thematic map- DRR in the BE in Sri Lanka

sensitive new development projects, has the capacity of examining the risks of natural disasters simultaneously. In addition, following factors were identified as the modes of implementing DRR in the BE in Sri Lanka.

### **3.3 What are the prevailing barriers to DRR in the BE?**

As indicated in Section 3.1, there was a consensus among the respondents of underperformance of DRR in the BE in Sri Lanka at present. In this context, the interviews highlighted the problems that have been indicated as the reasons for the present situation of DRR in the BE.

The country's poverty was illustrated as a significant drawback to achieving DRR in the BE. Emphasising the strong connection between poverty and disaster vulnerability, it was suggested that raising the country's built environment to a satisfactory level of disaster resilience is a significantly difficult task. Further, the weakness of the regulatory framework of the country was also cited as a key reason for to poor implementation of DRR in the BE. For example, the loopholes in public consultation procedures were seen as a problem to achieving comprehensive DRR in the BE because it prevents constructive public input that could facilitate prevention of increased risk of disasters due to development plans.

A comprehensive list of barriers to DRR in the BE identified through the interviews is presented below. The barriers were divided into two main categories as general barriers and barriers occur due to the problems in the construction sector of the country.

#### **3.3.1 Barriers in general**

- Poverty
- Weakness of the regulatory framework
- Absence of a central data bank
- Focus on disaster relief
- Inadequate public awareness
- Problems due to lack of public consultation
- Loopholes in public consultation procedures
- Lower public priority for DRR
- Non-interlinked policies

- Poor coordination between relevant institutions
- Weak mechanisms at regional level
- Absence of a proper resettlement plan

### **3.3.2 Problems specific to the construction sector**

- Absence of a systematic procedure to integrate DRR
- Poor quality construction
- Poorly designed infrastructure
- Non-compliance with the regulations
- Underuse of existing guidelines
- Lack of technology
- Complicated engineering techniques
- Knowledge gap of key stakeholders in relation to DRR
- Designing without knowing peoples' requirements
- Lack of calibration with local knowledge
- Poor planning
  - Improper land use plans
  - Limited risk assessments during planning
  - Rapid planning to meet funding requirements
  - Remote planning from the location
- Problems at the local government level
  - Inadequate involvement of local authorities
- Loopholes in the approval process

### 3.4 How to improve DRR in the BE?

Various remedies were suggested to improve the substandard performance of DRR in the BE. The most commonly suggested way for improvement was to strengthen the regulatory framework which governs DRR in Sri Lanka. As mentioned under the barriers, weaknesses in the existing regulatory system was seen to be a major hindrance to successful DRR in the BE. In this context, three interviewees mentioned an important procedure called Disaster Impact Assessment (DIA) that has been proposed for integration into the current EIA process in order to specifically address the impact of disasters on new developments. Overall, the following ways were recommended to improve the current situation.

- Strengthening initiatives for mainstreaming DRR into development
- Creating a shared vision about DRR among all stakeholders
- Improving the regulatory framework to comprehensively address DRR issues
- Developing DRR expertise among professionals
- Providing DRR education for stakeholders, i.e. construction professionals, policy makers
- Raising public awareness of DRR in the BE
- Getting the community involved in DRR initiatives
- Strengthening development planning approval process integrating DRR
- Implementing strict public consultation procedures in development approval processes
- Conducting adequate risk assessments
- Integrating disaster impact assessments
- Providing better resettlement options for disaster prone communities
- Developing/improving infrastructure to increase resilience
- Developing adequate evacuation arrangements

### 3.5 Who are the responsible parties?

The analysis of the interview data was able to identify the responses which indicated the entities who are responsible for country's DRR in the BE. The majority of the respondents agreed that the primary responsibility for ensuring DRR in the BE lies with government institutions and local authorities because they possess the policy making and regulatory powers. Table 4 provides an overview of responsible parties for DRR in the BE and their respective roles as suggested by the empirical investigation of the study.

Table 4: Responsible parties for DRR in the BE and their roles

Responsible party	Role
Central Government (Ministries-Construction, Disaster Management; Other authorities- DMC, UDA, etc.)	<p>Formulating policies and protocols (regulations, guidelines, etc.) to integrate DRR into development including protocols for mainstreaming women into DRR in the BE</p> <p>Monitor protocols and required standards in development activities to ensure they are met</p> <p>Educate children by modifying school curriculums to incorporate the importance of DRR and associated processes</p> <p>Training and development/ modification of higher education/vocational education curriculums to develop expertise of DRR and expertise related to the social components for mainstreaming women into DRR in the BE</p> <p>Raising public awareness of DRR and the importance of mainstreaming DRR into the BE</p>
Local authorities	<p>Ensuring DRR is integrated into development activities through the building approval process</p> <p>Studying the risks and vulnerabilities of the locality</p> <p>Ensuring the DRR needs and knowledge of local communities are addressed in development</p>
Divisional Secretariat/ government representatives at village level	<p>Acting as a point of contact for government authorities or/and parties involved in a development to get an initial idea about the locality, its risks and vulnerabilities and approaching local communities to capture their DRR knowledge and needs</p> <p>Representing the interests of the local community</p>
Academia and the scientific community	<p>Researching DRR measures and initiatives that could increase the resilience of the built environment</p> <p>Developing guidelines</p> <p>Raising awareness of various public groups by dissemination of research findings</p> <p>Counselling relevant parties, including government bodies, through advisory committees on DRR and mainstreaming DRR into the BE</p>

	Developing databanks containing useful information on DRR in the BE
Construction stakeholders (Developers/owners, construction professionals, building contractors)	Ensuring DRR is integrated into development activities by conforming to relevant regulations, standards, and guidelines  Acknowledging the importance of integrating local community to DRR in the BE
Public	Ensuring the DRR knowledge and needs are addressed in development and development activities  Participating in DRR initiatives (community consultations, etc.) when necessary and voicing their viewpoint
Public representatives	Representing the DRR knowledge and needs of vulnerable segments of the local community  Influencing the relevant authorities and parties responsible for development activities using their political authority to integrate adequate DRR measures into BE
Religious leaders	Acting as a point of contact for government authorities and/or parties involved in a development to obtain an initial idea about the locality, its risks and vulnerabilities  Representing the DRR knowledge and needs of the local community  Encouraging the local community and its groups to impart their knowledge of DRR and their needs and to participate in community consultations
Networks of NGOs	Contributing to DRR initiatives and associated processes using their knowledge and expertise of the subject  Representing the DRR knowledge and needs of the local communities

## 4. Conclusions

The paper assessed the current situation of DRR in the BE in Sri Lanka including different ways of implementation, and investigated the prevailing barriers, ways of improving the current situation and responsible parties in order to provide an overview.

The study revealed that the current state of DRR in the BE in Sri Lanka has not reached a satisfactory level yet although it is continuously improving. It indicated that the progress of DRR in the BE in the country is lacking its desired pace due to various barriers. The country's poverty was illustrated as a significant drawback to achieving DRR in the BE whilst the weakness of the regulatory framework of the country was also identified as a key reason for poor implementation of DRR in the BE.

The EIA process in Sri Lanka was highlighted as the most powerful currently available mechanism of integrating DRR into development activities within the built environment. The study suggested various remedies to improve the substandard performance of DRR in the BE.

The most commonly suggested way for improvement was to strengthen the regulatory framework which governs DRR in the BE in Sri Lanka. Central government, government institutions and local authorities were identified as the primarily responsible parties for DRR in the BE in Sri Lanka.

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