Framework for capacity building for post disaster construction & demolition waste management at national level

Gayani Karunasena,
Department of Building Economics, University of Moratuwa
(email: gayanik@uom.lk)
Dilanthi Amaratunga,
School of the Built Environment, University of Salford
(email: r.d.g.amaratunga@salford.ac.uk)
Richard Haigh,
School of the Built Environment, University of Salford
(email: r.p.haigh@salford.ac.uk@salford.ac.uk)

Abstract

The entire world is facing frequent and severe disasters In a disaster, generation of waste is unavoidable and critical as it differs from a normal situation in terms of quantity and composition Thus, improper waste management is a major environmental issue in any post-disaster scenario, specifically when it is contaminated with toxic substances leading to environmental degradation and health problems Therefore, measures to control waste generation and management of waste are needed for proper disaster waste management, being an important aspect of the entire process of disaster management Literature revealed capacity gaps in disaster waste management emphasizing the importance of capacity building for post disaster waste management in Sri Lanka Thus this paper presents framework for capacity building for post disaster waste management with special emphasis on C&D waste at national level entities in Sri Lanka Data were gathered through semi structured interviews conducted with experts representing Government, Non government and other sector organizations involved in post disaster waste management Capacity gaps such as fewer opportunities for career development, unawareness, lack of incentives are identified at individual level while unavailability of formal procedures for preparation, monitoring and evaluation of programmes/ projects, policy issues such as unenforceability, inadequate government support and unavailability of institutional arrangement are identified at entity level Framework for capability building in disaster C&D waste management was presented, with suggested approaches to overcome identified capacity gaps Framework can assist national entities involved in disaster waste management to focus on specific capacity building processes based on their institutional priorities It contains evaluated approaches to enhance capacities, providing flexibility to initiate capacity building at different levels such as individual, team, programmes, projects, entity or network of entities and in different contexts than disaster waste management It guides national entities involved in post disaster waste management to enhance their capacities for effective and efficient processes of post disaster waste management with special emphasis to C&D waste

Keywords: Disaster waste, Construction & demolition waste, post disaster, capacity building

1. Introduction

Management of disaster waste is identified as an area of least concern yet it presents momentous challenges for disaster management those with inadequate capacities due to the large volume and hazardous constituents created US Federal Emergency Management Agency (FEMA) and Environment Protection Agency (EPA) identify physical damages that create enormous amounts of demolition waste through destruction of buildings and infrastructure as a grave consequence of disasters (USEPA 1995; 2008; FEMA 2007 Brown et al, (2011a) revealed that construction and demolition (C&D) waste as the major component in most cases of disaster waste such as Fukushima earthquake and tsunami in 2011, Haiti earthquake in 2010, Hurricane Katrina in 2005 and Indian Ocean tsunami in 2004 Pike (2007) concluded that approximately 55% of the US FEMA's federal disaster spending is directed towards immediate relief including waste removal, such as in the case of post - Hurricane Katrina in year 2005 UNEP (2005), USEPA (2008) and Brown et al, (2011a) justify such enormous expenditure due to overwhelming impacts on existing solid waste management facilities that compel communities to use disposal options that are otherwise not acceptable Within this context, disaster waste emerges as a critical issue in responding to a disaster Brown *et al* (2011b) indicate that disaster debris impacts public and environmental health as well as rescue and emergency services such as provision of lifeline supports and social and economic recovery of affected areas (Brown and Milke 2009; Brown *et al*, 2010)

Brown *et al* (2011a) revealed number of gaps in existing legislation, organisational structures and funding mechanisms related to disaster waste management Thus, emerges the importance of designing early stage strategies for disaster waste management with predefined disaster waste management procedures, adequate capacities of local areas, identified recyclable material and disposing sites for sustainable disaster waste management (Baycan and Petersen, 2002; Baycan 2004; Basnayake *et al*, 2005; UNDP 2006; Ekici, 2009; Moe, 2010; Brown *et al*, 2011a), anchoring these strategies to national disaster waste management policies with flexibility for further development to ensure continuity and sustainability (Shaw and Sinha, 2003; Baycan and Petersen, 2002; Joint UNEP/OCHA 2010) In this context, this paper aims to present an theoretical framework for capacity building for post disaster C&D waste management to attain sustainable post disaster C&D waste management for future resilience Next section of the paper presents the brief overview on post disaster C&D waste management

2. Post disaster C&D waste management

Disaster C&D waste management is, without a doubt, one of the main environmental concerns within a post disaster scenario Brown et al (2011a) state that disaster debris comprised of largely inert buildings and vegetative material generated by a disaster Typically, C&D waste is comprised of asphalt, brick, tiles, concrete, mortar, reinforced concrete, rock, rubble, sand, soil, bamboo, ferrous and non-ferrous metal, glass, fixtures, plastic, slurry, mud, trees, wood and other organics and debris (Poon et al , 2001)

Further classify disaster C&D waste as the largest component of urban disaster waste and a common type of waste generated in all types of disasters When contaminated with toxic substances such as lead, asbestos, arsenic, gypsum and organic pollutants it becomes hazardous (USEPA, 1995; FEMA, 2007) Kourmpanis et al (2008) say that it is a priority waste stream that needs effective management due to non degradable components that lead to environmental degradation and health problems

Post disaster C&D waste management includes collecting, transporting, processing and disposing of C&D waste generated by disasters, partial demolitions and reconstruction during the relief, rehabilitation and reconstruction phase of the disaster waste management cycle

Scope of this paper has limited to debris generated from totally or partially damaged buildings and infrastructure as a direct impact of disasters or from demolished buildings and infrastructure at rehabilitation or early recovery stages Waste generated during the reconstruction phase of the post disaster management cycle is not considered to be disaster C&D waste as mostly it is not contaminated and easy to manage

3. Post disaster C&D waste management in Sri Lanka

Sri Lanka is prone to natural disasters commonly caused by floods, cyclones, landslides, droughts and coastal erosion for generations with increasing losses of life and property (Jayawardane, 2006) Indian Ocean tsunami in 2004 is widely acknowledged as the largest and most devastating natural catastrophe in the history of Sri Lanka, being extremely hard-hit in terms of loss of life, infrastructure and economic assets (Joint report, 2005; UNDP, 2006)

Unlike in the case of floods and landslides where waste is managed by usual municipal waste management authorities, Indian Ocean tsunami in 2004 created significant quantity of disaster waste challenging national and local capacities (Joint UNEP/OCHA, 2005) United Nations Environment Protection Report (2005) revealed that in Sri Lanka about 100,000 houses was destroyed generating about 450,000 tons of waste Basnayake et al (2005) stated that a cost of US$ 5-6 million approximately was incurred for management of debris in Sri Lanka, where waste was not properly disposed, reused or managed (UNEP, 2005) Uncontrolled open air dumping and open burning of waste caused significant negative public health and environmental impacts through contamination of soil and groundwater, increased vermin presence and negative odour and visual impacts (EC, 2006; Jayawardane, 2006; Basnayake et al, 2005; UNEP 2005) Disaster C&D waste is not recycled and reused at its optimum capacity in Sri Lanka, instead disposing them to landfill sites (UNEP 2005) Pasche and Kelly (2005) state that collected disaster waste having a considerable portion of C&D waste is often disposed at “unplanned landfills in environmentally sensitive sites” Risks to public and environment by prolonged exposure to disaster waste after the Indian Ocean tsunami in 2004 is highlighted by Srinivas and Nakagawa (2008)

Waste removal programs conducted at local levels in collaboration with NGOs do not consistently meet current best practices due to lack of guidance, practical procedures and resources (Shaw, 2003; Martin, 2007) Absence of enforceable national legislation on disaster waste management further aggravated issues related to waste removal these matters In Sri Lanka, Disaster Management Act (Act No 13 of 2005) enacted after the Indian Ocean tsunami in 2004 does not contain any provisions on management of disaster waste although it provides a legal basis for disaster risk management Disaster waste management challenges faced after the Indian Ocean tsunami in 2004 include exposed coastal dumping sites, waste burning, insufficient landfills, lack of coordination and environmental effects on ground water, further aggravated by lack of financial and intellectual capacities such as knowledge, expertise and training related to disaster waste management (Basnayake et al, 2005; Pilapitiya et al, 2006; Srinivas and Nakagawa, 2008) National Disaster Management Centre of Sri Lanka accepted that capacities of Sri Lankan institutions are inadequate for successful disaster management (DMC, 2009a) Importance of capacity building to mitigate damages cause by improper coordination and immature organisational processes of related organizations and communities during disasters is thus highlighted (Keraminiyage et al, 2008; Baycan and Petersen, 2002; Hettiarachchi, 2007, UNEP, 2005; Brown et al, 2011), together with the importance of enhancing capacities of local government authorities (UNESCO, 2005)

Study on post-disaster waste management strategies by Karunasena et al, (2012) revealed that gaps in Sri Lanka such as, lack of single responsible authority including a hierarchical structure for disaster waste management, lack of pre-planned framework of rules and regulations that are enforceable by statute and mandatory, capacity constraints such as technology know how, funds, physical resources etc, management constraints such as communication and coordination among involved parties, poor government encouragement and idling of resources, lack of awareness, applicability of continuity and sustainable approaches and less research and development In this context, the literature established the necessity of capacity building when lack of financial, institutional and technological capacities and access to knowledge to deal with risks and benefits exist Thus, the necessity for capacity building within existing organisational structures, funding mechanisms, management and technical capacities and legal aspects for post disaster C&D waste management in Sri Lanka is established

Next section presents the research methodology adopted for the study

4. Research Methodology

Expert interviews were conducted to gather data for the proposed framework for capacity building in C&D waste management at national level Semi structured interviews were adopted as the mode of data collection as it provided opportunities for respondents to express their opinion without interruptions maintaining the focus of interview Seven individuals were selected based on their experience of post disaster waste management especially C&D waste Profiles of the expert interviewees are presented in table 1

Table 1: Profiles of expert interviewees

Entity	***Expertise***
Solid Waste Management Authority	*Solid waste management*
Environmental Foundations Ltd	*Environmental protection*
World Wildlife Fund	*Environmental management*
Ministry of Local Government & Provincial Councils	*Municipal & local waste management*
International Federation of Red Cross and Red Crescent Societies	*Post reconstruction*
Department of Irrigation	*Flood hazard management*
National Building Research Organisation	*Landside hazard management*

Evaluation of the proposed framework was conducted based on the opinion of experts gathered through interviews Three experts were selected based on their expertise in post disaster waste management, specialising in C&D waste representing all stakeholders in disaster management Two of the three experts were selected from the Disaster Management Centre (DMC) and Central Environment Authority (CEA), as they represent key government entities involved in disaster management and environmental protection, being responsible for development of related national policies The remaining expert was selected from the Ministry of Local Government and Provincial Councils, responsible for development of local authority level policies Semi structured interviews were conducted with prior oral demonstrations of the proposed framework to obtain expert opinion on the practicability of proposed approaches and suggestions for further improvement

5. Research findings

5.1 Evaluated approaches for capacity building for identified capacity gaps in post disaster C&D waste management

Evaluated approaches for capacity building for identified capacity gaps are summarised at table 2

Table 2: Evaluated approaches for capacity building for post disaster C&D waste management

Capacity gaps	***Approaches***
Lesser opportunities for career development	*Provide more opportunities for career development, such as local and international exposure with more incentives to attract and retain staff*
Lack of formal procedures for preparation, conducting, monitoring and evaluation of training and awareness programmes	*Develop an expert knowledge database on disaster waste management* *Establish formal procedures to prepare, conduct, monitor and evaluate local and foreign programmes*
Lack of provisions for disaster C&D waste management	*Incorporate disaster waste mgt into existing solid waste management practices, policies and authorities*
Lack of single point responsibility	*Restructure institutional practices allocating specific functions to each with single point responsibility*
Lack of formal procedure to establish linkages and collaborations	*Develop formal and transparent procedures to establish linkages and collaborations, at both local and international levels* *Enhance capacities of government sector to promote interactive working , specifically at local levels*
Lesser consideration for sustainable concepts within disaster management practices	*Train general public and officials on sustainable techniques with special emphasis on environmentally friendly, culturally supported mechanisms*
Inadequate government support	*Promote holistic approaches for implementing waste projects*
Loopholes in government rules and regulations on fund raising and procurement	*Enhance capacities of staff to obtain funds through project proposals*
Less consideration for environmental protection	*Provide incentives to recyclers and mobilization of peoples' support for recycling*
Lesser interest in research and development specifically in the government sector	*Establish resource centres with knowledge on new developments and adequate resources*
Inadequate opportunities for collaborative research	*Provide opportunities and incentives for collaborative research work* *Develop a research culture among staff*
Lesser transparency and accountability	*Decentralize the system within established rules and regulations*
Uniformity of prevailing centralized framework	*Appoint responsible persons at each level of the communication process*
Vacuum between relief and early rehabilitation	*Design framework for disaster C&D waste management through District Coordinating Committees* *Provide provisions for disaster waste management when preparing urban development plans*

In respect of skills and confidence building, opportunities for career development in disaster C&D waste management need to be established for suitable persons They include local and foreign exposure with necessary incentives Expert knowledge database on disaster waste management, including disaster C&D waste comprising of procedures to adhere to during national calamities need to be developed with the involvement of experts from all stakeholders in the country

National level policies, rules and regulations need to be revised to include disaster C&D waste management as prevailing rules do not address disaster debris, such as National Environmental Act and Wetland polices Further, national contingency plan for disaster waste management including C&D waste need to be established in collaboration with other entities, vesting single point responsibility with DMC Parallel to that National Steering Committees for disaster waste management involving all key players need to be appointed To suit above developments, both national and local level institutional structures need to be changed such as, design framework for disaster C&D waste management through District Coordinating Committees Further, prepare orders enforceable by law that clearly define responsibilities and functions of each institution This can be achieved through the decentralised system with established rules and regulations and appointing responsible persons for disaster C&D waste management at local level

Formal and transparent procedures need to be prepared to establish linkages and collaborations as well as conducting, monitoring and evaluating of projects and programmes on disaster C&D waste management

Create awareness among general public and train officials on sustainable, environmentally friendly and culturally supportive techniques for disaster C&D waste management Create awareness programmes on how to convert waste into profitable businesses, such as promoting holistic approaches to initiating projects such as recycling of C&D waste along with composting Further, introduce a scheme to provide incentives for public to promote reusing of reusable materials for rebuilding process

As revealed by experts', though provisions for waste management already incorporated in urban developments plans, provisions for disaster C&D waste management need to be incorporated

6. Conclusions

Disaster waste has become a crucial issue not only in Sri Lanka but also in worldwide due to the increase of number of disasters. Thus, it is a challenge, which has to be faced by local governments in order to minimise or manage waste following a disaster In Sri Lankan context, findings revealed that contribution for disaster waste management is very less and number of gaps which are prevailing in disaster waste management process lead to an improper management of waste after a disaster

Capacity gaps such as fewer opportunities for career development, lack of awareness and lack of incentives are identified at individual level while lack of formal procedures for preparation, monitoring and evaluation of programmes/ projects, policy issues such as powerlessness, inadequate government support and lack of institutional arrangements are identified at national entity level The evaluated framework for capability building in disaster C&D waste management was presented, with suggested approaches to overcome the capacity gaps identified Table 2, illustrates the findings of the evaluated framework based on experts' opinion comprising approaches for capacity building in post disaster C&D waste management

Further, evaluated approaches for enhancing capacities, also provide flexibility to initiate capacity building at different levels such as individual, team, programmes, projects, entity or network of entities and in different contexts than disaster waste management

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