WASTE MANAGEMENT STRATEGEIS: MUNICIPAL WASTE VS DISASTER WASTE

G. Karunasena[1], D. Amarathunga[2]

[1]Lecturer, Department of Building Economics, University of Moratuwa, Moratuwa, Sri Lanka.
[1]E-mail: gayani@becon.mrt.ac.lk
[1]Telephone: +94-11-2650738; Fax: + 94-11-2650738

[2]Senior Lecturer, School of the Built Environment, University of Salford, United Kingdom.
[2]E-mail: r.d.g.amaratunga@salford.ac.uk
[2]Telephone: +44-161-295 4471; Fax: + 44-161-295 5011

Abstract: Waste has become a global issue with rising population, urbanization, economic activities and consumerism. Further, this is becoming more critical due to waste generated through frequent disasters. This is evident with increased number of environmental, social, economical and health issues such as epidemics. Thus, this paper intends to critically review waste management practices, of both municipal and disaster waste to identify prevailing gaps. Lack of physical, human and financial resources, less enthusiasm among community groups and legal loopholes are identified as major gaps. Community involvement in planning, development and implementation of waste strategies, enhancing strategic level capacities, raising public awareness and establishing supportive authorities are proposed to eliminate identified gaps.

Keywords: *Municipal waste, Disaster waste, waste, Gaps, Waste management*

1. Introduction

Waste is defined as any losses produced by activities that generate direct or indirect costs but do not add any value to the product from the point of view of the client (Formoso *et al*, 1999) or any substance or object which the holder intends or is required to discard. Hoornweg *et al*, (1999) further refined that waste arises from human and animal activities which are normally solid referred as solid waste. Tchobanoglous *et al*, (1993) categorized it into two as municipal solid waste (MSW) and industrial waste. According to the business dictionary (2009), MSW means all types of solid waste generated by household and commercial establishments and collected usually by local government bodies and includes residential, commercial, institutional and construction and demolition waste. According to Environment Protection Agency in USA, disaster waste also comprised with similar items such as soil and sediments, building rubble, vegetation, personal effects, hazardous materials, mixed domestic and clinical wastes and often, human and animal remains representing a risk to human health from biological, chemical and physical sources (EPA, 2008). Zon (2000) stated, people do not seem to be much aware of possible environmental problems caused by the disposal of household waste where it is only seen as a problem when practical issues occur at storage or disposal. Further, Damgghani *et al* (2007) stated that poor waste management practices may result in several problems such as unpleasant odour and the risk of explosion in landfill areas, as well as ground water contamination. Kobayashi (1995) indicated that managing disaster waste become further critical unlike ordinary waste as it is mixed and difficult to separate. Peterson (2004) added that this become further critical in disasters as it differs from the normal situation which generates waste in a more or less stable quantities and composition which may contain or be contaminated with certain toxic or hazardous constituents. In Sri Lanka, solid waste management become a environmental, social as well as a political issue due to scarcity of vacant lands, collection and disposal issues (Jayaratna, 1996) and dengue epidemic (Anji, 2009). This was evident during the Asian Tsunami in 2004. Thus this burning problem should be eliminated for betterment of the nation. Though community and the government seek a solution through conducting various solid waste management projects, still issues are visible which has become a researchable issue in Sri Lanka. Accordingly, this study intends to identify gaps existing in solid waste management in Sri Lanka, with special emphasize on municipal and disaster

waste. Forthcoming sections of the paper illustrate literature findings, methodology adopted, survey findings and conclusions drawn.

2. Literature findings

Solid Waste Management

Solid Waste Management (SWM) is a major part of the social system (Rahardyan *et al*, 2004). In early days, the issues related to solid waste management was at its lowest level with each taking care of his own by dumping at the back of his cave (Wilson, 1977). Today it is increasing rapidly and composition is also changing with urbanization, change in life styles and food habits of people (Poopor *et al*, 2004; Ogbonna, 2007; Agdag, 2008). Key reason for solid waste becoming an issue is the rapid increase of population rather than developing waste management systems. According to Damghani *et al* (2007), it can be classified into four groups as, municipal, hospital, industrial and construction and demolition. As previously stated municipal waste means all types of solid waste generated by household and commercial establishments and collected usually by local government bodies (Business Dictionary 2009). Cader (2001) indicates that SWM involves managing activities associated with generation, collection, transport and disposal of solid waste in an environmentally compatible manner, adopting principles of economy, energy and conservation. Kum *et al*, (2004) highlighted major challenges associated with waste collection services and disposal facilities. This becomes a challenge with waste generated by frequent disasters due to volume and composition. Brown *et al* (2010) indicate that following a disaster in addition to above another three waste streams may get generated such as disaster generated debris, emergency and relief services generated waste and surplus donations. Further, authors highlighted that it is likely in a large scale event, that municipal and industrial waste streams will also be altered due to disruptions and displaced persons. Thus, these are evident for complexness of solid waste management system. Many have introduced various strategies, models and projects for management of waste such as Three R concepts (Reduce, Reuse and Recycle), The Nova Scotia MSW strategy (Wagner and Arnold, 2006), Unit Charging Programs-Pay As You Throw (PAYT programs) (Chakrabarti, 2008), community based solid waste management programs and community awareness programs. Next section of the paper reveals the literature findings on solid waste management practices in Sri Lanka.

Solid waste management in Sri Lanka

In Sri Lanka, the basic legal framework required for solid waste management is provided under Government, Provincial Council (PC) and Local Authorities (LA) regulations and legislations. Rameezdeen (2009) indicated that there are three levels of legislation related to SWM in Sri Lanka. Those are the National Environmental Act (NEA), local governmental laws and the Police Ordinance. Further, he mentioned that according to NEA (Amendment) No.56 of 1988, Central Environmental Authority (CEA) can request any local authority to comply with and give effect to any recommendation related to environmental protection and any recommendation relating to some aspect of environmental pollution such as to prohibit unauthorized discharge, emission or deposit of litter, waste, garbage and sewerage. With respect to disaster waste, in-depth review on national level polices for disaster management (Refer Disaster Management Act no 13 of 2005) revealed that there are no provisions for disaster waste management. Disaster Management Act only states that disaster management council shall provide protection for environment and maintain and develop affected areas (Disaster Management Act, 2005). Thus, disaster waste is also classified within municipal solid waste as there are no other regulations specifically dealing with them.

In addition to that, the national policy is build on the 'polluter pays' principle. Reduction of consumption and maximization of recycling and reuse were initiated through various projects (Rameezdeen (2009). The "National Strategy for Solid Waste Management" is based on the premise of waste management from generation to final disposal (Chandana *et al*., 2006). Further, "Waste Management Zonal Concept" is the strategy, which has been identified by the Waste Management

Authority of Sri Lanka to overcome present short comings in the administration of waste management in the Western Province. This concept facilitates sharing of available resources among local authorities of each zone and working as groups in waste management (Waste Management Authority of Sri Lanka, 2005). Under the public awareness programmes, promotions are conducted encouraging the public to segregate waste at generation points. Waste collection points called "*Sampath piyasa*" are built to store the waste until they are subjected to proper disposal. In addition, public awareness programmes titled *Pivituru paasel* project, *parisara mituro* project, *pivituru suva piyasa* project, *parisara kekulu* project and *pivituru ayatana* are conducted along with various other media campaigns. Information material related to public awareness includes posters to be displayed at schools, government institutions, community centres and in public buses (Zon and Siriwardena, 2000). Though there are many initiatives, issues related to solid waste management are still prevailing in Sri Lanka as evidenced by the Dengue epidemic. The next section of the paper illustrates the research approach used to identify the gaps in solid waste management with a special emphasis on municipal and disaster waste.

3. Methodology

Case study was selected as the research approach as it provides an opportunity for in-depth analysis of existing solid waste management practices to identify gaps. According to Yin (2003) it is "*an empirical inquiry that investigates contemporary phenomena within its real life context; especially where boundaries between phenomena and context are not clearly evident*". Three waste management projects are selected as cases which are currently conducted in Sri Lanka as illustrated at table 01. All projects mentioned below are coordinated by the government institutions at national level targeting management of municipal solid waste in short term period as three to five years. None of the projects identifies disaster waste except the COWAM project which was initiated with the intension of management of construction waste generated by the Asian Tsunami in 2004.

Table 1: *Profile of waste management*

Project	**Description**
Project A & B	Provide supportive services to local authorities on SWM.
Project C	To create awareness and provide infrastructure to conduct SWM

Semi-structured interviews were conducted to gather data as it facilitated in depth analysis and gather different views and opinions of respondents within scope of the study. Three interviews were conducted to collect data from each case, where one was conducted with the particular project managers to gatherer general information on each project and other two with the beneficiaries to identify real benefits received. Content analysis was used to analyze collected data. Content analysis is a method that compresses many words into a fewer content categories. According to Silverman (2006) this involves establishing categories and then counting the number of instances that fall into each category. This method pays particular attention to reliability of its measures and to the validity of its findings. Nvivo software was used for easier and speedy content analysis. Relevant coding structures were prepared using software and analysed in order to determine gaps in solid waste management as illustrated at figure 1.

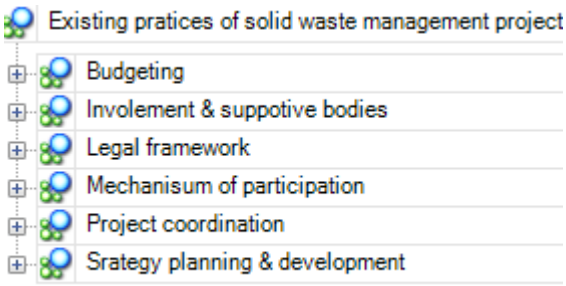

Figure 1: *Coding structure*

4. Case findings

As already mentioned, data gathered through case studies revealed information in following six areas: budgeting (funding and cost management), involvement of supportive bodies (tools and equipments), legal framework (regulations and legal development), participation (contribution and target groups), project coordination(committee involvement) and strategy planning and development (requirements identification, strategy development etc) as follows.

Budgeting

All three projects are mainly government funded projects. Project A & B were partly funded by non-governmental organizations. Budgetary support was mainly aimed at enhancing technical capacities to conduct the project but not to uplift local authorities' support services such as physical resources. It is an identified weakness of projects A and B.

In terms of cost management, each project has an annual budget based on an action plan for the entire project matching with the total predetermined budget. Also, all projects promoted waste collection by separation at generation points and collecting recyclable waste as a cost management strategy. Further, public awareness strategies are used for minimizing costs of per person for waste management.

Findings revealed that projects A and B are at satisfactory levels of recovering the project costs by promoting large composting projects while the project C was more concentrated towards cost saving at strategy implementation stage by allowing participants to use available resources as supportive equipments of the project.

Supportive bodies

All accept that involvement of many parties can achieve successful decision making. Community and other committee level involvement can be seen at decision making process of the project A while projects B and C do not identify the importance of community involvement in preparing project action plans. Further, all project coordinators accepted that sound knowledge and attitudes of project staff is essential in proper project handling. Less dedication of employees in local authorities is also considered as a major weakness of projects A and B. In addition inadequate machinery, collection and transportation equipments and suitable lands have further aggravated the issues in these projects. Thus, having supportive bodies as recyclable waste collectors is strengthening these projects. Further, in project B, labourers are promoted to use manual systems instead of highly technological and complex systems which raised health issues. Project C revealed that there are no issues regarding handling of tools and equipment to conduct awareness programmes. However, inadequate resources to collect waste by separation, collection and transport are identified as major obstacles.

Legal framework

All projects are coordinated by government organisations; hence there are fever obstructions when working with other organizations. In case of projects A and B, national policy on SWM is followed to

ensure environmentally sound solid waste management practices. Although having such a corporate policy is for betterment of the project, it is a weakness noted in that policy it has no clear sources of funding. Hence, programs initiated by projects A and B such as “unit charging” and “polluter has to pay” programmes are malfunctioning due inadequate regulatory support.

In term of regulations, bodies responsible for project B have failed to implement a licensing system, regulations, standards or guidelines for solid waste disposal except for some hazardous materials. However, bodies responsible for project C have enacted a provincial legislation within the Western province provide proper regulatory framework for SWM.
According to interviewees of projects A and B, there are lesser opportunities to develop by-laws with local authorities.

Participation
It is revealed that projects A, B and C obtain adequate contributions from several parties. While projects A and B are having public, private and community involvement, project C is involved only with the public sector and the community.

Project A is to obtain highest participation in project implementation stage by getting a higher level of community participation in strategy planning. Also, attention has been paid to special target groups such as labours of local authorities and students. Project C has selected students as their main target group of the project and project B targeted students when conducting awareness programmes. Further, in project A general public are getting a real experience on SWM by contributing to prepare action plans whereas in projects B and C they are not obtain any such assistance from the general public.

Projects A and C believe that target groups concept enhances community contribution in projects. Students have a higher participatory level in project C. The views of beneficiaries of projects A and B differ by considering that communities do not have enough time to participate at awareness programmes such as workshops, training programme, etc.

Project coordination
Projects A and B have satisfactory national level project coordination and indicated on importance of involvement of coordinating committees. In both projects, coordination committees are involved in providing technical guidance and financial support. Project A also identified the importance of coordination in community level of the project. Interviewees’ point of view, community level coordination is identified as critical factor. In case of project C, it does not perform activities through proper coordination committees.

Strategy planning and development
All projects have realised the importance of identifying real needs that shall be addressed by the projects. Project A identified technological and financial assistance as the real need of local authorities and project B identified development of capacities of local authorities as the timely requirement. Project C identified community awareness as the key requirement. In addition to above, all projects are giving consideration to environmental, economical, technological and social factors in strategic planning. However, project C is providing less interest on economical factor since it promotes reuse to minimize initial costs.

Projects A and B are directed towards enhancement of capacities of local authorities that have close relationships with communities whereas the project C is targeting to change the mind set of the future generation.

In term of strategy development, the project C is more concentrated on the target groups concept in strategy planning accepting that through selected target groups (such as students) relevant messages can be given to a larger number of people within a short period of time through awareness programmes. Further, the project C is more concerned about positive attitudes and motivation of the community. Both A and B projects are indirect community conjuncture projects but having direct connections with local authorities.

5. Discussion

Case studies carried out led to the identification of following gaps which can be summarised as illustrated in table 2:

Table 2: *Gaps identified in SWM projects*

	Gaps identified
Participation	▪ No proper way to reach all group of people ▪ Community has less positive attitudes towards waste management ▪ Less attention to increase public awareness ▪ Projects conducted only for selected groups of people
Strategy planning and development	▪ Less consideration on air and water pollution ▪ Have not developed proper system for recycling waste transportation ▪ Political interferences
Project coordination	▪ Inadequate coordination with related communities
Legal framework	▪ Inflexible legal framework ▪ Inadequate legal solutions ▪ Policies are not clear on matters of funding.
Supportive environment	▪ Collection and transportation equipments' shortage ▪ Inadequacy of available lands for composting, dumping and land filling ▪ Accountability is less among of employees of local authorities ▪ Inadequate resources ▪ Less enthusiasm of private sector organizations
Budgeting	▪ Less budgetary allocation for equipments ▪ Polluter *pay* concept is not well functioning

Accordingly, findings revealed the importance of committee involvement in strategy planning, development and project implementation stages. However, it is identified that there is lesser community participation. Therefore, through establishing community based committees it will be possible to create proper links between project activities and communities. It will be helpful to achieve community participation in project implementation stage hence get their involvement in strategy planning level in SWM projects.

Most SWM project failures occur due to improper management at project coordination, handling of legal issues, financial management, handling of equipment and personnel and strategy management. Although having adequate resources such as funds and equipment, unless a project implements proper management strategies, it can end as a failure. Hence, it is important that any critical project activity be linked with strategic management.

Further, the research study shows that gaps arise due to less participation of target groups. Successful project participation can be achieved through awareness of every stakeholder regarding requirements of proper SWM strategies which motivate involvement with positive attitudes. It can be achieved through awareness or training programmes to establish public - private community participation.
As mentioned in section 3, there are no waste management projects targeting disaster waste management in Sri Lanka, other than the one initiated after the Asian Tsunami in 2004, called Construction Waste Management (COWAM) project. It offers consultations on sustainable management of construction and demolition waste within the targeted region. Major gaps identified, according to respondents' are, public unawareness, less enthusiasm among the public, legal issues, value and ownership issues, access to private property, safety of workers, unavailability of single point responsibility and lack of resources such as labour and machineries.

Accordingly, in respect of both municipal and disaster waste, similar gaps of waste management such as less participation of community, legal issues, inadequate resources, etc are prevalent.

6. Conclusions

Solid waste becomes a global challenge due to limited resources, an exponentially increasing population, rapid urbanization and worldwide industrialization. In developing countries like Sri Lanka, these factors are further affected by inadequate financial resources, inadequate management and technical skills within municipalities and government authorities. Therefore, many solid waste management projects were introduced to avoid these drawbacks. However, environmental, social and health impacts are still visible as a result of poor waste management practices. Thus, this became a researchable problem to further investigate to identify gaps existing in solid waste management (SWM) projects in Sri Lanka.

The aim was achieved through in depth investigation of selected three SWM projects (cases) at national level. Unavailability of proper procedure to reach all groups of people, less positive attitudes of the community, less attention to increase community awareness, political interferences, lesser consideration on air and water pollution, unavailability of proper systems for recycling waste and transportation, absence of community participation in strategy planning and development, inflexible legal frameworks, inadequate legal solutions, less budgetary allocations and inadequate resources (collection and transportation equipment and lands for final disposal) are identified as gaps in solid waste management. Public unawareness, less enthusiasm among public, legal issues, value and ownership issues, access to private property, safety of workers, unavailability of single point responsibility and lack of resources are identified as major gaps prevalent in the case of disaster waste. Establishment of community committees with access to strategy planning, development and implementation, adopting strategic management to critical activities of project to minimize failures related to financial resources, project coordination, handling of legal issues, handling of physical and human resource and enhancing public awareness can be proposed as ways to minimize prevailing gaps.

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About Author
Gayani Karunasena graduated with a BSc (Hons) Degree in Quantity Surveying from the University of Moratuwa, Sri Lanka. Thereafter, she obtained a Master of Philosophy in Construction Information Technology from the same University. Currently, she is employed as a lecturer at the same University and reading for her split site PhD on the area of disaster waste management.