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ASSESSING THE STATUS, CHALLENGES, AND OPPORTUNITIES OF PUBLIC-PRIVATE PARTNERSHIP (PPP) IN SOLID WASTE MANAGEMENT (SWM) IN ETHIOPIA: A CASE STUDY ON MEKELLE CITY, TIGRAY

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ABSTRACT

The objective of this study was to explore the status, challenges, and opportunities of the existing Public-Private Partnership (PPP) in SWM in the Mekelle city. It has employed a qualitative approach; non probability sampling methods particularly purposive and convenience sampling procedures were applied in selecting sample respondents. Primary data was used- it was collected through key informants interview and scheduled semi-structured interviews; and analyzed on logical judgment basis. The existing solid waste management practice in Mekelle City clearly indicated that an Integrated Solid Waste Management (ISWM) model has been in practice, though incomplete, in addressing the challenge of urban solid waste management, such as Private Sector Participation (PSP) with clear contractual agreements; public sector participation (Municipality and Environmental Agency) involving NGOs (UNDP and ULGDP) and Community Based Organizations, and institutional restructuring. Except for not adopting technological innovations, the existing private-public partnership (PPP) in Mekelle City solid waste management is found to be relatively strong. Therefore, the municipality should introduce technological innovations (such as incineration, conversion to bio-gas, refuse derived fuel and composting, precast) to cater the ever increasing solid waste volume and create new opportunities for employment. Finally, further research is suggested on identifying, adapting, and expansion of innovative SWM techniques, considering the ever increasing solid waste volume in response to the Mekelle city expansion and its population growth.

KEYWORDS

Community Involvement, Environmental Education, Public Private Participation, Solid Waste Management, Waste Collection.

1. INTRODUCTION

This study was aiming at assessing the current status, challenges, and opportunities of Public-Private Partnership (PPP) in Solid Waste Management (SWM) in Mekelle City, Tigray- Ethiopia.

Increase in urbanization, population density and income, changing food habits, among others, positively cause rise in solid waste. Solid waste is, thus, an integral part of modern society. Human activities create solid waste. This calls for proper collection, separation, transportation, treatment, and disposal of solid waste. Otherwise, it causes risk to environment and public health.

Rapid urbanization is a dramatic reality in Ethiopia. Small towns are becoming cities and big cities are getting bigger as growing and increasingly mobile populations crowd into urban areas. Grierson and Brown (1999) explained that expanding urban populations, with their ever greater needs and expectations, are fuelling a relentless growth in demand for more and better urban services; services that many municipalities cannot hope to provide in the current climate of stagnant municipal budgets and decreasing external support. The staff, equipment, budgets, and the systems and methodologies needed to service growing cities are not adequately available within the public sector.

Mekelle city is among the fast growing cities in Ethiopia in which cost effective and sustainable SWM is becoming among the key municipal issues. The city is expanding, population is growing, residential areas are concentrated, waste generating businesses are emerging everywhere, food habits are significantly changing, etc. Thus, the role of waste generators and waste managers need to be assessed for developing cost effective and sustainable SWM system and infrastructure on the basis of their partnership.

Solid waste management constitutes one of the most crucial health and environmental problem facing governments in developing countries (Cointreau - Levine, 1994; Zurbrugg et al., 2006). It has been a local government responsibility to provide this service for decades (Pfammatter & Schertenleib, 1996). Government municipalities often oversee the collection, treatment, and disposal of solid waste. They struggle with the problems of high volumes of waste generated; the disposal technologies and costs involved in managing the waste (Furedy 1992; Rotich et al., 2005). While there are a variety of methods to treat and dispose of waste, the optimal waste management system depends on a large number of factors, such as: topography, population density, transportation infrastructures, socioeconomics and environmental regulations (Sakai et al., 1996).

However, they have failed to provide it to a large section of the population (Bolaane & Ali, 2004; Choguill, 1996; Cointreau – Levine, 1994). The main reason for this inability to manage waste is due to rapid population growth coupled with the expansion of cities, diminishing financial resources and poor urban planning (Bolaane & Ali, 2004; Choguill, 1996).

Thus, local government authorities incorporate private firms in delivering solid waste management services. These services encompass waste collection and transfer; disposal; recycling and composting; and in few cases resource (energy) recovery. It is broadly recognized that 'public-private partnership (PPP)' can help meet the growing demand for municipal services. According to Hutchinson (1996), Donaldson and Wagle (1995), and USEPA (1999), PPP is defined as the transfer and control of a good or a service currently provided by the public sector, either in whole or in part, to the private sector. It involves a wide range of private sector participation in public services (as cited in El-Fadel & Massoud, 2002). Grierson and Brown (1999) also explained PPP as municipal authorities working together with private enterprises to fulfill public sector responsibilities for urban municipal services.

Interest in PPP has been increased in Ethiopian municipalities. One of the most obvious manifestations of this reality is that small enterprises are moving in to fill the vacuum left by the public sector capacity. These private enterprises have demonstrated that private sector enterprises have an important role to play in meeting the demand for municipal services.

According to Jeffrey (1996), Sabra (1994), Shami (1998), and USEPA (1998), the increased interest in PPP can be attributed to:

- 1) Improved performance of the public sector by employing innovative operation and maintenance methods,
- 2) Reduced and stabilized costs of providing services by ensuring that work activities are performed by the most productive and cost effective means,
- 3) Improved environmental protection by dedicating highly skilled personnel to ensure efficient operation and compliance with environmental requirements, and
- 4) Access to private capital for infrastructure investment by broadening and deepening the supply of domestic and international capital (as cited in El-Fadel & Massoud, 2002).

Among the major responsibilities of a municipal administration is solid waste management. The solid waste is rising in almost all cities and towns for solid waste are an integral part of modern society. Rode (2011) reported that such rise is observed because of increase in urbanization, population density and income, changing food habits, taste and pattern. The growth of industry, commercial units such as hotels, theatres, restaurants, supermarkets are rising fast. Such units are positively contributing to the solid waste generation.

In the same way, the growth in the local economy has led to the rapid expansion of Mekelle city and its population. The increasing population and development has produced increasing volumes of waste to be managed. This rapid growth in population has added unmatched burdens to the municipal systems collecting and disposing of solid wastes.

Prior to 1991, there was hardly any problem of solid waste management in Mekelle City. The solid waste was locally managed. Almost all the wastes were organic in nature and were used as manure. The wastes collected were dumped on nearby river banks or in open fields. In those days, the flow of water in nearby rivers was capable in degrading the dumped organic wastes which were small in quantity. But these traditional practices could not continue due to the increasing population densities. Increase in population density has led to the increase in the volume of waste. This has created a massive threat to public health due to the lack of proper solid waste management.

Among the burdens is increasing cost of municipal solid waste management (SWM). The increasing cost of municipal SWM has led Mekelle city administrators to examine if this service is best provided by the public sector or can better be provided by the private sector. Public-private partnership (PPP) has emerged as a promising alternative to improve SWM performance. As a result, the SWM has been partially privatized, where private entrepreneurs are engaged in the collection and disposal of solid waste. In 1995, Bartone described that solid waste collection and processing is one area where there is clear evidence both of the benefits of private sector participation and of the need for closer cooperation between municipal authorities and private entrepreneurs (as cited in Grierson & Brown, 1999).

After the mid-1990s initiation started by the Mekelle city municipality to diagnose the problem and some short-term as well as long term suggestions were set. These suggestions were basically meant for the smooth functioning of the Solid Waste Management and quick collection and disposal of the waste. Thus, this study will assess the experience encountered to date with private sector participation in SWM in the Mekelle city. In addition, the public perception about solid waste collection services rendered was examined.

2. RELATED LITERATURE REVIEW

This section addresses the theoretical review and the empirical evidences on PPP in solid waste management challenges and opportunities.

2.1. THEORETICAL REVIEW

The formation of a public-private partnership on the community level, public-community based partnership (Franceys & Weitz, 2003), provides better services because it works more directly with the involved stakeholders (Baud et al., 2001). The development of SWM through the public-community partnership is seen as a way to improve the SWM system.

While opinions vary on the exact conditions necessary to facilitate successful PPPs, general consensus exists on a number of criteria. In the United States, the National Council for Public-Private Partnerships identifies the following as critical to success (National Council for Public-Private Partnerships, 2010):

- 1) Top leadership must be committed and actively involved in developing the partnership. Regulatory framework must also be in place to facilitate implementation of the project.
- 2) Public sector must be involved in monitoring the partnership's performance to ensure continued success.
- 3) Clearly laying out expectations ahead of time ensures a higher rate of success. The contract must outline the responsibilities of each party and a process for dispute resolution.
- 4) There must be a method of repayment for the private investor (tariffs, tolls, etc.).
- 5) Open communication is critical to securing support of various constituencies and ensuring the partnership's success.

Moreover, the following criteria were identified as conditions specific to waste management in Vietnam, to overlap significantly with those priorities highlighted above by the National Council for PPPs (SS URENCO, 2009):

- 1) Both parties must share responsibilities in managing the project.
- 2) Cost recovery for the investor as well as flexibility in the tariff schedule must exist.
- 3) Minimal time should be spent on bureaucratic procedures and little tolerance allowed for corruption and incompetence.
- 4) Achieving government consensus on the current regulatory framework.
- 5) Adequate infrastructure is critical to attracting investors.
- 6) Attracting foreign investment and ensuring the success of PPPs requires a stable and reliable workforce. Retaining well-educated and well-trained individuals continue to be a significant challenge.

In sum, generation of solid waste is increasing rapidly due to the combined impact of population growth and improving living standards. As people of all income levels consume more, there is an increased demand for waste management infrastructure projects and need to address public health concerns.

Solid waste management is a non-excludable good as it is difficult to be protected by the general market forces. One way of managing non-excludable goods or services is either by the internalization of costs (by levying charges for the use of the services) or by following a command and control policy or a combination of both. Government intervention is necessary for this. But, PPPs has been found a solution to cater urban solid waste management.

Therefore, by providing an avenue for private sector involvement, PPPs help promote stronger systems through management efficiencies, advanced technologies, cash flow management, workplace efficiencies, shared resources, shared capital, and personnel development. A strong PPP capitalizes on the strengths of both private and public sector to reduce development risk, provide better and more cost-effective public service, and speed up the rate of implementation or coverage.

2.2. EMPIRICAL EVIDENCES

The definition of partnership has evolved from a matter of simple coordination and coalition to more participatory terms such as mutual collaboration, common goal and shared responsibility (Haque, 2004). PPPs:

- Offer promise of better success when the strength of more than one player is required (Rosenau, 1999).
- Considered to be flexible and dynamic holding the promise of possible compromise in the form of constructive collaboration (Nkya, 2006).
- Ensure private sectors are better at performing economic tasks, innovating and replicating successful experiments, adapting to rapid change, abandoning unsuccessful or obsolete activities and performing complex or technical tasks (Rosenau, 1999).
- Increase the responsiveness of policies and create accountability to new stakeholder group by including them into policy-making process (Steets, 2004).

According to Adarsh (1996), in addition to the traditional practice where Municipal Authorities assume the responsibility of urban waste management, the following innovative urban waste management activities are being practiced in India:

- Ensuring **people's participation** in the collection, segregation and disposal of garbage by forming clubs or community based organizations.
- Encouraging the **involvement of NGOs** in working on various environmental programs and areas related to urban SWM, including educating the public about the importance of better waste management.

- Developing public-private partnerships leading to the **privatization** of some aspects of garbage collection, recovery and disposal.
- Applying **technological innovations** for effecting improved recovery and disposal of waste. Some of the known technologies observed are incineration, conversion to bio-gas, refuse derived fuel and composting.
- Initiating provisions aimed at **administrative restructuring** of the urban local bodies (Municipalities) to enable them to discharge their specific responsibilities more efficiently.

Cointreau – Lavine (1994) has identified the following broad forms of Public Private Partnerships in SWM:

- **Contracting-** government awards a finite-term contract to a private firm for the delivery of solid waste collection service, street sweeping service, collection of recyclables, transfer station operation or disposal site maintenance. The private firm is paid for service delivery by the government under the terms of the contract.
- **Concession-** government awards an agreement or license to a private firm to set up a facility that utilizes the government - owned resource refuse. This concession may enable the private firm to recycle materials (paper, plastic, metal, glass) from refuse; to recover resources (compost, heat, electricity) from refuse; or to transfer or dispose of refuse. The concession is in the form of a long-term contractual agreement, whereby the private firm builds the facility.
- **Franchise-** government awards a finite-term zonal monopoly (a franchise) to a private firm for the delivery of solid waste collection service. The private firm recovers its cost and profit through direct charges to the households and establishments that are served. The company incurs the costs of billing including costs of nonpayment and late payments by community.
- **Open competition methods-** government freely allows qualified private firms to compete for refuse collection, recycling, or disposal services. Individual households and establishments make private arrangements with individual firms for refuse collection and recycling. No firm holds a zonal monopoly, and any number of firms may compete within the same zone. Costs are directly billed by the private firms to their customers.

Private Sector Participation (PSP) in waste management has been introduced in Nepal. In most cases, the involvement of private sector has been in the form of management contracts where a private contractor is given the responsibility of collecting waste from a certain area for a fixed fee. There are two PSP systems commonly practiced by municipalities in Nepal (SWMRMC, 2004):

- **Franchise system-** a private company is given the responsibility to collect waste as well as service fee from waste generators in a designated area. This form of PSP usually results in less cost for the municipality and the service provider becomes more accountable to the people.
- **Concession system-** a private sector invests in waste management related facilities such as compost plants and operates it for a certain time.

As waste is generated by the people, their participation is essential to ensure a well managed solid waste management system. Municipalities have realized this fact and initiated programs to educate local communities and involve them in waste management, including the following (SWMRMC, 2004):

- **Children and Environment:** establishing nature clubs, building capacity of club members and organizing various activities within the school and surrounding community.
- **City Volunteer:** work as a link between the municipality and the community to promote household composting and recycling and community involvement in keeping their neighborhood clean.
- **Community Participation and Training:** working with community groups and provides them technical and financial assistance where necessary; also form and support Ward Environment Committees in several wards.
- **Demonstration of Environmental Technologies:** promoting technologies such as compost bins and vermi compost kits.
- **Community Recycling Centers:** encourage and assist people in recycling their waste.
- **Mass Education:** reaching out to the general public through radio programs, message boards and regular exhibitions.

According to Puorideme (2010), the emerging conditions that appear to have hindered the practice of an Integrated Solid Waste Management (ISWM) are:

- Limited collaboration between the Municipal Assembly and the public and private sectors.
- Lack of clear contractual arrangements for Private Sector Participants (PSP).
- Lack of public sector participation involving environmental Non-Governmental Organizations and Community Based Organizations.
- Lack of recognition of informal sector participation involving scavengers and itinerant wastes buyers.
- Lack of community mobilization units under the waste management departments.
- Lack of technological innovations for urban solid waste management.

Many other researchers have also reported the following barriers to PPPs in SWM:

- Attitudinal barriers to public private partnerships (JICA, 1997; Kettl, 1993; Medina, 2000; Schubeler, 1996).
- Institutional barriers to public private partnerships (Pets, 2004).
- Political barriers to public private partnerships (El- Fadel & Massoud, 2002; Schubeler, 1996).

There has been an important increase in the use of public private partnerships. PPPs represent the joint effort of a government and private entity to provide goods and services. With regard to waste management projects, PPPs can (Massman, 2007):

- Create a larger infrastructure for managing waste than could otherwise be achieved through public funding;
- Strengthen infrastructure with guaranteed services;
- Provide more taxpayer value;
- Stimulate innovations that typically occur in a commercial market; and,
- Optimize the quality of infrastructure and personnel by combining skills and assets of both public and private sectors.

Besides, Massman (2007) summarized the reasons for implementing PPPs as follows:

- To provide additional capital;
- To provide better management and implementation skills;
- To provide more added value; and
- To more efficiently allocate risks, thus improving the identification of needs and the optimal use of resources over the whole life of a project.

According to Puorideme (2010), the potential advantages of PPPs over traditional public procurement procedures are acceleration of infrastructure provision, faster implementation, reduced whole life costs, better risk allocation, better incentives to perform, improved quality of service, generation of additional revenues, and enhanced public management.

Local government authorities incorporate private firms in delivering solid waste management services. These services encompass waste collection and transfer; disposal; recycling and composting; and in few cases resource (energy) recovery.

The operational options for primary waste collection in developing countries are observed to be (Cointreau – Levine, 1994; ILO, 1997) door-to-door collection system, communal storage or bring system, and house to house collection with trucks. Wilson et al. (2006) have also reported that the common methods of waste disposal in developing countries are observed to be open dumping, burying and burning of waste in open spaces, sanitary landfill, recycling, and composting.

Adverse environmental impacts from improper solid waste management are rooted in inadequate collection, recovery of recyclable and disposal of wastes. These impacts are also due to inappropriate location, design, operation, or maintenance of dumps and landfills. Improper waste management activities are associated with the following environmental impacts:

- Threats to public health (EGSSAA, 2006; Johannessen et al., 1999; Muttamara & Leong, 1997):
- Surface and groundwater pollution (EGSSAA, 2006; Muttamara & Leong, 1997).
- Air and atmospheric pollution (EGSSAA, 2006; El - Fidel et al., 1997; Muttamara & Leong, 1997)
- Ecosystems damage (Beede & Bloom, 1995; EGSSAA, 2006).

Besides, SS URENCO (2009), in its study in Vietnam, reported that the challenges of SWM were landfill capacity constraints; landfill hazards; separation and recycling; financial management; lack of sufficient human and technology capital; and capacity, training, and public awareness challenges.

3. PROBLEM OF STATEMENT

Solid waste management (SWM) is an important environmental health service and is an integral part of basic urban services. Disposal became problematic with the rise of towns and cities where large numbers of people started to congregate in relatively small areas in pursuit of livelihoods. On the one hand, the density of population increased in these centers of congregation and, therefore, wastes generated per unit area also increased. On the other hand, available land for disposal of waste decreased in proportion. SWM thus emerged as an essential, specialized sector for keeping cities healthy and making them a place to live (Bolaane & Ali, 2004; Choguill, 1996; Furedy, 1992; Grierson & Brown, 1999; Pfammatter & Schertenleib, 1996).

The challenges of the SWM sector are continuing to grow with the growing urbanization. Urbanization has become a worldwide trend, and is particularly rapid in the developing world. In tandem with the growing urban population, the production of solid waste is also increasing. It is clear that SWM in future will expand in scope and complexity. It will also consume a considerable proportion of city budgets. The SWM sector, thus, deserves careful attention for striking a balance between quality of service and cost effectiveness. This challenge is particularly significant for developing cities, like Mekelle city, where resources are limited but urbanization is occurring rapidly.

For that reason, there is an emerging trend in encouraging the private sector to enter into solid waste management (SWM) operations, and attempts are being made to formally link the public and private sector operators. Such linkages may improve the efficiency of the entire sector and create new opportunities for employment. Effective, efficient, and sustainable solid waste management is compelling for the ever growing Mekelle city. **It is, thus, worth assessing the current status, challenges, and opportunities of Public-Private Partnership (PPP) in SWM in the Mekelle city.**

4. OBJECTIVES

4.1. GENERAL OBJECTIVES

The study was assessing the status, challenges, and opportunities of the existing Public-Private Partnership (PPP) in SWM in the Mekelle city; and the public perception about solid waste collection services rendered was examined by using logical qualitative judgment.

4.2. SPECIFIC OBJECTIVES

The study had the following specific objectives:

- 1) To examine existing status of SWM system,
- 2) To assess how solid waste generators manage the solid waste,
- 3) To ascertain how solid waste managers manage the solid waste, and
- 4) To examine public perception on solid waste collection services.

5. METHODOLOGY

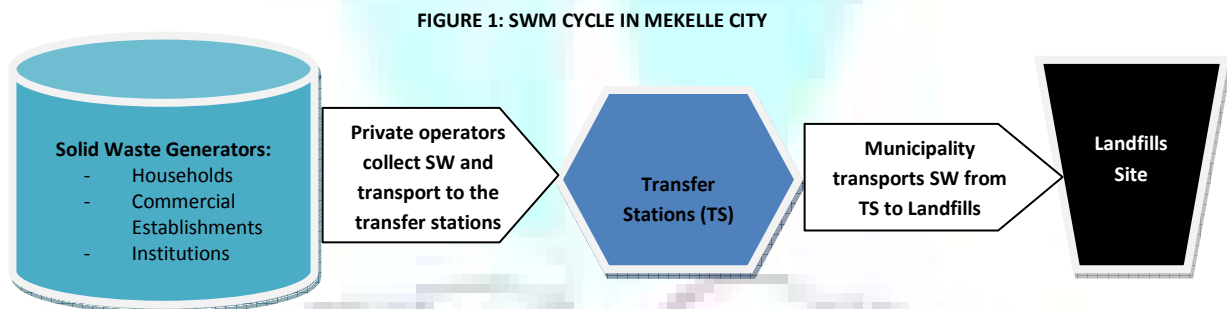
5.1. RESEARCH DESIGN

The study was employing a qualitative approach given the nature of the study. It was exercising a participatory approach. It offered solid waste generators (i.e., households, hospitals, universities, hotels, etc) and solid waste managers (i.e., municipality and private firms) the opportunity to participate in searching and examining the solid waste management challenges and opportunities. Moreover, it gave the researchers the opportunity to be involved in the issue of solid waste management in Mekelle city, to get a better understanding from the actors' point of view.

This study was assessing the status, challenges, and opportunities of PPP in SWM in the Mekelle city. In addition, the public perception about solid waste collection services rendered was examined. It was carried out in Mekelle city. Mekelle is the largest and relatively highly urbanized city in Tigray. It is, thus, believed that Mekelle city is feasible for assessing the PPP in SWM. Moreover, the study was confined only to the SWM portion of the Mekelle municipality service.

5.2. CONCEPTUAL FRAMEWORK

This study has tried to examine the status, opportunities, and challenges of Public-Private Partnerships (PPPs) in Solid Waste Management (SWM) in Mekelle city. The interaction among the public (municipality), private business, and community in SWM was examined by considering the following conceptual framework.



Source: Own design (2013)

5.3. DATA TYPE, SOURCE, COLLECTION, AND ANALYSIS TECHNIQUES

Primary data was used. It was collected from both the waste managers and waste generators by using scheduled semi-structured interviews. Finally, the data was analyzed on logical judgment basis.

5.4. SAMPLING TECHNIQUE

Non probability sampling methods particularly purposive and convenience sampling procedures were applied in selecting the waste generators and waste managers, respectively, for data collection. 70 households (10 each from seven local administrations), Milano Hotel (1), Axum Hotel (1), Mekelle Hospital (2), and Mekelle University (2) were selected from the waste generators on convenience basis; and 10 key informants were selected from the waste managers on purposive basis. Moreover, commercial establishments (such as super-markets, mini-markets, cafeterias, pubs, coffee houses, bars, tailors, beauty salons, and barbers), other than above, were randomly consulted on the existing SWM in the Mekelle city.

6. RESULTS AND DISCUSSIONS

The description of the study area provided evidence that population is growing quite rapidly as a result of the social and economic development opportunities that have been introduced during the last two decades. Population increase has significant influence on the quantity of solid waste generated and its proper handling in the municipality. The population of Mekelle City is rapidly increasing as a result of its rapid urbanization. However, this population growth has not been accompanied with increase in the municipal solid waste management infrastructure. The implication of this growth is large quantities of solid waste generation and increased pressure on solid waste management infrastructure as a result of the increasing solid waste generated daily. In view of this, the existing solid waste management in Mekelle City is analyzed in this section.

6.1. SOLID WASTE STREAM IN MEKELLE CITY

Solid wastes generated in Mekelle City can be classified under organic waste (i.e., grass, paper, fruits and vegetables, food scraps, leaves and wood, inert waste such as ash and sand, dead animals, etc) and inorganic waste (i.e., plastics, metals, glasses, clothes, bones, and batteries). The major sources of solid waste generators include residential, institutional and commercial establishments. Households and hotels generate large quantities of organic, bone, and plastic

wastes while university generates greater quantities of organic and plastic wastes. Other commercial establishments generate organic, plastic, metal, batteries, glasses, and clothes. According to the Mekelle City Municipality, significant amount of solid waste generated is organic. Most of the workshops by-products (metals) are reused for further production.

The high proportion of plastic waste is as a result of the fact that plastic bags and containers have become the most dominant packaging material for most of the items (including water) bought from open markets, supermarkets and restaurants. Inert waste including sand and ash from households and construction works also constitute the greater proportion of solid waste since most households depend largely on coal and fire wood as source of energy for cooking, baking, and brewing. Apart from the households, the rapid increases in hotels, restaurants and bar operations have contributed to the high levels of organic waste generation. Hospitals generate greater quantities of organic and plastic wastes. Besides, according to the Municipality, much of the solid waste from hospitals are hazardous and these institutions are expected to manage these waste by themselves in a manner that ensures public safety and for that matter do not form part of the classifications above. The management of hazardous waste by the hospitals is not discussed for the respondents were not voluntary to share "how" they manage it.

6.2. EXISTING SOLID WASTE MANAGEMENT ARRANGEMENT

The Mekelle Municipality has the primary responsibility of managing the solid waste generated in the municipality. It performs a range of services in solid waste management including collection, transportation and disposal. As a result of logistics and financial constraints, three private operators (Diliet, Fana, and Superdan) have been contracted by the municipality to collect solid wastes from the households, hospitals, hotels, university, restaurants, shops, etc and transport to the transfer stations. Moreover, micro enterprises were also organized and have sub-contract from the private operators to collect solid wastes from the streets only by using carts and load to the mini-transfer station as well as private operators' cars.

There are four transfer stations in Mekelle city: Dejen, Mayduba, Meskerem Hospital, and Quiha. Transportation from these transfer stations to the landfill (disposal) site is managed by the municipality itself. Sometimes, the private operators were instructed to directly transport the solid waste to the landfill site when the transfer station is fully occupied, on fee basis.

Households pay Br.6/annum to the municipality attached to their annual land rent; commercial establishments pay Br.24/annum to the municipality attached to their annual land rent; but government organizations, except Mekelle University, are free. The payment for services carried out by these private operators for households, government organizations, and commercial establishments is done by the Mekelle municipality on contract basis (Br. 27/M³ plus 15% of the total payable amount; Br. 541.97 per month per transfer station for health safety; Br.11, 476 per month for office employees; Br. 50 per dead donkey and horse; Br. 50 per sewerage hole (manhole) if clearing is conducted beyond their agreement, for their agreement is sewerage clearing 3 times per year). The private operators should pick solid waste 12 times per month from the households, government organizations, and commercial establishments. Beyond this, the solid waste generator pays directly additional service fees to the private operators ranged from Br. 153 to Br. 500 per month, excluding VAT.

The Mekelle Municipality supervises the private operators at the municipal level. The private operators also reports monthly to the municipality. The municipality has been successful in involving the private sector in solid waste management, which was carefully monitored and evaluated. However, the private operators appeared not accountable to the households. For example, the households complained that they picked up not more than twice a week, i.e., less than 8 times per month. Similar complaints are also reported from hotels.

The payment for street waste collection by the micro enterprises is done by the private operators on sub-contract basis, i.e., Br. 37,000 per month. On the other hand, the payment for services rendered by the private operators to Mekelle University is managed by the client on contract basis. The private operators were carefully monitored and appeared accountable to their clients.

6.2.1. SOLID WASTE STORAGE AND COLLECTION

The private operators were responsible for collecting solid waste from households, hospitals, hotels, and university. They practice door-to-door solid waste collection. There are no communal solid waste containers where waste generators dump their waste for it to be collected by waste service providers. Rather, the solid waste generators have their own containers such as waste bins, plastic and metal barrels, etc. The municipality also placed dust bins along the major streets for storing waste for collection. Waste generators do not pay user fees for such collection system. The frequency of collection of solid waste by private operators for transfer stations is twelve (12) times per month and from the transfer station to the final landfill (disposal) site by the municipality is on daily basis. But, the system is characterized by absence of communal solid waste containers in the residential areas. As a result, the residential areas are full of different solid wastes dumped here and there.

Only private operators practice households' door-to-door and office collection of solid waste in Mekelle City; however, micro enterprises are confined only to the street solid waste collection. Households and offices are encouraged to apply plastic waste container according to their preference where solid waste is stored for collection. Waste is moved straight from the source to a collection vehicle at a given time.

The study revealed that there was written contractual agreements between the private operators and the municipality; the private operators and the micro enterprises; and the private operators and Mekelle University. Thus, when and how services were rendered to the beneficiaries was the discretion of the municipality and the Mekelle University. However, the private operators are not accountable to households for the door-to-door services.

6.2.2. SOLID WASTE DISPOSAL

There are four transfer stations in Mekelle City where the private operators dump the collected solid waste from trucks in to the solid waste containers. The current municipal solid waste landfill site is open space, but fenced, located 6.5 kilometers away from Mekelle city. The municipality trucks picked up the waste containers from the transfer stations to the landfill site in Adi-Qolomay which is to the west of Adiha, i.e., located in western Mekelle. The disposal method at present is controlled landfill. Separation is arranged to be 60% at the solid waste generator, 30% at the transfer station, and 10% at the landfill site. MSEs waste pickers are allowed access to landfill (disposal) site for separating the organic and inorganic solid waste for Br. 42 per a municipality car, i.e., one container.

The solid wastes separated by the MSEs in the landfill site are composed of organic and nonorganic. Only the organic solid waste is being dumped on the landfill site, where the organic waste is spread in to layers; ground landfill is compacted in order to reduce its volume; and covered by soil in order to treat exposure to wind and facilitate composting, fire, wild animals (like hyena) and leachate pond is constructed in order to treat exposure to leachate.

The ground landfill forms like a plateau (mountain). The solution, however, towards disposing this composted organic waste is undefined. The non organic wastes are different plastics, glasses, and bones. The researchers did not find separated metals during their site observation. The site administrator also confirmed that the metals are being properly separated by the waste generators and at the transfer stations, for they have an immediate market. On the other hand, the nonorganic wastes have been accumulated in the field unsafely exposed for manmade and natural fire. An interview with the site administrator revealed that it is not known how to dispose the separated and accumulated nonorganic wastes. They are separated and accumulated on daily basis expecting there will be a solution in the future. However, it demands an immediate solution.

Besides to the danger it has being on the field, there was repeated fire broke during the last winter (i.e., mid of this year 2005 E.C.) burning the different plastics; threatening the locals. The researchers also observed that there is still smoke emission inside the burned nonorganic wastes which is prone for future fire.

The management of the landfill site is the sole responsibility of the municipality. The private operators do not contribute to the management of the landfill site. Source separation of organic and inorganic solid waste has been in practice. It is separated in to organic and inorganic mainly at source, i.e., by the solid waste generators; and by the private operators, and at the landfill site.

Building the capacity of community members to engage in safe composting by using organic solid waste could contribute to solid waste management in terms of solid waste reduction. Significant volumes of organic solid wastes (such as soil, grass, leaves, wood, scrubs of fruits, vegetables, food, etc) are disposed by the waste generators that could be easily used for rehabilitating their surrounding land fertility through composting. But, the Mekelle municipality has not been able to come up with composting technology.

Accountability lacks on unapproved solid waste disposal around the residential areas. Waste generators have employed various means of solid waste disposal that have not been approved by the municipality (i.e., open air burning, disposal on the street as well as dumping in the open). It was observed that solid wastes from households were disposed indiscriminately especially around uncompleted buildings and flat lands. The study also indicated that some residents disposed off their solid waste into drains or openly burnt their waste.

According to the municipality officials of the Mekelle City, measures have been put in place such as public education to bring the situation under control. It was observed, however, that the public education efforts of these service providers were not matched with sufficient waste infrastructure provision. It appears that public education programs on solid waste management were ineffective and unsustainable for addressing the issue of unapproved and indiscriminate open dumping of waste. Open dumping is prohibited but there were no communal waste container available for waste storage and collection. This implies that open dumping and open air burning of waste would continue regardless of the warning signs until such time that communal containers are provided for waste storage and collection.

6.2.3. RECYCLING AND COMPOSTING

The study revealed that even though organic solid waste and recyclable solid waste were generated in Mekelle City, the municipality as well as the private operators did not engage in any recycling and composting activity. According to the service providers, they do not have recycling and composting technologies to engage in any recycling activities.

6.2.4. OUTCOME OF THE SOLID WASTE MANAGEMENT SYSTEM

The existing solid waste management system has several repercussions for Mekelle City as a growing town. The study revealed that solid waste management practices that emphasize on collection, transportation and final disposal has been ineffective. The system has limited potential for creating jobs and other economic opportunities since recycling and composting technologies do not form part of the existing solid waste management system, for waste is wealth.

6.3. WASTE GENERATORS AND MANAGEMENT OF SOLID WASTE IN MEKELLE CITY

There are three broad categories of waste generators in Mekelle City. These include residential, commercial and institutional waste generators. In this study, households were classified under residential waste generators; Hotels were also classified under commercial waste generators while university and hospitals were classified under institutional waste generators. This section of the study provides insight into how these major waste generators manage the waste they generate.

6.3.1. SOLID WASTE MANAGEMENT IN HOUSEHOLDS

The study revealed that the households were involved in solid waste management activities including temporal storage, disposal, and reuse.

TEMPORAL STORAGE AND DISPOSAL

Households in Mekelle City have their own containers for storing the solid waste they generate. These containers were not uniform in size and type. However, the common characteristic of all the containers used by the households for waste storage were waste materials such as plastic, barrels, and cartons. The study also observed that the households were willing to participate in solid waste management but the municipality lacked the capacity to provide a standard storage sizes. Households empty their containers at most 2 times a week into the private operator trucks roaming for removal by solid waste service providers. However, the sizes of the household waste containers pose a challenge to the safe storage and disposal of household solid waste. The containers are often filled up before schedule and it contributes to indiscriminate open dumping since households had no communal waste container.

REUSE

Households reuse some of the waste they generate. Waste reuse is considered one of the very effective methods of solid waste management in recent time. Reuse is a simpler process involving reutilization of material in its end used form without the necessity of reprocessing, i.e., bottles and plastics are reused for packaging, such as oil, fuel, powder, etc, and plantation, such as flower and vegetables.

The plastic waste that was reused includes used polythene bags and plastic containers such as buckets. These materials were often sorted or picked from the household solid waste stream. The study revealed that the reused materials were not durable enough and as a result they were discarded as waste within a very short time after reuse. Even though households reused organic waste, they did not prepare compost. They often leave them in their backyard gardens to decompose and serve as manure.

6.3.2. SOLID WASTE MANAGEMENT IN COMMERCIAL AREAS

Solid waste management in the commercial area has been the responsibility of both the firms (i.e., commercial firms collect and separates their solid waste until picked by the private operators) and the private operators pick the collected and separated solid wastes 12 times a month. On the other hand, the private operators sub-contract to the micro enterprises who sweep the streets on a daily basis.

6.3.3. SOLID WASTE MANAGEMENT IN MEKELLE UNIVERSITY

The study revealed that the major types of solid waste generated comprises paper, plant and plastic wastes and the Mekelle University is responsible for managing the waste it generates under contractual agreement with private operators. But, it does not have any technology for recycling solid waste. The study also revealed that the private operators provided containers for waste storage and collection. It is not allowed to dump solid waste indiscriminately around or near the university premises.

6.3.4. SOLID WASTE MANAGEMENT IN HOSPITAL

The hospitals generate both hazardous and non hazardous solid waste. The hospitals are expected to manage their waste under contractual agreement with private operators. Solid waste is generated from various sources within the hospital. These sources included the wards and the hospital surroundings. The technologies used for the management of waste from these sources differ. Containers are provided by the private operators for the temporal storage and collection of waste from the surroundings of the hospital and wards excluding injection syringe. The injection needles are separated and burned in an incinerator constructed by the hospital. Hazardous waste such as human body parts are buried in a specially designed covered pits.

7. CONCLUSIONS

The analysis of data from the field revealed that the Mekelle City municipality has tried to adopt the Integrated Solid Waste Management (ISWM) model which has been proven to be the most preferred model for managing solid waste in urban centers of developing countries, except for introducing composting and recycling technologies.

The existing solid waste management revealed active stakeholder participation, involvement of NGOs and Community Based Organizations in solid waste management. The private and public sectors have been playing key roles in the solid waste management process.

However, the inability of the waste generators to efficiently manage the waste generated (i.e., did not minimize the solid waste by at least separating the organic wastes and composting; avoiding open waste disposal, etc) poses serious problem for the efficiency of the existing solid waste management practice and its sustainability.

The study revealed that existing solid waste management practices in Mekelle City was inefficient and unsustainable for managing the increasing volumes of solid waste. The current solid waste management practices in Mekelle City put emphasis on waste collection and disposal without recovery, recycling and reuse. Thus, the current system cannot cope with the increasing volumes of solid waste generated daily.

The study also revealed that waste generators did not have the capacity in terms of appropriate technologies to manage the waste they generated. Households lacked the standard containers for separating, collecting, storing and moving solid wastes to trucks. Household composting of organic waste was not in practice, and open and street dumping was the norm. Hospitals did not have appropriate technologies for adequately managing hazardous waste except for a small incinerator for burning injection syringes and a pit for burying human parts.

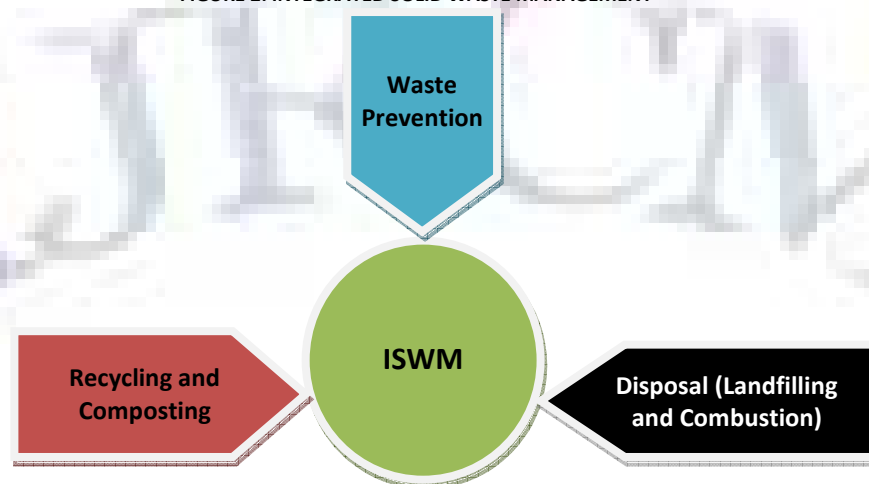
Moreover, the study revealed that the landfill site lacks fire truck; the workers separating waste at the transfer station and landfill site lack standard safety devices; waste generators lack standardized waste containers, composting technologies, and communal waste containers; and there is no clearly stated remedy for the organic as well as inorganic wastes mount up at the landfill site.

Therefore, in order to strengthen and sustain best practices of ISWM in Mekelle City:

- Special attention is required:
- ✓ For the annual sanitary payment made by the households and commercial establishments. The volume of solid waste generation is positively correlated with the level of income earned. However, the annual sanitary fee charged by the municipality among the households as well as among the commercial establishments is same; i.e., not based on the assessed amount of waste generated.

- ✓ On standardizing the solid waste containers and solid waste collection materials used at household, commercial establishments, and other offices. As can be seen from the above pictures (Photo 1 & 3) they are not standardized as a result they may breed bacteria, mosquito, etc. cause danger to household health; filled with short period of time causing spread here and there by wind, dogs, cats, rats, birds, pigs etc.; and cause inconvenience and result in physical damage for collectors while loading on cars and cart.
- ✓ For safety devices. As can be seen at the transfer station as well as the land fill separation (Photo 6-7), the workers lack standardized safety devices such as a devise that covers their neck-up part of their body. They are easily exposed to physical and health damages. Moreover, there has not been fire truck or any device to fight fire at the landfill site.
- ✓ For recycling and composting. However, the municipality has been looking for potential investors to come instead of taking the lead to introduce composting technologies at waste generators level and taking the risk to engage in recycling inorganic wastes with the intention to privatize it sometime in the future.
- The municipality should set standards for containers as well as safety rules in order to pledge those engaged in solid waste collection, separation, and emptying waste containers; and reconsider the set annual sanitary fee by taking into account the magnitude of waste generators' waste generation capacity.
- Provide local community with communal solid waste containers in order to mitigate open dumping and disposal. cap
- There is the need for continuous efficient collaboration between the municipal authority and the private sector, i.e., involving participation from the private sector in order to establish a solid-waste management partnership. Thus, the municipal authority should put in place mechanisms such as stakeholders forum, performance review meetings to facilitate the process of data and information sharing on solid waste management among the parties responsible for solid waste management. This is essential for experience sharing and avoidance of duplication of efforts.
- ✓ A collaborative effort is required by the stakeholders such as Mekelle University, Bureau of Agriculture, Agricultural Research Bureau, EFFORT, Environmental Agency, Municipality, and NGOs to seek an immediate solution for the treatment of the nonorganic and organic wastes amass at the landfill site.
- ✓ The landfill site should be equipped by a permanent fire truck along with a trained staff in fireguard, environmentalist, and sanitarian.
- ✓ Additional MSEs should be encouraged to engage in separating solid wastes at the landfill site.
- The households are expected to be empowered, i.e., to evaluate the performance of the private operators. This is necessary to strengthen the bond of collaboration between parties (households, private sector and municipal authority) and make private sector accountable to the households at the local level and vice versa.
- Introduce a concession system (in addition to the existing franchise and contract system) for the private operator would be expected to invest in waste management related facilities such as compost plants and operate them for a certain time.
- The municipality should formulate comprehensive solid waste management plans and solicit for funding from donor agencies that show interest in environmental issues to form and facilitate the operations of Community Based Organizations (CBOs) in solid waste management, i.e., secure or establish stable financing and ensure funds are used appropriately.
- The municipality can assist CBOs to develop proposals and source for funding from the World Bank and other NGOs to implement solid waste management programmes that contribute to efficient and sustainable solid waste management.
- The private informal sector (such as itinerant waste buyers) needs to be organized into associations and groups so that programs can be designed to build their capacities and also assist them with protective equipment to efficiently participate in the solid waste management process.
- ✓ Through the formation of co-operative societies or micro-enterprises, it is often possible to considerably increase the job stability and earnings of such informal sector workers and to enhance the effectiveness of their contribution to waste management.
- ✓ The programs should be designed in a way that fosters collaboration between the private formal and informal sectors.
- ✓ The regional government, municipal authorities and donor agencies should coordinate efforts aimed at promoting the growth of the informal sector in solid waste management.
- A unit should be created within the waste management department to be responsible for engaging civil society organizations in urban solid waste management, i.e., involve the community in waste-management decision making. This unit should be responsible for working with various community groups, youth groups and school children to raise awareness and provide training and necessary support for effective solid waste management.
- Capacity-building measures are required because many officers in charge of solid waste management, particularly at the local level, have little or no technical background or training in engineering or management. Thus, the municipality should build capacity of administrative and technical staff in government, NGOs and/or the private sector
- The municipal authority need to formulate strategies and implement technological innovations necessary for effecting improved separation at source, resource recovery, recycling and disposal of solid waste. Some of the technologies that are in practice abroad, such as incineration, conversion to bio-gas, refuse derived fuel and composting, can be adopted.
- The municipal authority need to adapt an integrated solid waste management system that takes into account key factors affecting waste generation, storage, and final disposition as recommended by the United States Environmental Protection Agency (USEPA).

FIGURE 2: INTEGRATED SOLID WASTE MANAGEMENT



Source: Adapted from USEPA (2002)

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