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Chapter 32

Capacity Gaps in Post Disaster Waste Management: Case study in Sri Lanka

Gayani Karunasena and Dilanthi Amaratunga,

Abstract Disaster waste is one of the major consequences aftermath of any disaster, impacts on public and environment, rescue and emergency services, provision of lifeline support and socio-economic recovery of affected areas. Thus, management of wastes created by disasters has become an increasingly important issue to be addressed in responding to a disaster. This chapter intends to present the prevailing gaps in disaster waste management and approaches to minimize the impacts on disaster management at developing countries with special emphasis to Sri Lankan context. Findings revealed that, unavailability of single point responsibility and provisions for disaster waste in existing policies and capacity constraints of the prevailing peace time solid waste management practices as major capacity gaps. Establishment of a regulatory body and enforceable rules and regulations with necessary levels of capacities were identified with seven areas for capacity building for post disaster waste management. The research enabled to attain sustainable post disaster waste management for future resilience.

Key Words Disaster waste, capacity gaps, post disaster

32.1 Disaster Waste and it's Importance

Increasing nature of impacts from disasters has made post disaster management a key area of concern. 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, in particular in developing countries. Shibata et al., (2012) highlighted that Great East Japan earthquake and tsunami occurred in 2011, estimated generated waste in Fukushima prefecture is 16 million tons which was equivalent to 14 years of waste generation. Brown et al., (2011a) state that disaster debris impacts not only public and environment but also on rescue and emergency services, provision of lifeline support and socio-economic recovery of affected areas. Haiti earthquake in 2010, Victorian bushfires in 2009, hurricane Katrina in 2005 and Indian Ocean tsunami in 2004 area few disasters that generated large volumes of waste overwhelming existing solid waste management capacities, requiring special approaches (Basnayake et al., 2005; Luther, 2008; Booth, 2010). Srinivas and Nakagawa (2008) mention of risks caused to public and environment by prolonged exposure to disaster waste after the Indian Ocean tsunami in 2004. Thus, management of wastes created by disasters has become an increasingly important issue to be addressed in responding to a disaster (Thummarukudy, 2012).

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Importance of focusing on long term ecological and economic sustainable waste management strategies for resilience to future disasters is emphasized by Blakely in year 2007. Further, many researchers have emphasized the importance of designing early-stage strategies to be

managed in the most environmentally sound manner possible, maximizing source reduction and recycling options and minimizing land disposal (Baycan and Petersen, 2002; Brown et al, 2010; Brown et al, 2011a). Brown et al, (2011a) further argued that most existing plans on disaster waste management provide more technical guide on how to manage with little guidance on decision-making and option consideration in different disaster situations.

In this context, this chapter focuses on gaps in post disaster waste management and presents the approaches to minimise the identified gaps. The scope of the chapter limited to the gaps created from natural disasters covering all types of waste with special emphasis to Sri Lankan context.

32.2 Capacities Needs for Post Disaster Waste Management

Recent decades has placed more focus on capacity building to increase resilience to natural hazards due to associated economic, social and environmental challenges. Capacity building dominates disaster management policies and practices in developing countries more vulnerable to disasters, particularly to impacts of climate change due to poverty, weak governance and ecosystem degradation (Webb and Rogers, 2003). Coping with disasters and enhancing capabilities of communities are termed as prior targets of vulnerable countries (Ozden, 2007). Hartwig et al., (2008) identify it as a key concept facilitating sustainability in developing countries. Boyd and Juhola, (2009) explained that it provides an opportunity to understand strengths, weaknesses, threats and opportunities towards a resilient future through identification of broader issues around sustainable development of a particular program, project or process, including unique cultural, social and ecological characteristics. Capacity building is necessary due to lack of financial, institutional and technological capacities and access to knowledge to deal with risks and benefits (Ayele and Wield, 2005).

It is impractical to initiate capacity building programs solely for disaster waste management, as it is necessary to enhance sustainable post disaster waste management systems. According to Brown et al (2011a) sustainability of disaster waste management systems depend not only on required technologies or guides but also on development of institutional and human capacities that enhance preparedness and responses to future disasters. Institutional capacities need to be built to prevent, prepare and respond to disasters, enhancing resilience of disaster-affected communities (Baycan and Petersen, 2002; Tadele and Siambabala, 2009). Intervention of communities can be more successful, leading to genuinely positive impacts on human well-being, building on local knowledge and existing capacities (Allen, 2006). Many highlighted that capacity building of local level governments, particularly in developing countries is also essential (Peterson, 2004; United Nations Development Program(UNDP), 2006; Bjerregaard, 2007). Apart from that Milke (2011) pointed out the important processes of capacity building such as development of educational modules for processing, storage and disposal of post disaster waste and development of a free database and information source for disaster waste management.

32.3 Study Background and it's Post Disaster Waste Management

Sri Lanka prone to natural disasters such as floods, windstorms, landslides and droughts. A

cyclone in 1978, floods and landslides in 2003 and tsunami in 2004 were major disasters that caused immense damage, interrupting economic and social activities of affected areas (Disaster Management Centre (DMC), 2005a). In addition, various human-induced hazards are caused by deforestation, indiscriminate coral, sand and gem mining and industrial pollutants (DMC, 2005b). Three decades of ethnic war also has cast huge economic and human impacts. Indian Ocean tsunami in 2004 is widely acknowledged as the largest, most devastating natural catastrophe reported in the history of Sri Lanka.

Floods, droughts and landslides are frequent natural disasters managed by local government authorities except in case of critical disasters. Subsequent to Indian Ocean tsunami in 2004, recognizing the magnitude and urgency of disaster situation, Sri Lanka established three task forces of Task Force for Rescue and Relief (TAFRER), Task Force for Law and Order and Logistics (TAFLOL) and Task Force for Rebuilding the Nation (TAFREN), for effective co-ordination (TAFREN, 2005a; TAFREN, 2005b; Jayawardene, 2006). National Council for Disaster Management (NCDM) established under Disaster Management Act No. 13 of 2005 is a high-level inter-ministerial body that provides direction to disaster risk management work in the country (DMC, 2005a; 2005b; 2006a, 2006b; Jayawardane, 2006; Karunasena *et al*, 2009; Karunasena *et al*, 2012a). Disaster Management Centre (DMC) is the lead agency implementing activities related to all phases of Disaster Risk Management (DRM) in the country within the Ministry of Disaster Management and NCDM. These activities are carried out in coordination with relevant stakeholder ministries, national and provincial level government and private entities, civil society, non government organizations, community based organizations and communities.

Literature revealed disaster waste removal programs implemented in Sri Lanka along with occurrence of Indian Ocean tsunami in 2004 highlighting many failures incurred due to non-existence of pre-planned disaster waste management strategies and enforceable or mandatory rules and regulations (Basnayake *et al*, 2005; European Commission, 2006; United Nation Environment Program, 2005). Review of national policies on disaster management (refer, Sri Lanka Disaster Management Act, no 13 of 2005) and waste management (refer National Environmental Act, no 47 of 1981) disclose that no specific provisions on disaster waste management exist. Rules and regulations related to peace time solid waste management processes are imposed on management of disaster waste (refer: National Environment Act, 1981; National Environment (Amendment) Act, 1988). National Disaster Management Plan and National Emergency Operation Plan expected to be implemented in future contains inadequate provisions on disaster waste management. Thus, it is pertinent that Sri Lanka as a country prepare sustainable post disaster waste management strategies. Brown *et al* (2011a) reveal that most developing countries do not have plans prepared in advance for disaster waste management.

As most other developing countries Sri Lanka also disposed its disaster waste during the post Indian Ocean Tsunami with the assistance of international aid organisations and United Nations agencies (Perterson 2004; UNDP 2006; Brown *et al*, 2011a). Evidence of large scale processing of disaster waste in Sri Lanka is non-existent as most of waste is disposed by land filling (Basnayake *et al*, 2005). Disaster waste generated after the Indian Ocean tsunami in 2004 at Telwatte (Hikkaduwa) was used to fill coral mined pits and lands with Central Environment Authority's (CEA) permission (Basnayake *et al*, 2005). The only recycling plant for construction waste established in Galle for processing post tsunami construction waste was subjected to operational delays and transportation costs of waste for recycling was costly, significantly reducing benefits of recycling (Raufdeen, 2009; Karunasena *et al*, 2012b).

Next presents research findings identified through case studies and verified through expert interviews for post disaster waste management in Sri Lankan context. Three case studies which included fifteen individuals and six experts representing government, non government and others were selected for data collection. Face to face semi-structured interviews were held as the main data collection method and code based content analysis and cognitive mapping were used to analyse collected data. Approaches presented for capacity building was further validated through the three experts representing waste management in Sri Lanka.

32.4 Capacity Gaps in Post Disaster Waste Management

Capacity gaps identified are summarised namely in seven areas such as skills and confidence building, organizational implementation, linkages and collaborations, continuity and sustainability, investments in infrastructure, research and development and communication and coordination as illustrated at table 32.1.

Unavailability of formal procedure for preparation, conducting, monitoring and evaluation of training and awareness programmes is a major capacity gap as evidenced by a lesser number of programmes conducted on soft skills development as against many programmes conducted for technical skills development at local authority level focusing more on peace time solid waste management with less emphasis to disaster generated waste such as Construction & Demolition waste Lesser opportunities for personal development such as training, workshops and scholarships and inadequate strategies to retain valuable human resources are identified as the other main capacity gaps prevalent in skills and confidence building.

Unavailability of a single point responsibility at national level for post disaster waste management and absence of provisions on disaster waste management in existing policies are major capacity gaps of organisation implementation. Inefficiencies and ineffectiveness of prevailing peace time solid waste management practices, policies and of responsible authorities is another capacity gap that impacts on disaster waste management. Non-revision, retraining or monitoring of existing solid waste management systems at frequent intervals further aggravates above.

Unavailability of formal procedures to establish linkages and collaborations is a major capacity gap, impacting on transparency and accountability. It is revealed that projects with complete proposals and documentation exist without proper implementation. There is also a noted reduction in active participation of NGOs and INGOs when compared with the period immediately after the Indian Ocean Tsunami in 2004.

As mentioned loopholes in prevailing peace time solid waste management practices, policies and also with responsible authorities and unavailability of formal procedures for monitoring and evaluation of implemented projects exist as capacity gaps impacting on continuity and sustainability of post disaster waste management in Sri Lanka. Less consideration at national level for incorporation of sustainable concepts into disaster management practices including disaster waste management is also a prevailing capacity gap of this area.

Table 32.1 Capacity gaps in post disaster waste management

Capacity gaps

Skills and confidence building

- Fewer opportunities for personal development –training/workshops
- Unavailability of formal procedure for preparation, conducting, monitoring and evaluation of training and awareness programmes
- Unavailability of strategies to retain valuable human resource
- Unavailability of provisions for disaster waste management in existing policies

Organization implementation

- Unavailability of single point responsibility at national level for post disaster waste management
- Inefficiency and ineffectiveness of prevailing peace time solid waste management practices, policies and responsible authorities
- Non-revision of existing waste management systems/ procedures

Linkages and collaborations

- Unavailability of formal procedures to establish linkages and collaborations
- Availability of projects with complete proposals without implementation
- Reduced active participation of NGOs and INGOs

Continuity and sustainability

- Less consideration of incorporation of sustainable concepts into disaster waste management practices
- Loopholes in prevailing solid waste management practices, policies and with responsible authorities
- Unavailability of formal procedures for monitoring and evaluation of implemented projects

Investments in infrastructure

- Loopholes in government rules and regulations on fund raising and procurement
- Less consideration for environmental protection

Research and development

- Reduced interest on research and development -government sector
- Inadequate opportunities for collaborative research programmes
- Inadequate transfer/ sharing of knowledge and technical know-how

Communication and coordination

- Uniformity of prevailing centralised framework
- Inadequate efficiency and effectiveness of existing systems

Other

- Vacuum between relief and early rehabilitation
- Policy issues, such as enforceability and wider scope
- Lack of awareness about peoples' needs
- Overlapping functions among institutions

Loopholes in rules and regulations on fund raising and procurement procedures are major

capacity gaps impacting on investments in infrastructure at government sector entities. Less consideration for environmental protection and conservation by donors is another capacity gap.

There is inadequate interest on research and development, specially in the government sector. This is further aggravated by traditional government practices that do not facilitate new approaches in the long run. Inadequate opportunities for collaborative research programmes and lack of transferring and sharing of knowledge and technical know-how are also prevalent as capacity gaps in R&D.

Identified capacity gaps of communication and coordination include tightly formal approaches established for communication and coordination during emergency situations, uniformity of prevailing centralised framework, lack of efficiency and effectiveness and less transparency and accountability of established communication and coordination system.

Apart from those capacity gaps identified within aforementioned seven areas, findings further revealed of capacity gaps influencing post disaster waste management in a general context. An example is the vacuum between relief and early rehabilitation which leave disaster waste unattended. Lack of awareness on peoples' needs and overlapping functions are also identified as prevailing capacity gaps. Lack of political will, inadequate funds, lack of awareness and attitudes of the public towards waste management are identified as the key influencing factors contributing for aforementioned capacity gaps. A study conducted on disaster waste management a developing country, Samoan Tsunami in 2009 by Brown et al (2011b) also revealed similar capacity gaps such as unavailability of responsible authorities, lesser synergy among ministries, lack of strategy for coordination, unavailability of disaster funds and formal procedure to monitor funds.

Next presents proposed approaches for enhance capacities of post disaster waste management to address the above mentioned capacity gaps.

32.5 Approaches for Enhance Capacities in Post Disaster Waste Management

Approaches proposed for enhance capacities in post disaster waste management are also summarised in seven areas aforementioned as illustrated at table 32.2.

Table 32.2 Approaches for enhance capacities in post disaster waste management

Approaches

Skills and confidence building

- Provide more opportunities for career development - local and international exposure
- Establish procedures to prepare, conduct, monitor and evaluate local and foreign programmes
- Enhance capacities of the government sector to promote interactive working
- Promote holistic approach for capacity building with more focus on local and sustainable approaches
- Develop an expert knowledge database on disaster management

Organizational implementation

- Incorporate disaster waste mgt. into existing solid waste management practices, policies and authorities
- Restructure institutional practices allocating specific functions to each with single point responsibility
- Increase collection of recyclable items, provide incentives to recyclers
- Develop enforceable rules and regulations for prevailing solid waste management/ disaster waste
- Introduce cash paying programmes for waste management
- Change procedures to facilitate quick and easy payment of compensation to affected parties

Linkages and collaborations

- Develop formal and transparent procedures to establish linkages
- Enhance capacities of government sector to promote interactive working, at local levels
- Provide more opportunities for collaborative projects
- Promote diversification
- Enhance active participation of NGOs and INGOs

Continuity and sustainability

- Train general public and officials on sustainable techniques with special emphasis on environmentally friendly, culturally supported mechanisms
- Introduce procedures to obtain permission for projects on quality, operational, maintenance and environmental impacts to ensure continuity and sustainability
- Establish formal procedures for monitoring and evaluation of implemented projects
- Promote holistic approaches for implementing waste projects

Investments in infrastructure

- Enhance capacities of staff to obtain funds through project proposals
- Establish transparent and accountable formal procedures for project selection
- Provide incentives to recyclers and mobilization of peoples

Research and development

- Establish resource centres with knowledge on new developments
- Organize open discussion forums for sharing research knowledge
- Provide opportunities and incentives for collaborative research
- Establish transparent systems in providing opportunities for career development

Communication and coordination

- Decentralize the system within established rules and regulations
- Provide adequate resources for communication systems
- Appoint responsible persons at each level of the communication

Other

- Prepare orders enforceable by law that clearly define responsibilities and functions of each institution
 - Capacity building and needs identification from bottom to top
 - Design framework for disaster waste management through District Coordinating Committees
 - Provide provisions for disaster waste management when preparing urban development plans
-

Provide more opportunities for career development of responsible persons, with local and

international exposure through seminars, workshops and scholarships to enhance capacities of officials at national level is identified. Parallel to that provide opportunities for self training through field activities, specifically in disaster waste management is emphasised. Provide incentives to attract and retain staff such as life insurance/ pension schemes and sufficient grants for career development, specially for government employees are proposed. To avoid repetition or duplication of programmes and unethical practices, establish formal procedures to prepare, conduct, monitor and evaluate local and foreign programmes. Implement a national level project to build technical support, assigning Disaster Management Centre (DMC) Sri Lanka with responsibility of training and awareness. Additionally introduce monitoring and evaluation methods such as beneficiary evaluations, statistical and non-statistical measures and progress reports. Sharing and disseminating knowledge among respective parties can enhance personal interests. Also enhance capacities of the government sector to promote interactive working, such as collaborative projects. Enhancement of soft skills is proposed as an approach to eliminate traditional bureaucratic red tape. Alignment of capacity development at each level with existing policies for real time implementation, such as individual capacity building programmes with master plans is suggested. These will eventually align capacity development with economic development of the country. Promote holistic approach for training and development focussing on indigenous and sustainable approaches for skills and confidence building, giving consideration to new aspects as good governance, livelihood development and resilience. Gupta and Sharma (2006, p67) pointed out that good governance and social capital as important elements for ensuring equitable recovery processes, as well as ensuring appropriate capacity building for marginalised and highly vulnerable communities. Development of an expert knowledge database consisting of experience of experts on typical disasters is also proposed as a propose approach for long term resilience. Further, researcher proposes a specific database on disaster waste management comprising of technical information on safe waste handling, disposal options, facilities, regulations and contact information of those involved in disaster waste management, similar to a decision support tool called EPA's Suite of Disaster Debris Management and Disposal (DDMD) in the USA (Thorneloe et al, 2007).

Incorporate disaster waste management into existing peace time solid waste management practices and policies including environmental and wet land protection policies to improve disaster waste management, reinforced with disaster waste management guidelines prepared specifically for developing countries with little or no existing infrastructure and expertise by United Nations Joint Environmental Unit (UNEP/OCHA, 2010). Expansion of existing peace time solid waste management practices such as zoning and seven steps process is proposed to promote sharing of resources and collaborations among local authorities. Establishment of enforceable rules and regulations for peace time solid waste management as well as disaster waste is necessary for long term sustainability. Restructuring of institutional processes allocating specific functions with single point responsibility is also a key approach to improve institutional structures for better disaster waste management. This will overcome non-functioning of important and necessary committees on waste management. These changes need to be incorporated into activities of entities as modes of mitigation, adaptation and recovery. Continuation with awareness and training programmes for public and local authorities on native and sustainable approaches for waste management emphasising on environmental protection and conservation will reduce inefficiencies and ineffectiveness prevailing in existing solid waste management processes. Examples are conducting of awareness programmes for domestic solid waste management at urban areas and enhancing of capacities of local authorities on composting and bio gas generation. Parallely, increase

collection of recyclable items, provide incentives to recyclers and mobilize peoples' support for recycling. Enhance existing procedures to facilitate quick and easy payment of compensation to affected parties from polluters, together with an effective spot fining system.

Developing formal and transparent procedures to establish linkages and collaborations with local and international entities is an important approach to enhance capacities by exchange of skills and practical knowledge. An example is to produce reports on benefits gained through established linkages and collaborations. This will enhance transparency and accountability of linkages leading to commitment of parties. Gupta and Sharma (2006) indicated networking among governments, NGOs, academia and communities is crucial for informed decisions and improved practices based on lessons learnt. Enhance capacities of government entities to promote interactive working, specially at local levels to gain effective and efficient outcomes from partnerships. Also, promote diversification to build new relationships and collaborations among entities. Enhanced active participation of NGOs and INGOs in disaster management also create opportunities for collaborations.

As an approach to enhance continuity and sustainability, create awareness among general public and train officials on sustainable, environmentally friendly and culturally supportive techniques on disaster waste management. Create awareness on how to convert waste into profitable businesses. As an example, promote holistic approaches in initiating projects such as composting and recycling, together. Further, it is important to change rules and regulations to facilitate sustainability concepts in disaster waste management practices. Establish formal procedures for monitoring and evaluation of implemented projects to avoid duplication of work and illegal projects with increased government intervention at regular intervals. Introduce procedures to obtain prior permission for projects on such aspects as quality, operational maintenance and environmental impacts to ensure continuity and sustainability. Additionally, at the end of a project, a certificate can be issued on achievement of sustainability standards.

Establishment of formal, transparent and accountable procedures for project selection and evaluation is important to improve investments in infrastructure, increasing confidence among investors. An example is to share financial reports at the end of a project among all involved parties. Create awareness among investors on how to make waste a profitable business while providing incentives to investors. Enhancing capacities of staff to obtain funds through project proposals and implementing policies, rules and regulations that facilitate self financing are important steps for the government sector.

Establishment of a transparent system to provide opportunities for career development, such as foreign training, workshops and scholarships is important to enhance research and development capacities. This is specially relevant to ignite and enhance interest on research and development within government entities. It can further be improved by allocation of sufficient funds for staff development and grant of promotions based on research performances, publications presented at recognised conferences, symposiums and papers published in academic journals. Further, it is necessary to provide opportunities and incentives for collaborative research work. Also, establish resource centres with data on new developments and adequate facilities. Conduct awareness programmes to develop a research culture in government entities, changing attitudes and traditional practices. Documentation of project outcomes for future reference and organisation of open discussion forums to share research interests at regular intervals will also enhance research and development.

Appointment of responsible persons at each level of communication and coordination process

is necessary to enhance transparency and accountability of existing systems. This can prevent lack of responsibility in the existing system. Provision of adequate resources and new technology, such as wireless and online communication facilities can improve effectiveness and efficiency of existing systems. Conduct awareness and training programmes for officials and general public on new technologies in communication and coordination at regular intervals. Decentralisation within existing rules and regulations can minimise adverse effects of inadequate implementational powers of Disaster Management Centre.

Preparation of lawfully enforceable provisions with clearly defined responsibilities and functions of each institution involved in disaster management is one such approach. It can minimise duplication of work and non-functioning of important committees and entities. Establishment of an institutional framework for disaster waste management with single point responsibility and adequate implementational powers is an important aspect of such an approach. Experts propose designing of a framework for disaster waste management through district coordinating committees and adequate provisions for disaster waste management shall be made when preparing urban development plans. It is further proposed to enhance capacities related to certain specific disasters, such as earthquakes that generate large quantities of waste.

32.5 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. Disaster waste management gaps such as unawareness, policy issues such as unenforceability, inadequate government support and unavailability of institutional arrangement are identified as capacity gaps in post disaster waste management. Further various approaches to minimise the prevailing gaps in disaster waste management are also discussed.

References

- Allen K M (2006) Community-based disaster preparedness and climate adaptation: local capacity building in the Philippines, *Disasters*, 30(1): 81–101
- Ayele S, Wield D (2005) Science and capacity building and partnership in African Agriculture: Perspectives on Mali & Egypt, *Journal of International Development*, 17: 631-646
- Basnayake B F A, Chiemchaisri C, Mowjood M I M (2005) Solid wastes arise from the Asian tsunami disaster and their rehabilitation activities: case study of affected coastal belts in Sri Lanka and Thailand, Tenth International Waste Management and Landfill Symposium, Sardinia
- Baycan F, Petersen M(2002) Disaster waste management-C&D waste, In: ISWA, ed. Annual Conference of the International Solid Waste Association, Istanbul, Turkey, pp 117-125
- Bjerregaard M (2007) MSB/UNDP Debris management Guidelines. Disaster Waste recovery
- Blakely E (2007) Collaborating to build communities of opportunity, Paper presented at Roosevelt Institute Symposium, New Orleans, Louisiana
- Booth W (2010) Haiti faces colossal and costly cleanup before it can rebuild, *The Washington Post*, Haiti
- Boyd E, Juhola S (2009) Stepping up to the climate change: opportunities in re-conceptualising

- development futures, *Journal of international development*, 21:792–804
- Brown C, Milke M, Seville E (2011b) Disaster waste management for the 2009 Samoan Tsunami, International conference on building resilience, Kandalama : Sri Lanka
- Brown C; Mike M, Seville E (2010) Waste management as a life line?' A New Zealand case study analysis, *International Journal of Disaster Resilience in the Built Environment*, 1(2):192-206
- Brown C; Mike M, Seville E (2011a) Disaster Waste management: A review articles, *Waste Management* , 31:1085-1098
- Disaster Management Act, No 13 of 2005 (2005) Published as a Supplement to Part II of the Gazette of the Democratic Socialist Republic of Sri Lanka of May 13, 2005. Colombo: Government publications bureau
- Disaster Management Centre (DMC) (2005a) Annual report 2005. Colombo: Disaster Management Centre
- Disaster Management Centre (DMC) (2005b) Towards a safer Sri Lanka – Road Map for Disaster Risk Management, Disaster Management Centre, Colombo
- Disaster Management Centre (DMC) (2006a) Annual report 2006, Disaster Management Centre, Colombo
- Disaster Management Centre (DMC) (2006b) Towards a safer Sri Lanka – Road Map for Disaster Risk Management, Disaster Management Centre, Colombo
- European Commission (EC) (2006) Progress report on Post Tsunami rehabilitation and reconstruction program. [Online] European Commission (EC). Available at: <http://ec.europa.eu/comm/world/tsunami/index.html> [Accessed 5 August 2008]
- Gupta M, Sharma A (2006) Compounded loss: the post tsunami recovery experience of Indian island communities, *Disaster Prevention and Management*, 15 (1):67-78
- Hartwig K, Pashman J, Cherlin E, Dale M, Callaway M, Czaplinski C, Wood E W, Abebe Y, Dentry T, Bradley E H (2008) Hospital management in the context of health sector reform: a planning model in Ethiopia, *International journal of health planning and management*, 23:203–218
- Jayawardane A K W (2006) Disaster mitigation initiatives in Sri Lanka, International Symposium on Management Systems for Disaster Prevention, 9th-11th March 2006, Kochi, Japan.
- Joint UNEP/OCHA Environment Unit (JEU) (2010) Disaster Waste Management Guidelines. Geneva: Joint UNEP/OCHA Environment Unit
- Karunasena G, Amaratunga D, Haigh R (2012a) Post Disaster Construction & Demolition Waste management: A Sri Lanka Case Study, *International Journal of Civil Engineering and Management*, 18(4):457-468
- Karunasena G, Amaratunga D, Haigh R, Lill I (2009) Post Disaster Waste Management Strategies in Developing Countries: Case Of Sri Lanka, *International Journal of Strategic Property Management*, 13(2):171-190
- Karunasena G, Rameezdeen R, Amaratunga D (2012b) Post-disaster construction & demolition waste management: the case of COWAM project in the city of Galle, Sri Lanka, 6th International conference and workshop on the Built Environment in Developing Countries (ICBEDC), 4-5 Dec. 2012, University of South Australia, Adelaide, Australia.
- Luther L(2006) Managing Disaster Waste: Overview of Regulatory Requirements, Agency Roles, and Selected Challenges, Congressional Research Service, Available at: <http://wikileaks.org/wiki/CRS-RL34576>, [Accessed on February 25]
- Milke M (2011) Disaster waste management research needs, *Waste Management*, 31
- Ozden A T (2007) Constituting a sustainable after disasters: The role of Architecture, *Journal of Faculty of Built Environment*, 9(3):1-17
- Petersen M (2004) Restoring waste management following disasters, In: IF, ed. International conference on post disaster reconstruction, UK. Coventry: IF Research group
- Raufdeen R (2009) Construction Waste Management: Current status and challenges in Sri Lanka, COWAM publication
- Shibata T, Solo-Gabriele H, Hata T (2012) Disaster Waste Characteristics and Radiation Distribution as a Result of the Great East Japan Earthquake, *Environmental Science Technology*, 46:3618–3624
- Srinivas H, Nakagawa Y (2008) Environmental implications for disaster preparedness: Lessons Learnt from the Indian Ocean Tsunami, *Journal of Environmental Management*, 89(1):4-13

- Tadele F, Siambabala M A (2009) Building disaster resilience through capacity building in Ethiopia, *Disaster Prevention and Management*, 18 (3):317-326
- Task Force for Rebuilding the Nation (TAFREN) (2005a.) Recovering from Tsunami: A report on the progress of the post-tsunami recovery of Sri Lanka and the role of TAFREN in the recovery effort, The Task Force for Rebuilding the Nation, November 2005.
- Task Force for Rebuilding the Nation (TAFREN) (2005b). District wise post tsunami rehabilitation and reconstruction projects: Rebuilding Sri Lanka, Post Tsunami Recovery and Reconstruction strategy Update of Part II – Progress made and problems encountered, Task Force for Rebuilding the Nation, Colombo, Sri Lanka.
- Thorneloe S, Lemieux P, Rodgers M, Christman R, Nickel K(2007) Decision support tool for the management of debris from homeland security incidents, In: XI International Waste Management and Landfill Symposium Sardinia.
- Thummerukudy M(2012) Chapter 11: Disaster waste Management: An overview , In Shaw, R. and Tran, P. (1 eds.), *Environment disaster linkages*, Emerald Group Publishing limited
- United Nations Development Programme (UNDP) (2006): *Post-Tsunami Recovery and Reconstruction Strategy*, United Nations Development Programme:Colombo
- United Nations Environmental Programme (UNEP) (2005) Sri Lanka post tsunami environmental assessment, United Nation Environment Program (UNEP). Geneva: UNEP, (DEP/0758/GE).
- Webb, P and Rogers, B: Addressing the “In” in Food Insecurity. Washington, D.C.: Food and Nutrition Technical Assistance (FANTA) Project, Academy for Educational Development (AED), 2003.