

Solid Waste Management System: Public-Private Partnership, the Best System for Developing Countries

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ABSTRACT

Solid waste management (SWM) is a major public health and environmental concern in urban areas of many developing countries. Nairobi's solid waste situation, which could be taken to generally represent the status which is largely characterized by low coverage of solid waste collection, pollution from uncontrolled dumping of waste, inefficient public services, unregulated and uncoordinated private sector and lack of key solid waste management infrastructure. This paper recapitulates on the public-private partnership as the best system for developing countries; challenges, approaches, practices or systems of SWM, and outcomes or advantages to the approach; the literature review focuses on surveying information pertaining to existing waste management methodologies, policies, and research relevant to the SWM. Information was sourced from peer-reviewed academic literature, grey literature, publicly available waste management plans, and through consultation with waste management professionals. Literature pertaining to SWM and municipal solid waste minimization, auditing and management were searched for through online journal databases, particularly Web of Science, and Science Direct. Legislation pertaining to waste management was also researched using the different databases. Additional information was obtained from grey literature and textbooks pertaining to waste management topics. After conducting preliminary research, prevalent references of select sources were identified and scanned for additional relevant articles. Research was also expanded to include literature pertaining to recycling, composting, education, and case studies; the manuscript summarizes with future recommendations in terms collaborations of public/ private partnerships, sensitization of people, privatization is important in improving processes and modernizing urban waste management, contract private sector, integrated waste management should be encouraged, provisional government leaders need to alter their mind set, prepare a strategic, integrated SWM plan for the cities, enact strong and adequate legislation at city and national level, evaluate the real impacts of waste management systems, utilizing locally based solutions for SWM service delivery and design, location, management of the waste collection centers and recycling and composting activities should be encouraged.

I. INTRODUCTION

One of the basic services that are currently receiving wide attention in the urban agenda of many developing countries is solid waste management (SWM) where new regulations and policies have been issued, urban infrastructure has been improved, commercialization and cooperation have been encouraged, and a framework for structuring the variety of approaches initiated. Considering these developments, an overview is necessary to analyze the current state as well as new opportunities and challenges regarding MSWM in developing countries with view to identify the suitable system and practices of SWM for developing countries in this paper.

II. BACKGROUND

Solid waste management has been and will continue to be a major issue facing countries worldwide. There is increasing waste generation rates due to population growth, changing lifestyles

of people, development and consumption of products with materials that are less bio degradable have led to the diverse challenges for MSWM in various cities of the world. This is because urbanization, rapid industrialization and rapid economic growth in these countries that has resulted in large increases in refuse output resulting in rapid depletion of landfill and poor performance of waste disposal systems that are used in these countries. Meanwhile, with limited resources, only basic technologies for treatment and disposal, and deficient enforcement of relevant regulations, serious problems remain for SWM in developing countries, especially in regard to safe disposal and recycling of MSW (ISWA and UNEP, 2002). Furthermore, this has been compounded by inappropriate waste handling, storage, collection and disposal practices pose environmental and public health risks. In densely populated urban centres for example, appropriate and safe solid waste management (SWM) is of utmost importance to create a healthy environment for the population.

III. STUDY PROBLEM

Although most governments have acknowledged this fact (Rabinovitch, 1997), numerous municipalities are hardly capable of providing even the most basic services. According to the World Resources Institute (1996) one to two thirds of the municipal solid waste generated in the developing world is dumped indiscriminately on streets or in drains, thus causing floods, insect and rodent breeding grounds and the spread of diseases (UNEP-IETC, HIID, 1996). The collected waste is generally dumped on land in a more or less uncontrolled manner. Such uncontrolled and inadequate waste disposal not only creates serious environmental problems and affects human and animal health but also causes serious financial and socio-economic losses (Schertenleib & Meyer, 1992). Worse still, cities in developing countries are confronting a twin dilemma. On one hand, the urban population is growing rapidly, causing a huge increase in demand for waste management services, and on the other, the traditional public sector is responding poorly to the growing demand for such services (Ahmed & Ali, 2006).

SWM is a service for which local governments are usually responsible and the most important task of these authorities is to manage the waste properly to keep the city clean and healthy. However, municipal services in most cities and towns are already over-burdened and simply cannot cope with the growing demand owing to inadequate capacity, insufficient manpower and materials, resulting in unhygienic and filthy living condition in the neighborhood. This situation has been escalated by increasing urban population growth, poverty, weak governmental institutions, lack of implementation and enforcement of policies, and insufficient public finances (Tukahirwa, Mol, & Oosterveer, 2010).

Consequently, it has been reported that lack of effective SWM can result in environmental health hazards and has negative impact on the environment which may extend beyond the geographical boundaries of the town or municipality (Seik, 1997). The challenge therefore for the municipal environmental engineers and planners in developing countries is to innovate SWM approaches that are viable and sustainable, i.e. satisfying short-term objectives without compromising on the long-term objectives.

IV. SIGNIFICANCE OF THE STUDY

The issue of poor solid waste management (SWM) has become a challenge for governments of developing countries because it is critical to the protection of public health, safety and the environment. Tanaka (1998) further notes the purpose of SWM to be the preservation of the

living environment and improving public health through the restriction of the waste discharge, appropriate sorting, storage, collection, transport, recycling and conservation of a clean living environment. This paper, therefore, investigates the issues and dynamics of solid waste management. It analyzes a number of studies, each considering a different approach to SWM and all generally focusing on public-private partnerships for SWM. The paper would provide informational support as contribution to academic efforts to clarify the various aspects of SWM in order to develop policy recommendations for proper SWM approach in developing countries.

V. REVIEW OF RELATED LITERATURE ON SWM

Areas of significant interest for this study were for example; the effectiveness of public-private partnerships for service delivery and shed light on how such partnerships contribute to the meaningful urban governance in Bangladesh (Bhuiyan, 2010); background of SWM privatization in Dar es Salaam (Mbuligwe, 2004); evaluation of the post-privatization of solid waste collection contractors in Dar es Salaam city (Kaseva & Mbuligwe, 2005); constraints to promoting peoplecentred approaches in recycling (Bolaane, 2006); performance assessment of service providers involved in SWM in developing countries (Oduro-Kwarteng & Dijk, 2008); analyzing the possibilities for public/private partnerships using the example of SWM (Shafiul & Mansoor, 2004); analysis of the current state as well as new opportunities and challenges regarding MSWM in China (Xudong et al., 2010). others are ; A comparative analysis of municipal solid waste management (MSWM) in Singapore and Berlin (Dongqing, 2010); comparison of the cost between the service of private and public collection of residual household waste in Flemish (Jacobsen et al., 2013); a review of the integrated waste management system operating in the city of London, Ontario-Canada and Kumasi, Ghana (Asase et al., 2009); exploration of the households' perspective on solid waste collection services provided by the private sector in Dar-es-Salaam (Salha & Ali, 2006); and a comparison of two models for dealing with urban solid waste: Management by contract and management by public-private partnership (Adauto & Derval dos Santos, 2013).

Solid waste and Solid waste management

Before embarking on this theme, it may be useful to make introductory remarks concerning certain key issues related to SWM, starting with term solid waste, the existing waste management

systems in terms of waste generation, waste composition, waste collection methods, service coverage and transportation, waste treatment and disposal, municipal solid waste management strategic plan and government laws and regulations. Solid waste is all the waste arising from human and animal activities that are normally solid and that are discarded as useless or unwanted. Similarly, Wadood (1994), defines solid waste as useless, unwanted, and discarded non-liquid waste materials arising from domestic, trade, commercial, industrial, agriculture, as well as public services. Meanwhile, solid waste management according to Nunan (2000) refers to SWM as the collection, treatment, and disposal of municipal solid waste, which includes wastes from domestic, trade, commercial, industrial, agriculture, as well as public services, and Salequzzaman et al. (2001) call it all activities pertaining to the control, collection, transportation, processing and disposal of waste in accordance with the best principles of public health, economics, engineering, conservation, aesthetics and other environmental considerations.

The major concern for most systems of SWM is to achieve the objectives of SWM and to overcome the SWM problems in urban areas, and ensure solid waste management is sustainable (Salequzzaman et al., 2001). The objectives of SWM have evolved from the primary concerns of environmental health protection to considering human safety, resource conservation and the reduction of, as much as possible, the environmental burdens of waste management (energy consumption, pollution of air, land and water and loss of amenity). According to Bai and Sutanto (2002), in Singapore, the goal of waste management is to establish a sound material recycling society through the "3Rs" (reduce, reuse, and recycle) As a result, there has been systems, which administer and monitor the collection, treatment, and final disposal of hazardous wastes, waste trade, and secondary pollution generated by the construction and operation of MSW treatment and disposal facilities

Different types of municipal solid waste in Berlin can be categorized in terms of their origins, as follows: domestic refuse waste; trade waste; commercial waste; bulky waste; road sweepings. Major reasons are the increasing amount of waste which has been channeled for recycling and recovery. The remaining solid waste goes to waste incineration, for co-incineration in coal-fired power-stations, cement kilns and for mechanical and biological treatment. Furthermore, household waste consists of mixed household waste collected through curbside collection, bulky household waste and municipal waste such as street-cleaning residues, waste from markets and illegal dumping

(OVAM, 2002). Citizens are encouraged to reduce the amount of residual waste and to recycle

VI. CHALLENGES

The traditional approach applied to SWM faced many problems for example in the past, all waste management elements were often only evaluated from a purely engineering and technical viewpoint instead of being embedded in a local, institutional, socio-cultural and economic context, which is also influenced by national, political and regulatory aspects as well as national, global and economic factors.

For example, most informal agents are not under the administration of any governmental agency, resulting in many problems such as second-hand pollution, conflicts among them, and social safety concerns. In addition, there are no regulations enforcing this sector of SWM. However, none of these regulations considers the informal sector as an active and worthy actor and partner in SWM. In fact, section 20 of the KCC Solid Waste Management Ordinance (2000) defines as an offence for someone to collect, transport, remove or dispose refuse at a fee without a valid permit. Notwithstanding the absence of legal support, in Kampala the informal sector is active in the business of solid waste collection, supplementing the efforts of KCC and the formal private sector (Katusiimeh et al., 2013)

Lack of a common approach because local conditions differ considerably between different cities, and thus a one-size-fits-all solution would be ineffective. Policies that are successfully enforced in some areas might be ineffective and inefficient in other areas where the local infrastructure is weak. Moreover, treatment methods must be adopted according to local waste compositions. Although a number of encouraging policies have been enacted, commercialization still faces multiple risks in the market that could hinder its development. SWM in China has huge market potential, with the total market for MSWM estimated to be US\$ 600 million (The World Bank, 2005). However, neither the potential market size nor supporting policies and regulations can guarantee the development of the waste industry. Risks in the waste service and treatment markets have yet to be systematically studied. These risks include vague policies, conventional ways of thinking in local government, and uncertainty in waste product markets.

On the other hand, landfill space in the current landfill is limited and the setting up of new landfills outside the city poses additional problems due to increased transport distances requiring more fuel. The city is therefore looking for options to reduce the waste flow to the landfill and,

if possible, to increase the use of secondary raw materials by its industries.

The conservancy department of both Dhaka and Chittagong face operational challenges such as the lack/misuse of resources, corruption, political interference, central-local government relationship, lack of inter-departmental coordination, and lack of people's awareness. Some of these issues are in some detail discussed here. Lack of awareness and active involvement of the households as the key stakeholders in service provision planning are the main reasons why households refuse to contribute effectively and pay for the service. Some people are not civilized. Instead of putting waste in waste containers, they just push wastes from their house into the ground, open drains, on roads or littering anywhere. This makes our work very difficult, we use most of our time to collect this type of waste

It is noted that the large amount of solid waste generated in the city still remains uncollected (more than 50%), which is due to the mismatch between the amount of waste generated and the capacity of the service providers. This suggests that at that point collectors did not have enough facilities to serve all households in Dar-es-Salaam city hence some support was needed. Post et al. (2003) reported that even though the improvement and extension of the service should be made partially by the private sector, it also depends on the ability of local authorities to create an environment with sufficient incentives to extend service to a large area.

The production of urban solid waste in most cities rapidly increasing for example in 1995 urban Bangladesh generated 0.49 kg/person/ day waste which is estimated to increase to 0.6 kg by 2025 (Ray,2008); also on the average waste generation rate in Dar es Salaam city is currently within the range of 0.40 kg/cap/day. In another study, Ame (1993) established waste generation rates for high, medium and low-income group of households in Dar es Salaam city to be 0.45, 0.38 and 0.34 kg/cap/day, respectively, with a mean value of 0.39 kg/cap/day, while JICA (1996) reported a fairly high domestic waste generation rate of 0.7 kg/cap/day in Dar es Salaam. The potential reason of this is rapid and high growth of urban population. As a result for example, nearly 50% of the daily generated garbage remains uncollected in the cities of Bangladesh (Bhuiyan, 2005). In contrast, although Singapore's recycling rate has been increasing over the past few years, rapid economic and population growth as well as change in consumption patterns in this city-state has caused waste generation to continue to increase.

Meanwhile, current challenges to waste management in Kumasi that city authorities face are; inadequate funding for capital investment for effective delivery of waste management services; inadequate equipment holding culminating in limited coverage of service delivery; inadequate bye-laws and lack of enforcement of available ones; inadequate revenue mobilization to finance Waste Management Service costs; bad attitude of residents such as indiscriminate disposal of household waste and littering due to lack of effective environmental health education and service promotion strategy; and poor infrastructure, particularly road networks and waste collection points, mostly in new settlements, which impacts negatively on service delivery (Asase et al., 2009). Lastly, due to the dual roles of government in service delivery and administration, the efficiency and quality of services have been criticized and commercialization has been suggested (Wang and Nie, 2001b; Yuan et al., 2006).

Approaches, practices or systems of SWM

As discussed above, the barriers and challenges relating to SWM include the various processes from waste planning to waste collection and treatment to market development for recycled products. Furthermore, due to differences in local conditions, as well as in the infrastructure upon which local capacity relies, cities face diverse challenges. Thus, an Integrated Solid Waste Management approach (IWM) is necessary to solve such a complex issue. An integrated approach does not depend on a single tool or agent to solve all problems, but rather views the system as a whole and seeks solutions through the employment of multiple methods and collaboration among all stakeholders (Seadon,2006). A framework for integrated waste management must recognize the major concerns of all stakeholders within the system as well as the closely related local conditions outside the system. Therefore the general community, which is the most important stakeholder in waste management activities, must also take an active part in solving the problems by modifying their behavior patterns for proper SWM ().

The SWM systems in London and Kumasi are discussed in terms of the key features of IWM and common system drivers identified in case studies of IWM presented in McDougall et al. (2001). These key features of IWM include the utilization of an overall approach, the use of a range of collection and treatment methods and handling of all materials in the waste stream in an environmentally effective, economically affordable and socially acceptable manner. The system drivers identified by waste managers include: good system

management, vision, stability, critical mass, landfill space, funding, and legislation, control of all solid wastes and public opinion and communication. The key IWM features and system drivers are combined for the discussion of the two waste management systems as follows.

With lessons drawn from experiences in developed countries, developing countries can improve on existing SWM systems, since waste management systems have evolved through many steps over the years in developed countries (Wilson, 2007). It is becoming widely recognized that an integrated approach to waste management leads to the sustainability of the waste management system. The concept of integrated waste management (IWM) according to McDougall et al. (2001) takes an overall approach and manages waste in an environmentally effective, economically affordable and socially acceptable way. It involves the use of a range of different treatment options at a local level and considers the entire solid waste stream.

Furthermore, the challenges and barriers discussed in the previous section are in fact interconnected. For example, the shortage of treatment and safe disposal capacity can be improved if the waste management system is better planned, thus allowing more private companies to enter the waste service and treatment market at low risk. The rising pressure in terms of cost efficiency on public services pushes governments to transfer part of those services to the private sector. A trend towards more privatizing can be noticed in the collection of municipal household waste e.g. in Flanders, the collection of household waste is done by both private and public organizations (Jacobsen et al., 2013); in 1994 the Dar es salaam City Council acknowledged the difficulty of providing adequate SWM by itself and, after gaining the experience as discussed above, decided to involve the private sector as a partner in solid waste collection services (Ishengoma, 2003, Kassim & Ali, 2003). Similarly, in Kampala, the capital city of Uganda, SWM is the responsibility of the Kampala City Council (since 2011 the Kampala Capital City Authority, KCCA) and its divisions. KCCA is required to ensure that solid waste (garbage) is collected and conveyed to treatment installations or approved disposal sites (Auditor General, 2010). The resources committed to solid waste management (SWM) by KCC proved insufficient and in the 1990s privatization was introduced (among other reasons) to attract sufficient finances.

In another study, Anjum and Deshazo (1996) proposed an approach based on integrating demand-side information into the planning process and recommended the involvement of urban

households in SWM planning. Kaseva and Gupta (1996), and Kaseva et al (2002), recommended an enhanced solid waste recycling as a sustainable approach towards SWM in developing countries. One of the SWM approaches adopted by Dar es Salaam city council is contracting out waste collection and disposal services to private solid waste collection and disposal contractors. Similar approaches have also been reported in Calcutta, India (Bhatia & Gurnani, 1996) and Kumasi, Ghana (Post, 1999), where private operators are handling more than 40% of the waste.

Waste services can be provided in three ways i.e. (1) pure private service exists when consumers contract with private actors on an individual basis for waste collection services, (2) pure public service occurs where the government owns and operates a service, (3) new hybrid forms of public private partnerships are emerging where public ownership may be mixed with private operation (Bel and Warner, 2008). In order to obtain economies of scale, municipalities transfer their responsibility regarding solid waste management towards a supralocal joint venture of municipalities. These joint ventures arrange the collection and processing of all household waste fractions for the participating municipalities. A total of 308 municipalities in Flanders form 27 supralocal joint ventures. Furthermore, municipalities do not always opt for the most economic efficient service and they are free to organize the policy regarding household waste. They can manage it on their own, they can cooperate with a private partner or they can be a part of a bigger entity, namely a joint venture of municipalities which has a private or public service level (Jacobsen et al., 2013).

On the contrary, in the course of achieving proper SWM, a lot of efforts in many developing countries have focused more on collection and disposal and ignored waste recycling which can result in reduction of the waste quantities that will finally require disposal (Kaseva & Gupta, 1996; Kaseva, Mbuligwe, & Kassenga, 2002). Anjum and Deshazo (1996), report that in most cities, municipalities and towns in developing countries, SWM costs consume between 20% and 50% of municipal revenues. However, the waste collection service levels remain low with only between 50% and 70% of the residents receiving services and most of the disposal being unsafe. Bhatia and Gurnani (1996) have further observed that the efficiency of collection of waste in urban areas of developing countries vary from 59% to 82% suggesting that a substantial amount of solid waste remains uncollected.

Recent national policies have also addressed waste reduction, recycling, and recovery, for example, the policies to “actively promote incineration, composting, and other comprehensive utilization of MSW” (NDRC, 2006a), and to “establish waste separation and collection systems and continuously improve renewable resource recycling systems” (The State Council, 2005). Sealed compact vehicles have been employed to collect and transport bagged garbage in large cities in order to avoid additional pollution during the transportation process (Chen, 2008). Informal agents remain the major collectors of recyclables, having been involved in this field since the mid 1990s when the government stopped offering the waste redemption services previously offered under the planned economy system. The number of scavengers in China is estimated to be over 2 million (Zhang, 2004).

In high-income areas, the system of collecting waste was mainly door-to-door collection. This method is also in conformity with the desires of waste generators in high-income areas who generally are capable of paying for a more convenient waste collection method. When a collection vehicle arrives at the entry point of the street to be served, normally one of the crew members would walk along the street alerting the households to bring out their waste in containers.

In the last few years, progress and improvements in SWM continue with the implementation of new regulations, policies, and support. For example, the Law on Circular Economy Promotion, effective from January 1, 2009, established a legal framework on waste reduction, reuse, and recycling (People’s Congress, 2008). Management Measures on Urban Waste, issued in 2007, highlighted the following principles for SWM: volume reduction, hazard reduction (ensuring that no hazardous compounds are released into the environment), resource recovery (transferring valuable wastes into alternative resources), and producer responsibility (MOC, 2007). The National Eleventh Five-Year Plan on Urban Environment and Sanitization released in 2006 also stipulated that the goal of SWM should gradually move from end-of-pipe treatments to integrated management strategies (MOC, 2006). The guidelines for “environmental protection model cities” and “eco-cities” set particularly strict standards for MSW safe disposal rates of 85% and 90%, respectively (MOEP, 2008a). In Dar es Salaam case, private sector engagement in waste management came to effect through a by-law adopted in 1993. The by-law was enacted in order to enable the privatisation of solid waste collection in some central areas of the city of Dar es Salaam. Beginning in 1994, solid waste collection services

were privatized starting with a five-year contract covering eleven wards in Ilala municipality ().

With progress in the commercialization of waste treatment and services, funds for SWM have become more abundant and diversified as they include local investments from both government and private companies, as well as financial aid from international organizations. Investments from government on MSW treatment and disposal, which constitute a portion of the public spending on urban sanitation, have been over 5 billion RMB since 2004. However, funds for SWM are distributed unevenly between cities (Adauto&Derval dos Santos, 2013). According to Brazilian Federal Law 11.079/04, a public-private partnership can only be established for contracts worth more than US\$11,000,000 and must be based on sound technical criteria and a demonstration of its viability, particularly in view of the monetary value involved and the costs for the private partner (transaction costs) and public partner (administrative costs); the financial return for the private partner must also be clearly delineated. By law, the contract of a public-private partnership may last for 5–35 years.

Another source of financing is the private sector, which has increased in importance in recent years. The private sector has more experience and flexibility in terms of financing, especially for projects that are expensive to build and operate, such as incineration plants. Such projects are long-term investments and can usually bring stable returns under franchised operations, usually via Build-Operate-Transfer (BOT) contracts. Among these treatment and disposal facilities, large landfill sites and incineration plants are the primary types of project that have attracted private investors in recent years. In addition to the two above-mentioned sources, assistance from international organizations is also important. Due to increasing concerns regarding MSW in China, a number of international organizations are providing financial and technical support at various levels.

Effects/outcomes or advantages

A number of studies suggest that as a result of privatization of solid waste management has greatly improved for in Dar es Salaam city, solid waste collection has improved from 10% in 1994 to 40% of the total waste generated in the city daily in 2001. These findings show that solid waste collection activities in the city, improved from 10% in 1994 to 40% of the total waste generated in the city daily in 2001. This improvement is attributed to private sector involvement in solid waste collection in the city. Similarly, the use of private contractors in waste management has higher operating efficiency because, firstly they are free

from bureaucratic hurdles and the upkeep of their equipment is excellent. Good condition of vehicles and equipment ensures not only trouble-free operation but also results in higher output and profitability.

Contracting out of solid waste collection services to the private sector has emerged to fill the gap in service delivery. In 1991 the city was generating 1400 tonnes of solid waste per day out of which only 5% was being collected. Currently daily solid waste generation is estimated at about 2500 tonnes and approximately 48% of the total waste generated is collected. The study also showed that the solid waste collection service by the private sector is greatly influenced by households' attitudes and behaviour. Their participation, demand for service, awareness, satisfaction level and views on cost recovery are important in the sector. The study concludes that the above factors would be superior if customers (households) were more involved in the planning and decision-making. For example according to Boorsman (1994), private sector is endowed with qualities such as political independence, economic rationality, efficiency, dynamism and innovation, qualities which make it measure up favourably to public sector enterprise.

Differences in costs under public and private production can be attributed primarily to competition. They are offered a total and complete service level in terms of waste collection, and therefore these municipalities are willing to pay an extra amount of money. In Flanders competitive tendering for private solid waste collection is compulsory. Furthermore there is the recognition that cost competition is not enough, but that tendering should also include aspects of service quality, stability, innovation and citizen engagement

In another study describing two models for the management of urban solid waste implemented in the municipality of São Bernardo do Campo: one of the models uses management by contract (MC) (Law 8.666/93) while the other model is based on management by public-private partnership (MPPP) (Law 11.079/04). Economic aspects related to the cost-benefit relationship in the management of urban solid waste, as well as environmental improvements and job and income creation in the municipality are also discussed for the two models. It showed that the estimated cost of treating solid urban waste under MC and MPPP; the improved efficiency resulting from investments in the MPPP, will lead to a reduction in costs. From an environmental point of view, MPPP generated about 52% less residue for final disposal in sanitary embankments, with a consequent decrease in air, soil and water pollution; there was also a decrease

in the use of natural resources and an increase in the amount of material obtained through selective collection. This partnership also led to recovery of the avarenga embankment with the transformation of this area into a public park.

Through this management by public-private partnership it was also possible to develop plans to enhance public awareness and to invest in environmental education in the management of urban solid waste as part of an effort to increase the participation of the general population in selective waste collection. In addition to the advantages indicated above, MPPP provided more job opportunities by expanding the number of collectors; all of these collectors were employed in six new sorting centers equipped with presses, vehicles for moving bales and suitable benches or tables for sorting the material.

Numerous examples of community initiatives provide proof of some of the advantages of decentralised composting, such as improved environmental conditions in residential areas thanks to a functioning and regular waste collection system. The waste no longer overflows at public collection points, thereby facilitating secondary collection by the municipal waste service. Environmental awareness has increased among the citizens who also welcome the positive changes in their immediate environment. Separate collection and composting of market waste also contribute to reducing the environmental impacts and waste haulages in Indian cities.

However, due to a lack of capacity in the public sector the private sector has stepped in to fill the gap. The contribution by the private sector to solid waste service provision is now a common phenomenon in most cities in developing countries (Ali, 1997). Dar es Salaam (DSM) has, since 1994, had solid waste collection services provided jointly by public and private sector. There has been a noticeable advance in the service after the entrance of the private sector; on the one hand new opportunities for employment have been created and on the other there has been an improvement in the cleanliness of the city. The majority of the households reported that they were satisfied with the service as compared with the service before privatisation. Thirty-three per cent of the respondents were reasonably satisfied, 7% were very satisfied, 28% indicated that the service needed improvement, 30% of respondents do not receive service, and 2% do not know whether the service is good or needs improvements. The privatisation of solid waste collection in DSM has brought several advantages; it has helped to create employment among the Dar es Salaam residents and improve the cleanliness of the city. Currently, the quality of service is much better than it was before

the privatisation. The private SWCs are keen to continue with the service and this investigation shows that both the same contractors and new ones are always able to apply and compete for tender every year. Furthermore, there is a remarkable recognition from the public sector

VII. CONCLUSION

MSWM in most developing countries is often characterized by inadequate service coverage, operational inefficiencies of services, limited utilization of recycling activities, inadequate management of non-industrial hazardous waste and inadequate landfill disposal (Zurbrugg and Schertenleib, 1998). Although distinct differences exist between waste management in developed and the developing countries, as developing countries achieve economic growth coupled with population growth the environmental and economic burdens of solid waste management will increase. The significant strides made in achieving the current level of success in the developed countries' waste management system is broadly due to their belief that a sustainable waste management system is based on sound guiding principles, strong service delivery values with as many locally based solutions as possible and moving at a fiscally responsive pace. This mindset is needed to move waste management in cities and largely in developing countries towards achieving higher levels of sustainability, and any substantial change in the SWM management will require close cooperation between government, private sector and citizens. However, analysis of the several studies' results indicated that SWM by a public-private partnership was more advantageous for dealing with urban solid waste than management by other practices since it provided a strong selective collection program, reduced the amount of solid waste sent to sanitary embankments, led to the recovery an area of land previously degraded by the incorrect disposal of urban solid waste and stimulated the installation of an energy recovery unit.

VIII. RECOMMENDATION

- ❖ In view of these facts, the best arrangement is a public/private partnership working together to educate the people about the service providers and service in general. Organised co-operative SWCs should also be encouraged to run their daily activities effectively; the local authorities could provide the private collectors with the facilities or grant funding and give them advice on how to run the service effectively.
- ❖ Privatization is seen as important in the general process of improving and modernizing urban

waste management systems that any city interested in having an effective SWM system can emulate. However, in order to institutionalize the active participation of other, private service providers, regulations pertaining to SWM must be formulated with a view of promoting and enhancing partnerships between the city council and other private service providers. A case in point is the KCC Solid Waste Management Ordinance (2000).

- ❖ It is also recommended in this paper that as the private sector can be contracted for waste service and treatment; local governments need to focus more on administration, monitoring, public education, and planning. Local governments need to enhance their capacities to arrange and support waste planning by coordinating with various agencies within the government, improving information transparency for public consultation, and collecting reliable basic data on waste properties and market demand for recycled products.
- ❖ Integrated waste management (IWM) should be encouraged since it has been accepted as a sustainable approach to solid waste management in any region. It can be applied in both developed and developing countries. This is because it takes an overall approach and manages waste in an environmentally effective, economically affordable and socially acceptable way. It involves the use of a range of different treatment options at a local level and considers the entire solid waste stream as put by McDougall et al. (2001).
- ❖ To address these three aspects in practice, city and provincial governments need to alter their role and mindset, no longer acting only as service providers but rather as managers and coordinators. MSWM is an expensive undertaking if it is conducted in an environmentally sound manner. Involving the private sector should result in greater efficiencies.
- ❖ Preparing a strategic, integrated solid waste management plan for the city. The plan should be drawn taking into account the waste generation sources, quantity, characteristics and the socio-economic and cultural structure of the city.
- ❖ Enacting strong and adequate legislation both from the national and city level to guide waste management decisions and strategies. To this end, there is the need for the enactment of a comprehensive national waste management law, backed by the requisite regulatory framework in terms of the byelaws by the Local Authority.

- ❖ Evaluating the real impacts of the waste management system. It will be good to measure the extent of pollution or environmental impacts associated with the existing waste management system to better appreciate the need for instituting adequate measures to prevent its occurrence. With this as this background, the policies, regulations and legislation established will be aimed at closing cycles of materials and at the establishment of environmentally compatible methods for the disposal of wastes.
- ❖ Utilizing locally based solutions for SWM service delivery. Locally based solutions should be sought for waste management equipment to ensure that they are serviced frequently and are in good condition at all times. This could reduce the investment needed for effective service delivery.
- ❖ Design, location and management of the waste collection centres must be done with full participation of the respective communities. This is because community's involvement can result in proper sanitation behaviour and prompt payment of RCCs.
- ❖ Recycling and composting activities should be encouraged in cities where waste components are largely organic matter and recyclables, and it has also been reported to be an approach of a right measure in attaining sustainability in waste management (Chung and Poon, 1999).

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