Jimma University

School of Graduate Studies
College of Natural Science
Department of Biology

Assessment of the Status and Challenges of Solid Waste Management in Selected Kebeles of Jimma Town, Southwest Ethiopia

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Abstract

Solid waste is highly linked to urbanization and economic development. Today, worldwide urbanization is thought of as an unstoppable characteristic of global societal change. The uncollected or illegally dumped wastes constitute a disaster for human health and the environmental degradation. This study was aimed at the overall assessment of the existing practice, challenges and the status of municipal solid waste management (MSWM) service in selected Kebeles of Jimma town. Besides this, the study also had specific objectives such as, Assessing the status of HHs` solid waste collection, transportation and disposal practices and challenges facing HHs and also status and spatial coverage, institutional arrangement and capacity of MSWM service of the town. The study was conducted in Jimma town and Jimma is the biggest and dominant political and economic, cultural and historical town of south west Ethiopia and found at 354km distance from Addis Ababa. For the purpose of this study three Kebeles were selected using purposive sampling due to their high rate of generation and a total of 380 households were surveyed using simple random sampling. Both quantitative and qualitative technique used for data analysis and data were collected through questionnaires, interviews, and field observations. The study revealed that the status of SWM of town was very poor and inadequate in all elements of SWM such as waste collection, transportation and disposal activities. The HHs were practicing improper handling of SW storage, about (96%) of the HHs were storing all types of waste together and 25% practiced illegal dumping , only 45 % of HHs got access of MSSE service, 21% give SW to informal collectors and about 9% of HHs were burying and burning SW. The first main factors, socio-economic such as lack of awareness, about (84.7%) clean their houses in every day, but annually only (52.3%)of HHs participated on cleaning campaigns on average 3-4 times, average monthly income was 1001- 2000 Birr (32%) and 1000birr and less than were(26%), Distance of Containers from the houses above 600m was from(94%) of respondents. Also demographic-factor, family size with 4-6 were about (45%) of HHs and shown a reasonable correlation and impact on SWM. The second factor was poor institutional structure and capacity of Municipality. The finding shown that the major problems aggravating HH level SWM in the town include: lack of institutional coordination, insufficient and unskilled man power, very low financial capacity, weak enforcement of rules and regulations, socio-cultural factors and lack of awareness among the community. No collaboration of NGOs, no private sector involvement.

Key words: *Households, Municipality, Solid Waste Management*

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List of abbreviations and acronyms

BAU Business as Usual

CCR Centralized Chutes for Recyclables

CRGE Climate-Resilient Green Economy

CSA Central Statistical Agency

E-waste Electronic waste

EfW Energy from Waste

FIRM Facilitating Implementation and Readiness for Mitigation

GCIF Global Cities Indicators Facility

GE Green Economy

GHG Green House Gas

GWMO Global Waste Management Outlook

HDB Housing and Development Board

ISWM Integrated Solid Waste Management

MSSE Micro and Small Scale Enterprise

MSWM Municipal solid waste management

NEA National Environment Agency

NEMA National Environment Management Authority

NRP National Recycling Program

UNDESA United Nations, Department of Economic and Social Affairs

UNEP United Nations Environment Program

UN HABITAT	United Nations Human Settlement Program
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research

Chapter One: Introduction

1.1 Background of the study

Solid waste is strongly linked to urbanization and economic development. Today, worldwide urbanization is thought of as an unstoppable characteristic of global societal change (UN, 2014). World Urbanization prospects place world's urban population as of 2014 at 54 per cent (UNDESA, 2014). The report further states that sub-Saharan Africa, for instance, is in the midst of a dramatic urban transition that will persist well into the 21st century. Between 2010 and 2035, the sub-Saharan urban population will be more than double from approximately 298 million to 697 million and by mid-century it is estimated that over 1 billion people will be living in urban areas (UNDESA, 2014). Bandyopadhyany (2013) argues that cities only occupy two per cent of the worlds' land surface yet they are responsible for consuming over 75% of the planet's resources and produce 75% of the world's waste. The study further acknowledges that over the past few years, handling solid waste has become a major organizational, financial and environmental challenge. Globally, waste volumes are increasing quickly even faster than the rate of urbanization (Hoornweg and Bhada-Tata, 2012). Until 2012 alone, it was estimated that world cities generated about 1.3 billion tons of solid waste per year. This volume is expected to increase to 2.2 billion tons by 2025 and waste generation rates will more than double over the next twenty years in lower income countries (Hoornweg and Bhada-Tata, 2012). UN HABITAT (2014) adds that in low-income countries rapid urban growth is putting extra ordinary pressure on limited urban resources to deal with the ever increasing volume and variety of solid wastes. The situation is not made any better by the fact that even though solid waste services have a cost just like any other services provided, in general the expenditures are never recovered (Guerrero *et al*., 2013).

Municipal solid waste management constitutes one of the most crucial health and environmental problems. It poses a major challenge in many cities in the developing countries because it involves a huge expenditure but receives scant attention (Akaateba and Yakubu, 2013).The uncollected or illegally dumped wastes constitute a disaster for human health and the environmental degradation (Getahun et al., 2011). Solid waste is not only increasing in quantity but also changing in composition from organic to more paper, packing wastes, plastics, glass, metal wastes among other types, a fact leading to the low collection rates (United Nations Environmental Program, 2016).According to Cointreau-Levine (1994), around 30-50% of residents in most cities in developing countries do not get proper solid waste management services and most of the time their disposal practices are unsafe.

On solid waste issues, supply side constraints are among the main reasons for the insufficient supply of solid waste management services such as collection, transportation and disposal. Intact, many municipal governments of developing countries, including Ethiopia, lack adequate physical and financial resources to generate optimal amount of public services for their inhabitants (Altaf and Deshazo,1996;Thapa,1998;Lall*et al*.,2004).These have caused solid waste management services in Ethiopia to be poor and inefficient. As a result, the majority of inhabitants in most towns in the country often use unsafe solid waste disposal practices, such as open dumping, burning, burying, etc. For instance, according to Birke's (1999), study of the municipal solid waste management practices of 15 regional cities of Ethiopia, a controlled solid waste disposal is practiced in only two of them, namely Addis Ababa and Gonder.

As it is indicated, from major towns of Ethiopia Jimma is one of the town by which proper provision of solid waste management services is still unsatisfactory and in complete. In Jimma, illegal dumping of waste on open areas, in gullies, river courses is considered as routine task of residents. The efforts made by the municipality to change the situation in the town are also insufficient as compared to the extent of the problem. Therefore, in order to reduce this situation and achieve efficient solid waste management system of the town, detail study of the existing condition of municipal solid waste management service is required.

1.2. Statement of the problem

Waste management is a basic human need and can also be regarded as a 'basic human right' (UNEP, 2015). However, Muhammad and Manu (2013) indicate that it still constitutes a serious problem in many Third World cities. As urbanization lead to rapid growth, the rate of solid waste generation has twice (doubly) grown (generated) than its corresponding population growth (Getahun, 2011). Jimma town is characterized by rapid population growth. According to 1994 national census report, the town had 120,314 total populations while in 2007 national census it reached 155,436 and according population projection 2015 report estimated 177,900 total population with growth rate of 3.98% per annum. Such rapid increase in population together with rapid development of the town can produce increasing volumes of solid waste that needs proper management. Most of solid wastes that are generated in the town remain uncollected and simply dumped in open areas, road sides, river courses and gullies (personal observation). Thus, environmental and sanitary conditions of the town have become more serious from time to time, and people are suffering from living in such-conditions. A few survey and studies were carried out on the demand for improved management, client satisfaction and

problems of solid waste in the town (Degnet and Maru, 2005; Filaba, 2008). However, there is lack of reliable and recent data about the status and challenges of municipal solid waste management, and also the public awareness on good management of household SWM. Therefore, it became necessary to undertake an assessment on the issues of solid waste management in Jimma town for the following reasons: (1) Jimma town has the largest population size in southwest Ethiopia. The recent estimate shows that the town population increased from 155,436 in 2007 to 206,943 at present and (2) One of the main problems faced Jimma town was open and indiscriminate dumping of refuse (personal, observation). Decaying garbage and plastic bottles are found on the banks of Awetu River which passes in the middle of Jimma town and strategic locations in the heart of the Town. Wastes in such places are obviously a source of air and water pollution, land contamination and environmental degradation. So, it was very important to carry out the present study to identify the main causes for the problems of SWM in the selected kebeles of the town and the status of Households` participation and their challenges in solid waste management practices. Also it was necessary to examine the spatial coverage of municipal solid waste management service within the selected Kebeles of town.

1. 3 Objectives of the Study

1.3.1 General Objective

The general objective of this study was to generate baseline information on the overall status and challenges of solid waste management, for proper planning of SWM in selected Kebeles of Jimma town, Southwest Ethiopia.

1.3.2 Specific Objectives

The specific objectives of this study were:

- To assess the status of public awareness, solid waste disposal and dumping manner of residents (households), in the selected kebeles of the town..
- To evaluate present institutional arrangement, fund availability, operation equipment and capacity of municipal solid waste management service of Jimma town.
- To examine the spatial coverage of municipal solid waste management service within the selected Kebeles of town

1.4 Significance of the Study

The findings of the present research on solid waste management will provide information on the problems of solid waste management the selected Kebeles of Jimma Town. The Municipality can also use it as preliminary information for necessary planning for proper management of solid wastes in the town. The information generated may also help the Jimma Town Health and Sanitation Bureau to look back at the efforts underway and upgrade their working systems. It is also assumed to serve as baseline information for further similar studies in the remaining parts of the town.

1.5. Delimitation of the Study

The study was confined to selected Kebeles of Jimma town, Southwest Ethiopia. The delimitation was based on the consideration of a high amount of solid waste generation and a severe problem of municipal solid waste management. And also its accessibility for minimizing financial, time and other constraints as it is a home town of the researcher. On the other hand, the problem that the researcher studied was delimited to assess the overall status and challenges of solid waste management in selected Kebeles of Jimma town and institutional arrangements and capacity for delivery of proper service of SWM in the town.

Chapter Two: Literature Review

2.1. Concepts of Solid Waste Management

Wastes generated by households, commercial and industrial premises, institutions such as schools, hospitals, care homes, prisons and public spaces such as streets, markets, slaughter houses, public toilets and bus stops, parks and gardens contribute to municipal wastes (UN HABITAT, 2010). Such wastes usually contain a high proportion of putrescible (organic) components such as food, kitchen, and garden waste (UNEP, 2013). Municipal solid waste management (MSWM) refers to the collection, transfer, treatment, recycling, resources recovery and disposal of solid waste in urban areas (Sahoo *et al.,* 2013). Solid Waste Sorting is an activity of separating different types of wastes in their respective nature (Regassa *et al*., 2011).Recycling is processing of discarded materials into new useful products (Badgie *et al*., 2012). Re-use involves using discarded goods without reprocessing or re-manufacture (UNEP, 2013).Composting is the biological decomposition of the biodegradable organic fraction of municipal solid waste under controlled conditions to a state sufficiently stable for nuisance-free storage, handling, and safe use in land application (Badgie, et al., 2012).The term e-waste or electronic waste is being used for unwanted electronic materials which are not giving service for the user and needs to be disposed. The materials can be computers, laptops, mobile phones, CD and DVD players and other electronic materials. Because of world-wide technological and industrial advancements, the number of electrical wastes in-creasing rapidly (Jayarama, 2011).

2.2. Overview

Waste management is one of the essential utility services underpinning society in the 21st century, particularly in urban areas (UNEP, 2015). However, World Bank (2014), posts that cities face numerous challenges at every stage of the MSW value chain. According to UN Habitat (2010), it is one of the costly urban services, typically absorbing up to 1 percent of Gross National Product and 20-40 percent of municipal revenues in developing countries. Whether that percentage of revenue is ever deployed to actual solid waste management is debatable considering that services are often grossly deficient especially within low income settlements which often comprise sizable proportion of the city's area (UN Habitat, 2010).

Ineffective solid waste management practices make a poor impression on foreign investors and tourists, and may result in loss of reputation and investment (UN Habitat, 2013a).

2. 3. Solid Waste Management Systems

Globally, waste volumes are increasing quickly–even faster than the rate of urbanization (Hoornweg and Bhada-Tata, 2012). Nevertheless, proper waste management has a major contribution to make in shifting the planet towards a sustainable future (UNEP and UNITAR, 2013). According to Hoornweg and Bhada-Tata (2012), municipal solid waste management is the most important service a city provides both in low-income countries as well as many middle-income countries. Wilson (2007) observes that while developed countries exhibit a high degree of sound environmental considerations in their waste management utilizing sanitary landfills, waste treatment and processing, energy and material recovery options, in developing countries waste disposal is uncontrolled and waste treatment, processing, energy and material recovery are rare. Many developed countries have made great strides in addressing waste management, particularly since the environment came onto the international agenda in the 1960's (UNEP, 2015).Global Waste Management Outlook (GWMO) of 2015 reports that the initial focus was on waste after it had been discarded, whereas at present attention has moved upstream, addressing the problem at its source through, for example, designing out waste, preventing its generation, reducing both the quantities and the uses of hazardous substances, minimizing and reusing, and, where residuals do occur, keeping them concentrated and separate to preserve their intrinsic value for recycling and recovery and prevent them from contaminating other waste that still has economic value for recovery (UNEP, 2015).For instance, in Adelaide City, Australia, waste collection system is highly modernized, and 100 per cent of households in the Adelaide metropolitan area receive a high-quality kerb side waste collection service, usually on a weekly basis (UN HABITAT, 2010). The high standards of collection and street and public place cleaning services and customer care are consistent regardless of the socio-economic status of the area. Here solid waste collection system is by both private sector companies and public company. The majority of collection services operate as three-bin systems for separate collection of recyclables, green organics and residual waste (UN HABITAT, 2010).In Adelaide recycling and disposal, according to UN HABITAT (2010), is at 54% and 46% of the total waste collected respectively. Disposal is purely by landfilling carried out to a high standard of environmental protection (UN HABITAT, 2010). The situation is even better in Sweden where according to Research Office of the Legislative Council Secretariat (2014), only

1% of municipal solid waste (MSW) end up at landfills while treatment is characterized by an almost equal share of recycling/composting (48%) and incineration (51%) as of 2011. Incineration has developed to such a level that Sweden has been short of feed stock to fuel its incineration plants and started to import waste from its neighboring countries (Research Office, 2014).In the Czech Republic, Danco (2013), reports that around 70% of MSW generated is landfilled while the MSW recycling rate stands at 16% and municipalities are responsible for MSW management in their administrative territories. The Czech Republic has also implemented a landfill tax where citizens pay a fee for municipal waste services per capita (Danco, 2013).

A typical solid waste management system in a developing country displays an array of problems, including low collection coverage and irregular collection services, crude open dumping and burning without air and water pollution control, the breeding of flies and vermin, and the handling and control of informal waste picking or scavenging activities (Ogawa, 1996). This is consistent with UNEP (2015) assertion that low- and middle-income countries still face major challenges in ensuring universal access to waste collection services, eliminating uncontrolled disposal and burning and moving towards environmentally sound management for all waste. Achieving this challenge is made even more difficult by forecasts that major cities in the lowest income countries are likely to double in population over the next 20 or so years (UNEP, 2015).Abdelhamid (2014), observe that most developing countries lack the technical and financial resources to manage solid wastes safely. As a result, solid waste management service is often inefficient and underperforming in developing countries (World Bank, 2014). Muhammad & Manu (2013) conclude that most Third World cities do not collect the totality of wastes generated, and of the wastes collected, only a fraction receives proper disposal.

Despite the sorry state of affairs in SWM for Asian and Caribbean cities, there are success stories where some countries have recorded improvement in their SWM systems. Singapore for instance, as pointed out by UNEP (2015) in the Global Environmental Outlook, has transformed her waste management strategy from a situation of dumping of wastes in swamps in the 1960's to developing a SWM system with the central idea that waste is a resource. Singapore has devised cost effective systems to collect and treat waste. UNEP (2015) expounds that the system involves households paying a flat monthly fee which is less than 0.5% of the average monthly household income. The fees according to UNEP (2015), is collected via monthly utility bill that also includes the fees for

electricity, water and gas. As part of the strategy, all combustible waste that is not recycled is treated in energy-from-waste (EfW) plants, whereby the waste volume is reduced by 90% and energy is recovered to produce electricity that meets up to 3% of Singapore's total electricity demand (UNEP 2015). The report concludes that only non-combustible waste, comprising 2% of Singapore's waste, and residues from the EfW plants are sent to the Singapore's only landfill, the offshore Semakau Landfill, which was commissioned in 1999.Another major focus of Singapore's waste management strategy according to GWMO of 2015 is recycling. UNEP (2015) reports that Singapore's National Environment Agency (NEA) launched a National Recycling Program (NRP) in 2001 to provide recycling collection services to the residents. The program, according to UNEP (2015) started with provision of recycling bags with fortnightly door-to-door collection. In response to feedback from residents living in high-rise public flats built by the Housing and Development Board (HDB), where over 80% of Singapore's population lives, regarding space constraints for storage of recyclables, coupled with a demand for more recycling infrastructure, the number of recycling bins and the collection frequency have gradually increased. In November 2008, UNEP (2015) reports that through consultation with stake holders, NEA was mandated by law to compel estates to have Centralized Chutes for Recyclables (CCR).

In conclusion, generally, there seems to be a marked difference between solid waste management system in developed and developing countries. For instance, while in developed countries collection systems achieve an almost 100 per cent in most cases, the same cannot be said of developing countries whether in Asia or in the Caribbean. Jacobi and Besen (2011) observe that richer countries generate larger amounts of waste and garbage but have greater management capacity due to a host of factors, including economic resources, environmental concern of the population, and technological development. On the other hand, cities in developing countries with very rapid urbanization lack financial and administrative capacity to provide infrastructure and essential services, garbage collection and disposal included (Jacobi and Besen, 2011).

2. 3.1. Solid Waste Management Systems in Africa

In many African cities, according to UN HABITAT (2014), waste management systems appear to be absent, with solid waste disposed of directly adjacent to informal settlements in mounds, trenches and near watercourses. Many cities are marred by inefficient collection, management, disposal and reuse of municipal solid waste (Simelane and Mohee, 2012). On a positive note however, UN HABITAT (2014) notes that African urban wastes provide many recycling and reuse

opportunities and are a key area for development. In Addis Ababa, Ethiopia for example, Desta, *et al*., (2014) contend that current condition of SWM lacks integrated waste management approach and the systems are not all effective that wastes are often improperly disposed in undesignated sites. This is attributed to rapid population growth in addition to unplanned urban expansion and financial scarcity to proper waste management (Desta *et al*., 2014).

The situation in Egypt is not any better where according to the World Bank (2015), MSW collection systems capture between 30-85% of the waste generated in urban areas. In Cairo, although the situation is a bit better because as World Bank (2015) reports, a collection rate of roughly 65% is achieved. However, the remaining material accumulates in and around residential and commercial areas and is often dumped into rivers and abandoned canals (World Bank, 2015). Municipal Solid Waste (MSW) disposal facilities are substandard, with just 2% of the country's waste managed in state-of-the-art sanitary landfills. The balance is primarily managed at controlled and uncontrolled dumpsites, where environmental controls are minimal, and open burning of the waste is common place. One notable factor with solid waste management in Egypt is that the informal sector plays a significant role in Egypt's collection and recycling sector. The informal systems are most common in places where municipal collection services are poorly managed or the logistics of transporting household waste down the stairs or block to a designated disposal point is too onerous or inconvenient (World Bank, 2015).

In Kenya, according to NEMA (2014), waste management has been traditionally by legislation bestowed to the local authorities. Waste management systems tend to follow one main stream: open dumping which is very limiting considering the complex nature of solid wastes (NEMA, 2014). The system also contravenes the internationally recognized principle of Integrated Solid Waste Management (ISWM): waste minimization, reuse, recycling, composting and landfilling.

NEMA (2014) contends that the ability and the capacity of councils to manage waste was over-stripped due to urbanization and rapid population growth. Furthermore, the Councils relegated the waste management agenda to the bottom in priority of allocated meager resources, both financial budget and physical for its management. The technical and institutional capacities are equally and seriously inadequate (NEMA, 2014).

2.3.2. Solid Waste Management Challenges

Challenges in solid waste management are more acute in developing countries than in developed countries (Hoornweg and Freire, 2013). Perhaps one major challenge in developed countries as pointed out by Hoornweg and Freire (2013), is the complexity of wastes generated by their populations. Land space for siting landfills is also a challenge in solid waste management in developed countries. For instance, the United Kingdom will run out of landfill space by 2018 with their current generation rates (UN Habitat (2013a). The problem of solid waste management is especially acute in developing countries because as Muhammad and Manu (2013) observe, most third world cities do not collect the totality of wastes generated, and of the wastes collected, only a fraction receives proper disposal. This is supported by UNEP's (2015) assertion that low- and middle-income countries still face major challenges in ensuring universal access to waste collection services, eliminating uncontrolled disposal and burning and moving towards environmentally sound management for all waste.

Badgie *et al*. (2012) hold that inadequate municipal solid waste management is certainly one of the contributing factors to the degradation of the environmental quality. Surmounting this challenge is made even more difficult by forecasts that major cities in the lowest income countries are likely to double in population over the next 20 or so years (UNEP, 2015). Guerrero *et al*., (2013) concludes that solid waste management is a challenge for the cities' authorities in developing countries mainly due to the increasing generation of waste, the burden posed on the municipal budget as a result of the high costs associated with its management, the lack of understanding over a diversity of factors that affect the different stages of waste management and linkages necessary to enable the entire handling system functioning.

2.3.3. Solid Waste Management Challenges in Africa

UN HABITAT (2014) notes that due to poor policies, 62% of urban populations in Sub-Saharan Africa live in slum areas dominated by uncontrolled informal spatial developments, most often located in environmentally fragile areas, and without access to basic services including waste management systems. According to Simalane and Mohee (2012), in urban centers throughout Africa, less than half of the solid waste generated is collected and 95 percent of that is neither contained nor recycled. Mixing of wastes is another problem facing solid waste management in Africa as observed by Remigios (2010), where dumping is unrestricted and industrial, agricultural, domestic, and medical wastes end up in one site which in most cases is not fenced off. Another

challenge in solid waste management in Africa is lack of data. Simalane and Mohee (2012), observe that the quality and availability of data on solid-waste generation and management in Africa is scanty, a factor that impedes development of program that promote efficient use of solid waste. Okot-Okumu, (2012) in a survey of East African cities, identifies lack of prioritization of waste management in the annual plans of urban councils. UN HABITAT, (2013b) underscores that SWM services in East Africa are chronically underfunded, with too few vehicles, poor equipment and inadequate maintenance.

Public apathy towards solid waste management is also a challenge to solid waste management. In this regard, Ali *et al*., (2010) identify public misconceptions, attitudes and behaviors as some of the issues greatly contributing to the problems of illegal dumping and uncollected household waste being witnessed in the major cities of the East African region. In conclusion, Waste management problems in Africa vary in nature and complexity ranging from infrastructural, political, technical, socio-economic to organizational/management-related challenges. Moreover, regulatory and legal issues and challenges need to be addressed (UNIDO, 2009).

2.4. Planning Interventions for Effective Solid Waste Management

According to World Urbanization Prospect (2014), rapid and unplanned urban growth threatens sustainable development when necessary infrastructure is not developed or when policies are not implemented to ensure that benefits of city life are equitably shared. Waste generation is increasing in quantity and complexity with urban growth (Hoornweg and Freire, 2013). Thus, cities should implement plans that ensure supply of affordable, serviced land which is probably the most important input for sustainable urbanization.World Bank (2013), notes that planning is fundamental to the provision of most basic infrastructure services water, energy, sanitation, and solid waste management to all residents (urban and peri-urban alike). This is done through allocation of land use in a way that allows for infrastructure improvements. In this regard, GCIF (2015) suggests that urban planning process should include a diverse set of stakeholders including low income and marginalized groups, national minorities and indigenous people because this allows such plans to leverage on the expertise of the said stakeholders.

Globally, UNDESA (2014) submits that 54 percent of the world's population currently reside in urban areas. However, we are living in an increasingly urbanized world, where many cities' infrastructure systems are already strained or unable to service existing populations (GCIF, 2015). UNDESA (2014) submits that a holistic approach to urban planning and management is needed to

improve living standards of urban and rural dwellers alike. World Bank, (2013) further adds that cities need policies for the provision of public goods and basic infrastructure services including water, sanitation, and solid waste management. According to UN Habitat, 2013a) cities can achieve this by integrating waste management and spatial planning.

Urban planning can help to solve the problem of solid waste management through resource allocation and budgeting exercises. This is achieved by incorporating political visions and values into the physical reality of cities (UN HABITAT, 2010). In spite of the importance of planning in solid waste management, Dewi *et al*. (2010) observe that many planners and decision makers in the area of municipal solid waste, lack thorough understanding of the whole chain of waste management system and its impact on environmental quality and public health. City planners' involvement in waste management has been largely limited to siting waste management facilities (Dewi *et al*., 2010). According to Onu *et al*., (2014) study, the importance of urban planning in solid waste management in Africa is perhaps demonstrated by lack of it.

2.5. The current solid waste management status and Barriers in Ethiopian cities and Towns

Solid waste management (SWM) in Ethiopia is a sector requiring significant attention. According to UN estimates, Ethiopia's urban population will triple between 2010 and 2040. Preliminary city-level population projections suggest that some of Ethiopia's larger cities will much more than triple their 2010 population by 2040: Hawassa's 2010 population will grow more than six fold by 2040. Ethiopia has in the last decade been working to provide adequate collection and disposal for its citizens. It has managed to build some landfills for disposal of the country's waste. But increased population in Ethiopia's urban centers has strained the capabilities of local governments to manage the solid waste generated. The landfills are not well developed and properly managed. Moreover, these landfills/dumpsites are a major source of GHG emissions, and the economic value of waste buried in landfills/dumpsites has not been capitalized.

In addition, the absence of a coordinated, national solid waste management policy, and a city-level action plan for integrated waste management policies, has hampered the implementation of solid waste management activities. Current tariff structures do not recognize alternative treatment methods (recycling, compost, etc.) as part of the waste management system.

There is evidence of increased solid waste in Ethiopia as a result of the rapidly increasing human population, increased economic status and income, changing consumption patterns, urbanization

and industrialization. Pollution is a growing concern as industries and urban areas grow. Many rivers are polluted with urban and industrial waste. There is also a high level of air pollution in urban areas. Pollution has become a health threat for people and livestock.

The GE strategy estimates that 40 per cent of solid waste is deposited at landfills in cities with populations from 20,000 to 100,000 people and 70 per cent is deposited in cities with over 100,000 people. The strategy estimates a gas capture rate of 60 percent and 0.756 KgCO2e per kg of waste (CRGE, 2011).Based on the GE strategy, the urban sector contributes about 4.7 MtCO2e or 3 per cent of total emissions in Ethiopia. Under the BAU scenario, emissions from cities will increase to 10.2 MtCO2e by 2030. The main drivers of emissions increases are urban population growth, expansion of cities and GDP growth. Emissions from the solid waste sector were estimated at 1.2 MtCO2e in 2010. These emissions are expected to grow to 4.5 MtCO2e in 2030. The projection in increase is from two areas: rapid urbanization that is estimated to grow 4.4 per cent between 2010 and 2030, and increases in the number of urban centers with at least 20,000 people from 86 in 2010 to 237 in 2030. The solid waste generation per capita is also expected to increase from 0.33 kg/per/day in 2010 to 0.44 kg/per/day in 2030, leading to a generation of 1.5 million tons of solid waste annually by 2030 (CRGE, 2011).

There are three key technical barriers that need to be overcome in solid waste management: collection, treatment and disposal Poor collection rates associated with transportation of waste at the secondary level are one of the main problems identified by many municipalities. Waste collection and transport are not available everywhere, especially in small cities. Waste collection vehicle maintenance budgets are inadequate and there are not enough vehicles overall, or in good condition for use. Fee collection is ineffective and cannot reflect the actual capital cost. Lack of capacity in installing and managing modern treatment facilities are common themes across municipalities. Knowledge of waste treatment system maintenance is also lacking. The key barriers seen across municipalities in this area are lack of properly designed, implemented and managed disposal or landfill sites. The number of operating sanitary landfills is inadequate, especially those offering full disposal operations. Disposal fees do not cover landfill operating and maintenance costs. Knowledge of disposal system maintenance is lacking.

2.6. Household Educational Level and Solid Waste Handling

Public awareness and attitudes to waste can affect the whole municipal solid waste management system. All steps in municipal solid waste management starting from household waste storage, to

waste segregation, recycling, collection frequency, willingness to pay for waste management services, and opposing of waste treatment and disposal facilities depend on public awareness and participation. According to United Nations Environment Program (2016), people's attitude towards waste may positively affect their interest and willingness to pay for collection service.

Therefore, attitude towards solid waste may be positively influenced by public information and awareness measures. At the same time improved solid waste patterns can't be maintained in the absence of knowledge.

Finally, in this literature review it is assessed that solid waste generated in developing countries differs from that of developed countries, in respect to amount and composition. As a result its handling approaches varied according to nature and characteristics of the waste; moreover, influencing factors of solid waste management such as income, household size, educational level and distance of storages from houses have a significant negative or positive impact on solid waste handling.

2.7 Conceptual Framework

Municipal solid wastes are generated from different sources such as from industries, institutions, commercials, households and the like. This particular study was emphasized on demographic, socio economic and Institutional arrangement and Capacity of municipality factors affecting municipal solid waste management practice at the household level. All in all, the main focus and boundary of this study is summarized on the following conceptual framework.

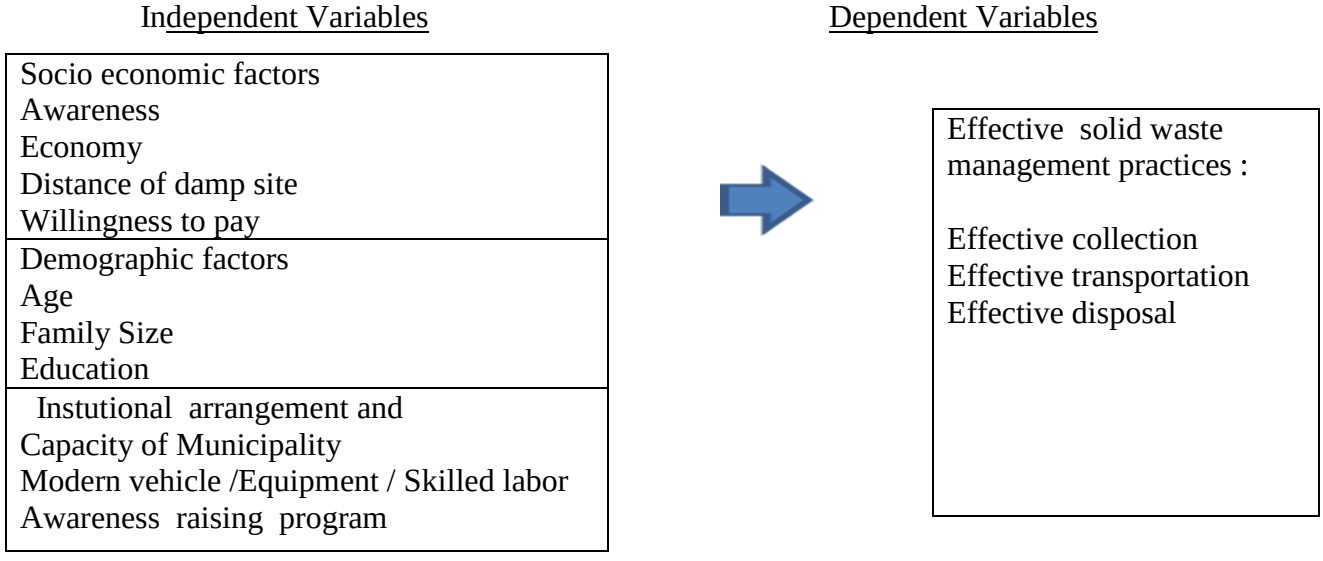


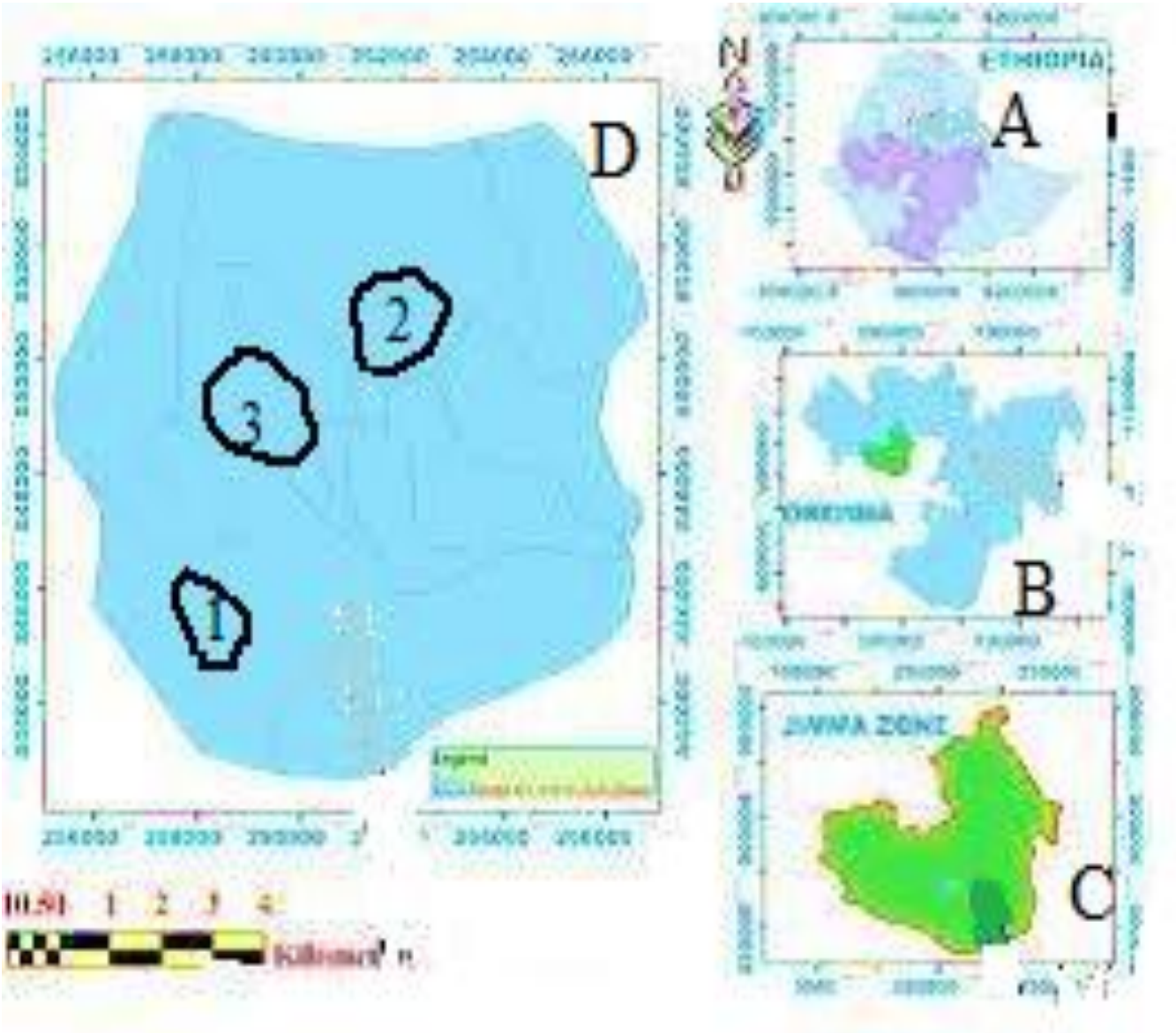
Diagram 1, Conceptual framework

Chapter Three: Research Methodology

3.1 Description of the Study Area

This study was conducted in Jimma town, Southwestern Ethiopia. Jimma, which has been founded in the late 1830s, is one of the biggest and dominant political, economic, cultural and historical towns in the southwestern part of the country. Jimma is locally known as the town of Abba Juffar and found at the distance of 354kms far from Addis Ababa with a geographic location of 7° 40' N latitude and 36° 60'E Longitudes. According to the master plan of the town, the total area of land of the town is 4623 (46.23km2) hectares. The mean annual rainfall of the town varies between 450-1800 millimeters. Jimma has a warm and humid climate with daily average temperature of the town is high at March (30.4°C) where the average is 27.5°C and low at January (8.5°C) where the average is 12.5°C with mean daily temperature of 19.5°C (CSA, 2007) .

Based on 2007 Ethiopian Central Statistical Agency (CSA) population and housing census report, the current population of Jimma town was estimated to be 159,009 of which females and males account 49.7% and 50.3% respectively with annual population growth rate of 4.9%. River Awettu is crossing at the center of the town. During the field survey of this study, Jimma town had 17 administrative *Kebeles*. For this study, three Kebeles with the highest solid waste generation rate, were chosen purposively and they were called namely: Seto-semero, Hirmata-Mentina and Hirmata-Merkato.



Letters and Numbers Reprasents**:**

A= Map of Ethiopia, **B**= Map of Oromia Region, **C**= Map of Jimma Zone &**D**=Map of Jimmatown

1= Seto-Semero, **2**= Hirmata-Merkato and **3**= Hirmata-Mentina kebeles

Map 1. The Study Area

3.2 Research Design

To obtain the information properly, the study was adopted a descriptive research design.

Descriptive survey method is suitable for describing the existing situation narrating facts and investigating phenomena in their natural setting (Koul, 1997). Thus, descriptive survey approach was employed in the study. Because, it was more appropriate to describe the existing situation of MSWM service of the town as it exist. As most of descriptive survey methods questionnaires, interviews and field observations were used to accomplish the study.Before actual data collection, to taste the adequacy of the tools to collect enough data and to minimize the errors that might occur; measuring (testing) of the variables under the study was done on 30 households out of selected sample (10 from each selected kebeles) were taken.

The reason for the number of households been 30 was to make equal 10 samples from each selected three Kebeles. The two variables of the study were: Dependent Variables (Effective solid waste management practices**:** Effective collection, Effective transportation, Effective disposal) and Independent Variables: (Socio economic factors , Demographic factors, Intuitional arrangement and Capacity of Municipality).The questions that were inadequate and less capable to collect data, and which cause ambiguity was refined and corrected to be effective. Through this evaluation, the necessary remedy and deep insight is made on the tools.

3.3 Data Source and Type

This study used a primary data as a main stream of data sources. The primary data were obtained from sampled households respondents and government officials including workers in Municipality of Jimma town by the questionnaires, interviews, field observations and photographs. For related literature reviews website (internet) report, documentation, magazines, journals, and articles were used.

3.4 Sampling and population size determination

3.4.1 Sampling Technique

For this study, three Kebeles which were assumed to have the highest solid waste generation rate were chosen purposively. These include Seto-semero, Hirmata-Mentina and Hirmata-Merkato Kebeles. Due to their location in the center of the town they also consist of high aggregation of Hotels, Restaurants and the biggest market Bishishe. Simple random sampling technique was used to select households for data collection in the three selected Kebeles on municipal solid waste

collection, handling practice and awareness of the community. Based on the current population projection of Health Extension workers office, the number of households for Seto-Semero, Hirmata-Merkato and Hirmata-Mentina are 1790**,** 2040 and 1112, respectively. The sampling interval of households in each kebeles were determined by dividing the total number of households to the allocated sample size. The initial interviewed household was selected by lottery method and the subsequent households were selected using systematic sampling technique.

That means a random start used to select the initial interviewed household and then proceeds with the selection of every *k*th element (with 15 intervals) from then onwards to give equal probability of chance to be selected.

3.4.2 Sample Size Determination

Sample size (n) of households that participate was determined by using a sample technique (Cochran, 1977) formula, given by: $n = \frac{NZ^2P\,q}{d^2[N-1]+Z^2Pq}$

Where:

n is sample size.

Z is 95% confidence limit i.e.1.96.

P is 0.1 (proportion of the population to be included in the sample i.e. 10%).

q is 1-p or 1-0.1 i.e. 0.9.

N is total number of population

d is margin of error or degree of accuracy desired (0.05).

Seto Semero $\mathbf{n}=\frac{1790x1.96^2\,x0.1x0.9}{0.05^2x1789+1.96^2x0.1x0.9}$

$= \frac{618.88176}{4.818244}$ =128 .44 = 128

Hirmata Merkato $\mathbf{n}= \frac{2040x1.96^2x0.1x0.9}{0.05^2x2039+1.96^2x0.1x0.9}$

$= \frac{705.31776}{5.443244}$ = 129

Hirata Mentina

$\mathbf{n}= \frac{1112x\ 1.96^2x0.2x0.9}{0.05^2x1111+1.96^2x0.1x0.9}$

= 123.09

= 123

Table 1. Selected sample Kebeles and households (HH)

Sample kebeles	Total number HH	Sample HH
Seto Semero	1790	128
Hirmata Merkato	2040	129
Hirmata Mentina	1112	123
Total	4942	380

Source: Health Extension offices of each selected kebeles

Additionally, data on institutional arrangement, status and capacity of the municipality on solid waste management of the town was collected from 20 key informants. The number of key informants include: Officers of selected Kebeles & Municipality(3+3) = **6 ,** Total of **= 20** individuals.

3.5 Data Collection and Analysis

3.5.1. Data Collection tools

Structured questionnaires, interview and field observation were used to obtain data and information for the study. Structured questionnaire was used for the selected households to have information about their awareness, willingness to pay for collectors, solid waste disposal practices and dumping manner, their challenges and the status of client satisfaction on organizational arrangement of solid waste management services of Jimma town municipality. Interviews were conducted to collect data from key informants i.e. municipality workers and officers of the Municipality and the three selected kebeles. All data were collected by three data collectors who were trained by the researcher. The questionnaire and interview checklists prepared in English language were translated in to local languages during interview and retranslated back to English language by the investigator and data collectors. Moreover, photographs of waste collection and dumping sites as well as other relevant information were taken during field observations.

3.5.2. Data Analysis Technique

The study used both qualitative and quantitative techniques for data analysis. The quantitative data obtained using questionnaires were analyzed by simple mathematics and the result was summarized in the form of tables and chart. The qualitative data /perception, opinion, attitude etc) mainly obtained using open ended questionnaire and semi structured interview including the researcher's

observation were analyzed, described and interpreted in the form of narration. Depending on the findings, comments and suggestions forwarded concerning the problem understudy and improvements that need to be made over the problem in order to tackle the major causes of the problem and ensure safe and environmentally sound solid waste management system.

3.6 Ethical Consideration

First the researcher requested and obtained permission from the Biology Department of Jimma University by a written latter to the Jimma Municipality Head office to conduct the data collection process. Then the researcher again obtained a permission latter written from the Municipality to the three selected kebeles. For the sake of security of the individuals, the responses of the participants were used without the individuals' names and Respondents were informed that their participation was voluntary and was assured of complete anonymity. Furthermore, they were advised that they do not have to answer any question they feel uncomfortable about.

Chapter Four: Result and Discussions

4.1 Demographic and Socio-Economic Profile of Respondents

4.1.1 Demographic Profile

Among the sampled respondents for this study more than half (82 %) of them were females. This was due to the fact that most of the time females stay and work inside their house rather than working outside. On the other hand, 86% of the total 14 interviewee's workers were female respondents. Such dominance of women is appreciated and important for this research since women have better knowledge than men about their home solid waste property and its handling. This is because of the cultural practices of woman proximity to SW collection and house cleaning activity in our country; particularly in the study area. Similar finding was seen in a study done in Amsterdam by Muller and Schienberg (1997), given women's primary responsibility for cleaning, food preparation, family health, laundry, and domestic maintenance, women and men may view domestic waste and its disposal differently. Besides this, out of the total respondents about 60 % of sample respondents were belonged to adult age group (31-60 ages).This showed that age of households head was assumed to influence willingness to pay for the proposed solid waste management program negatively. In similar way a study done in Pakistan by Altaf and Deshazo (1996), finds that willingness to pay for improved solid waste management services is strongly and negatively influenced by the age of the household head. Furthermore, with respect to educational level the majority of the households in the Selected Kebeles the town had different educational backgrounds. As shown in Table 2, about 4% of respondents were Illiterate, 9% respondents were only can read and write, about 12% were below Grade 8, about 16% were 9-12, about 26% certificate, 22% Diploma and only 11% were Degree holders. This educational background of the respondents influences their active participation and handling of house-hold solid waste. In similar way a study done in Palestine focused on this educational gap came to the conclusion that there was a positive relationship between the level of education and the participatory behavior of the people in improved SWM activities (Al-Khatib et al., 2015).Therefore to upgrade their understanding about the problems of SWM organized and continues training and awareness campaigns are needed.

Table 2: Demographic characteristics of respondents in selected kebeles of Jimma Town

Variables	Category	Households		Workers		Officers	
		Number	Percentage	Number	Percentage	Number	Percentage
Gender	Male	68	1 8%	2	14 %	5	83 %
	Female	312	82 %	12	86 %	1	17 %
	Total	380	100 %	14	100 %	6	100 %
Age	18—20	46	12 %	--	--	--	--
	20- 30	91	24 %	3	22 %	--	--
	31- 40	118	31 %	8	57 %	2	33 %
	41- 50	76	20 %	2	14 %	4	67 %
	51 - 60	34	9 %	1	7 %	--	--
	≥61	15	4 %	--	--	--	---
	Total	380	100%	14	100%	6	100%
Educational level	Illiterate	15	4%				
	Read write only	34	9 %	4	29 %		
	1-8	46	12%	9	64%		
	9-12	61	16 %	1	7 %		
	Certificate(10/12+)	99	26 %	-	-		
	Diploma	83	22 %	-	-		100 %
	Degree	42	11 %	-	-	6	-
	Above degree	--	--	-	-	-	100%
	Total	380	100%	14	100%	6	

4.1.2 Socio- Economic characteristics of Respondents

The average Family size of Households in the study area was used as a measure of population growth and had great implication on health and generation of solid wastes. UN habitat (2014), report shows that in low-income countries rapid urban growth is putting extra ordinary pressure on

limited urban resources to deal with the ever increasing volume and variety of solid wastes. Globally, waste volumes are increasing quickly even faster than the rate of urbanization (Hoornweg and Bhada-Tata, 2012). Until 2012 alone, it was estimated that world cities generated about 1.3 billion tons of solid waste per year. This volume is expected to increase to 2.2 billion tons by 2025 and waste generation rates will more than double over the next twenty years in lower income countries (Hoornweg and Bhada-Tata, 2012). As shown in Table 3, the maximum HH family size was 4-6 that accounts for (45%) of the respondents. This indicated that the amount of SW generation depends on the size of the HHs. Meaning, increase in the number of family increased consumption which also increases waste generation and contributed to the creation of pressure on its managements. The second socioeconomic factor was the households` monthly income, which had an impact on household solid waste management. As shown in table 3, the largest number of respondents (32 %) monthly average income was 1001- 2000 Birr, about (26 %) of respondents` monthly average income was less than & 1000 and only (2 %) of the total respondents` monthly income was more than 5000 Birr. A study by Lauria *et al.* (1999) for the Philippines finds that income has a significant and positive influence on household willingness to pay for improved sanitation services. In another study (Altaf and Deshazo, 1996) in Pakistan, found out a significant and positive relationship between income and willingness to pay for improved solid waste management services. Therefore, concurrent to these findings, the current result indicated there was a direct effect of income on willingness to pay for solid waste management services in Jimma town. This variable is a continuous variable representing monthly household income in Ethiopian Birr. The monthly income level of HHs can affect the rate of waste generation and collection, transportation and disposal. Low-income contributes low participation in willingness to pay for solid waste which leads to low level of waste management at large.

Employment condition of the respondents has a relation in waste type and its management systems. As shown in table 3, the employment condition of HH respondents were higher in self-employment (39%) and followed by Government/public (33%) and the Unemployed/ job-less were (16%) of the respondents. Employment condition helped to estimate the income level which in turn determines the contribution of society in financial ability to pay to SWM activities. Some researchers argue that people of lower socio-economic groups tend to have less regard for environmental issues on the basis that employment and housing are their main priorities (as cited in Périou, 2012).

Table 3. Socio- Economic characteristics of Respondents

Variables	Category	Household		Workers	
		Numbers	Percentage	Numbers	Percentage
Family size	1 – 3	133	35 %	9	63 %
	4 – 6	171	45 %	4	31 %
	7 – 9	53	14 %	1	6 %
	10 and more	23	6 %	-	-
	Total	380	100 %	14	100%
Average monthly income	Less than & 1000 Birr.	99	26 %	-	-
	1001 – 2000 Birr.	122	32 %	14	100 %
	2001 -3000 Birr.	76	20 %	-	-
	3001- 4000 Birr.	53	14 %	-	-
	4001- 5000 Birr.	23	6 %	-	-
	More than 5000 Birr.	7	2%	-	-
	Total	380	100 %	14	100%
Employment condition	Government	125	33 %	14	100 %
	Self employee	148	39 %	-	-
	Private sector	46	12 %	-	-
	Unemployed (no job)	61	16 %	-	-
	Total	380	100%	14	100%
Awareness of HH head on SWM	Useless	175	46 %	-	-
	Somewhat useful	122	32 %	3	21
	Useful	83	22 %	11	79
	Total	380	100%	14	100%
Willingness to pay waste collection	Yes	346	91%	8	57%
	No	34	9%	6	53%
Access to MSSE service	Enough access	171	45%	14	100%
	Inadequate	122	32%	-	-
	None	87	23%	14	100%
	Total	380	100%	14	100%

Regarding household's Awareness towards Solid Wastes Management as shown in Table 3, among the households,(46%) of them stated that solid waste means totally useless whereas,(32%) and (22%) were stated somewhat useful and useful respectively. The finding indicated that less awareness of the community on SWM became one factor of SWM in the town and this result supported by different literatures as followed. The need to improve public awareness and community participation in waste management has been widely recognized by researchers as necessary to create sustainable waste systems and to promote environmental citizenship amongst community members (Lumbreras Martín and Fernández García, 2014). Out of the total,(91%) households showed willingness to pay for MSSE and Informal solid waste collection services, whereas,(9%) households were not.

Regarding SW disposal practice of the households` as shown in Table 3, Among the households only 45 % of them said that they had Enough access of MSSE service whereas 32% Inadequate access of MSSE service and 23% stated None access of MSSE service at all. So this result showed that absence of access of service was one cause for illegal SW damping in Jimma. This was supported by the study of Périou,(2012). In the municipal solid-waste management system (SWMS) of developing countries typical problem areas can be identified. These can be described as: 1) budgetary constraints, 2) inadequate service coverage and operational inefficiencies of services including unskilled manpower, 3) ineffective technologies and equipment, 4) inadequate landfill disposal.

4. 2 Existing status of solid waste management practice in the selected Kebeles of Jimma town

4.2.1 Primary Solid Waste Storage Facility and its Handling

In waste storage practice assessment as shown in Table 4, about (96%) of the households practiced storing all types of waste together (mixed solid waste in one container) system while only(4%) of the households used to store separately. However, this not a safe practice as most of the wastes could easily be delayed and encourage propagation of files and rats which are the primary carrier and dispersal agents of diseases in many cases. As it is clearly observed in Table 4, the majority of households (90.8%) stock up their solid waste in sack ("Madaberiya"). This was highly related with the least cost of sack, easily availability in the market, its suitability for holding large volume of

solid wastes, and low frequency and spatial coverage of door to door solid waste collection service of the town.

The study finding also showed that there were (45%) of the households storing their solid waste for one weeks in storage container before its final disposal, whereas (28%) of the households used to store wastes for two weeks at their home, From (13%) households picked up twice per week and from only (6%) HHs picked up three times per week. The remaining (7%) of the households were found that their wastes is not picked up at all and this showed their solid waste has no fixed time of collection and also illegally disposed everywhere. Regarding length of time in collection system of the waste from the Source, as organic matter constitutes significant percentage of the waste, it should be collected and disposed of within a maximum of three days before it smells and pollutes the environment. Uncontrolled domestic waste frequently piles up around low-income family homes and neighbor hoods, representing a permanent risks of pollution, infection and injury (Giroult, 1995). Such risks are carried through waste scavengers, like dogs, rodents, flies, and surface and underground routes of risk transmission.

Table 4: Waste collection and storage practice of HH respondents

Variables	Category	Number	percentage
Waste Storage Practice	All type of waste together	365	96%
	Separate solid waste	15	4%
Type of Container for storage of solid waste at home(the source)	Sack (madaberia)	345	90.5%
	Plastic bag (festal)	12	3.2%
	Plastic dust bin	23	6%
	Total	380	100%
Frequency of waste collection	Once every two weeks	110	29%
	Once per week	171	45%
	Twice per week	49	13%
	Three times per week	23	6%
	Not at all	27	7%
	Total	380	100%

4.2.2. Secondary solid waste storage facilities and their handling

Secondary storage facilities refers to different types of solid waste containers which involve keeping solid waste generated from different households at a common or central point from where collection vehicles can pick it and transport to final disposal site(Zebenay, 2010). These facilities are provided by municipality which is responsible for management of the town solid waste. Until early 2018 (2011 E.C) there were total of 11 public solid waste containers in different areas of the Selected three Kebeles of the town in areas where high population density was assumed to exist. Absence of frequent collection of those public solid waste containers, and misuse of the society due to from the existed 3 old lifter trucks 2 had been out of service those containers caused odor and polluted Residents around. As a result, the town was forced to collect those public solid waste containers instead of serving the intended purpose. However, for solving problem of secondary storage facility, the Jimma town Municipality put 4 containers in two far areas from living houses (double container in each place) and prepared only 2 communal solid waste accumulation sites called transfer stations in the center of the town Presently. In these 2 accumulation sites daily Solid waste collected from HHs, Hotels and Market areas by Small Scale Micro Enterprises members (MSSE) accumulated at Night and Transported early in the morning from 5:00 pm - 7:00 am with CINO -TRUCK. In general results from interview and observations shown that SW storage facilities and their handling by the Municipality was very poor and non-systematic way of SWM. In similar way a study done by UN habitat, (2013b) underscored that SWM services in East Africa are chronically underfunded, with too few vehicles, poor equipment and inadequate maintenance.

These area are located around : Hibir Building (Hirmata Merkato kebele) **,** A road to Fetih Mosque (Hirmata Merkato kebele),Back of Bete mengist (Hirmata mentina kebele) and Key Afer (Seto-Semero Kebeles)

Plates1. Collection and transportation of SW from the two transfer stations in the center of the town by Municipality early in the morning

The transfer stations and the public containers were found at the edge of main roads in order to make them accessible for transportation. However, in many cases those transfer stations are not well designed, not protected from rain and sun. They are just road side open dumps without any health and aesthetic impact considerations and optimum travel distance of beneficiaries. So, those sites are created bad smell, unsightly urban picture. According to interview made with an officer of Municipality, those transfer stations give service only to Micro and Small Scale Enterprise (MSSE) workers who collect solid waste from households, institutions and commercial areas. A study done in India found that poor conditions of containers and inadequate maintenance and replacement of worn-out collection vehicles contributed to behaviors such as littering and illegal dumping by citizens who felt they could not properly dispose of trash because trash bins and waste services were not properly maintained (Hazra and Goel, 2009)

Plates2.Typical public solid waste containers found in Distance from living areas in the selected Kebeles

In the public solid waste containers such as: Key Afer in (Seto-Semero Kebele and Back of Bete mengist in (Hirmata mentina kebele) residents indiscriminately dispose waste without storing it by sack or any other storage material. As a result, it is common to observe accumulated solid wastes in such area of the town. Besides this, the two above transfer stations and the public solid waste containers seen in Figure 4, Bellow was also characterized by uneven distribution both in terms of distance from beneficiaries and kebele specific locations. Observation results shown that, as the distance far from the center of the town increased, the numbers of transfer stations and container were decreased in relation with low solid waste collection service of MSSE. On the contrary, distance between each public waste containers and improper disposal of solid waste were increased at the periphery of the town. In relation to this, as a report of Al-Khatib *et al*., (2010), There are limited opportunities for the development of sustainable SWMS, as government budgets are limited and proper waste collection is overlooked.

Plate3. The Improper solid waste damped area around Awetu Rever

Now days in different parts of Jimma town, especially on the bank of Awetu River and around the Bishishe Market it became very adapted looking and practice of illegal disposal of Solid Waste because of un availability of public waste containers and less Awareness of the community. Supporting the current finding, a study conducted by Ali *et al*., (2010), identify public misconceptions, attitudes and behaviors as some of the issues greatly contributing to the problems of illegal dumping and uncollected household waste being witnessed in the major cities of the East African region.

Plates4. The Illegal solid waste damped areas around Bishishe Market and on Road side

4.3. Solid Waste Transportation Systems in Selected Kebeles of Jimma Town

Currently, in Jimma town there are two methods of waste collection and Transportation such as door to door and transfer stations collection and Transportation.

4.3.1 Door to Door Solid Waste Collection and Transportation Systems

This method is largely implemented for collection of solid waste from residential areas. It is provided by Micro and Small Scale Enterprise (MSSE) and informal waste collectors. But the service of MSSE is reached to very small number of residents. Currently in three selected kebeles of Jimma town there were 7 MSSE which engaged in deliver of solid waste collection service to the residents.

Table5. Overall characteristics of Micro and Small Scale Enterprise (MSSE) solid waste collectors in 2019

names of Micro Small Scale Enterprises(MSSE)	Kebele name	Average service charge		No of Equipment	No of man Power
		HHs	Hotels and merchants		
Tokkuma,	H/merkato	20-30	50-70	4 carts	5
Awol&Naji	H/merkato	30-50	50-70	2 carts	4
Kelil & Roba	H/merkato	30-40	10-30	1 cart	5
A/Milki	H/merkato	30-50	50-70	2 carts	7
Miliyon & Aschalew	H/merkato	30-50	15-30	1 cart	6
Simeng &Amina	S/Semero	15-20	15-30	1 cart	5
Gudina	H/mentina	20-30	50-70	2 carts	6
Total				13carts	38

According to the personal interviews with MSSE leaders, they charged 10-30 birr per month from households and 30-300 birr for institutions and hotels based on amount of solid waste and distance from the transfer stations. They collect solid waste from residents with one week interval. As previously shown inTable3, only 45% of the respondents said that they got enough access of MSSE service. This was largely attributed to small number of MSSEs and their less human and material capacity. Many researches support that one main cause for littering is lack of access for example, Convenience of garbage bins has been cited many times in research as a priority when disposing of trash, and when these are not present or lacking in areas this has been reason enough to litter (Henry et al., 2006). Related with this, the researcher also observed that they are being operating and contributing to the cleanness of the town. Nonetheless, due to multidimensional challenges they are not optimally utilized their efforts.

Those challenges are:

- Scarcity of equipment. For instance as shown in Table 4.three MSSEs(Kelil & Roba, Miliyon & Aschalew, Simeng &Amina) each were had only 1 cart while three MSSEs (Awol&Naji , A/Milki and Gudina) had 2 carts for each and only one MSSE(Tokkuma) had 4carts. In general all MSSEs had 38 members but their total number of carts were only 13. As a result all members can't do full day rather they were working by shift.
- Lack of support from different stakeholders such as kebele, Municipality, NGOs, MSSE office etc. As they said in their interview, the MSSE office of the town refused to give credit to them for purchasing equipment and collection vehicle.
- Shortage of collection car and transfer stations together with weak controlling mechanism of municipality for time wastage and absents of the truck.
- Lack of respect from the community as well as municipality and unwillingness of some households to pay for MSSE monthly collection fee after the use the service and lack of respect or demoralization (as answered in their interview). No training and protective materials were given to them by Municipality when they entered in the work.

In general from the above challenges of Micro and Small Scale Enterprises (MSSE) and personal observation of the researcher, it was possible to conclude that MSSE were not well organized, not well equipped with solid waste collection materials, with sufficient man power and technologies and they lack technical and moral support. As a result this the participation of MSSE restricted to collect waste from roadside residents and centrally located commercial areas. Finally, the small contribution and very limited spatial coverage of MSSEs lead large number of households turn their face to use informal collectors such as children, mentally retarded peoples, daily workers or laborers by paying 5-10 birr on average or through feeding them for picking waste once. As compared to MSSE informal collectors charge is low and also those individuals were easily available at any time. Many literatures strength this fact: Recognizing trash as a problem does not prevent littering or other negative behaviors concerning waste management (Moore, 2012). This attitude-behavior gap often emerges and can be further affected by a variety of reasons including convenience, social norms, lack of public participation, and lack of education and awareness of effective waste management techniques (Milea, 2009; O'Connell, 2011).

Plates5.Partial view of informal paid collectors illegal solid waste disposal in selected Kebeles of Jimma town

4.3.2 Collection and Transportation of Solid Waste from Transfer Stations

By the municipality

According to the interview taken from an officer of the Municipality and Researcher`s own field observations, in the case of SW transportation to the final disposal site, there was big problem because of from long time served three lifter trucks of the town two were completely out of service and only one worked sometimes with day to day maintenance. To solve this problem the Municipality put a schedule which was categorized in to two collection frequencies.

- Daily collection from Hibir Building (Hirmata Merkato kebele) and road to Fetih Mosque (Hirmata Merkato kebele) which are in the Center by a Cino-Truck and Loader.
- Once in a week from Back of Bete mengist (Hirmata mentina kebele) and Key- Afer (Seto-Semero Kebele) the rest other peripheral areas of the town.

According to MSSE workers interview and field observation vehicle cannot work based on the above programs in the 2nd types of transfer sites due to carelessness or low motivation of the deriver, low control and follow up of the Department on the truck . As a result, in many transfer stations of the town there was nothing more than an urgent need removal of accumulated waste when it became intolerable and complains raised. These situations make the town municipal solid

waste collection and transportation to be very low. Generally in this poorly coordinated program from the total of produced solid waste in the selected Kebeles of Jimma town, as shown in figure 9, only 45% of municipal solid waste which was collected by MSSEs was transported. This fact clearly indicated how the town municipal solid waste management was very poor and below expectation.

4.4. Street Sweeping Activity in Jimma town

In addition to collection of solid waste from transfer stations, street sweeping is also included in municipal solid waste management service offered by the Municipality of Jimma town. For cleaning roads in the town 13 women sanitation workers were employed with 1500 birr monthly salary by the Municipality. Street sweeping takes place every day since it needs to be done more frequently. The street sweepers are separately spaced on streets, and clean roads using brooms that gifted from the department. After cleaning they used wheelbarrows to collect piles of solid wastes from streets, and then most commonly they store it in sack and placed in transfer stations that are located in the center of the town . However, from the researcher`s observation and interview made with the officers there is serious shortages of manpower for street sweeping. The existing employees are not able to cover all streets and many roads remained unclean and unpleasant to see. Most of street sweeping takes place around the center of the town where streets are busy with many activities. Moreover, residents are very careless to clean their front yards and street and see it as the responsibility of the municipality. As shown in Table 6, From the total respondents about (84.7 %) said that they clean their houses in every day. But annually (52.3 %) of residents participated on cleaning campaigns of their surroundings on average 3-4 times. This clearly showed how communities give little attention and their less awareness to clean their surroundings. Much of the residents of the town are only stressed to protect their home but they do not care for others. Whatever the case may be, it is becoming a common problem both for the people and municipality. The need to improve public awareness of, and community participation in, waste management has been widely recognized by researchers as necessary to create sustainable waste systems and to promote environmental citizenship amongst community members (Lumbreras Martín and Fernández García, 2014).

Table6. The attitude and awareness of respondents

Variables		Agree		Disagree		Not sure	
		No.	Perc(%)	No.	Perc(%)	No.	Perc(%)
It concerns me if I see garbage scattered anywhere in the city		33	22	112	76	75	3
I clean my home always (every day)		322	84.7%	39	10.3%	19	5%
I am busy; I do not have time to participate in SWM Program		186	49%	148	39%	46	11
Cleaning the city is responsibility of the Municipality only		236	62%	84	22%	60	16%
How many times do you participated in cleaning campaign in a year	1-2	46	12%	-	-	88	23%
	3-4	198	52.3%	-	-	48	12.7%

Plates6.. Partial view of community participated on cleaning campaign of their surroundings.

4.5. Existing Solid Waste Disposal Practices in Jimma Town

4.5.1. Households' Solid Waste Disposal Practices

As showed in Chart1. Out of the total respondents about(23%) were throwing their SW in the road sides, bridges and gullies, about (21%) were used informal waste collectors for their waste disposal, about (9%) respondents were burying and burning their SW in their compounds and only (45%) of respondents were used MSSEs for SW disposal which was somewhat correct way of disposal. The finding shown that only less than half (45%) of the SW was in a way of proper disposal system and the remaining SW of the study area was exposed to improper damping This improper disposal of solid waste exposed the town community to bad smell and image of the town un clean. Similar study done in Addis Ababa by (Nigatu *et al*., 2011), suggested that: Open air burning and spontaneous combustion in dumping site, are among the causes of air pollution and unpleasant odors.

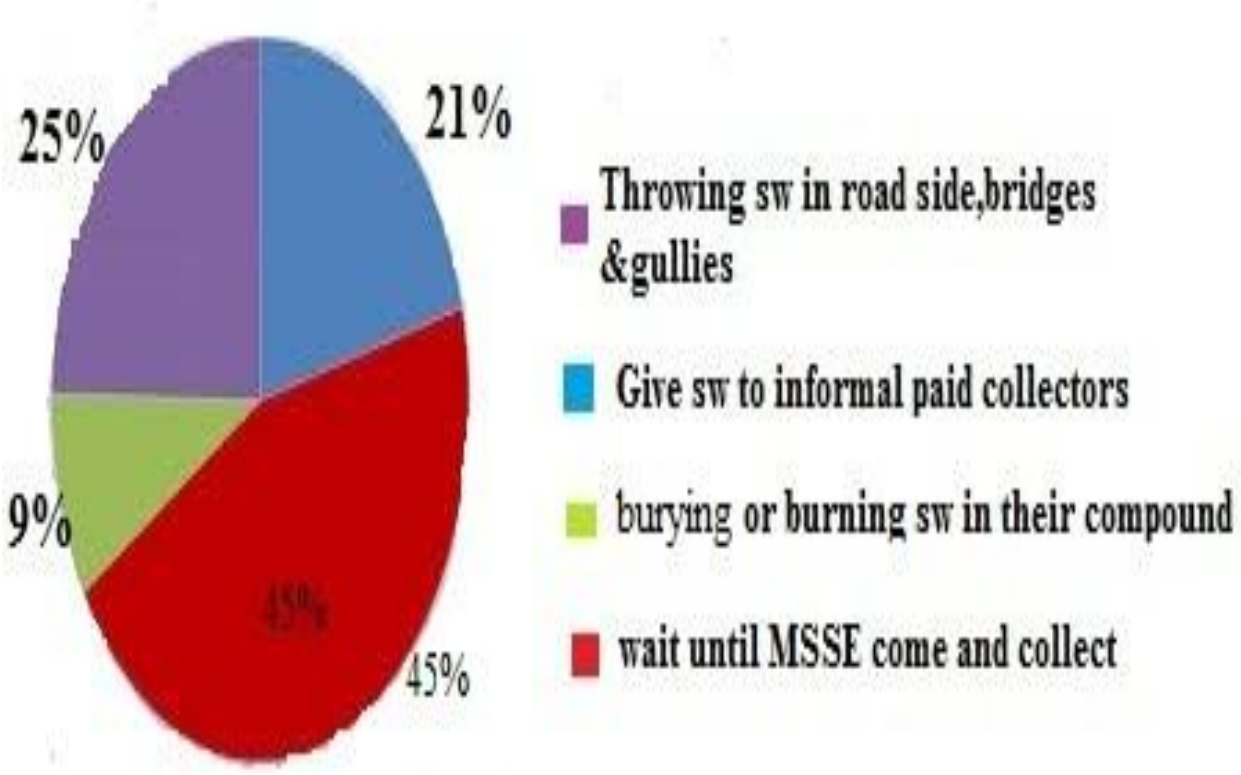


Chart1. Households solid waste disposal practices

4.5.2 Management of Solid Waste Disposal Site by the Municipality

Solid waste collection and transportation is not an end to solid waste management. Proper solid waste management also requires proper disposal of waste in a proper place. In sight of this Jimma town solid waste disposal site and its management in Existing condition is inadequate and below the standard. As the field observation of the Researcher and the Enterview of the officers of the Municipality confirmed that. Eventhough the Municipality Can built a Sunitary Landfill before three years stile it can not been made Functional (Didn`t start giving service for the past 3 years after its building is finished) .As the Enterview response of the officers , The reason for Why it can`t became Functional is absence of a Machine which do a recycling process on the Sunitary Landfill. So at this time the Solid Waste daily collected and Transported from the hole Jimma town is being disposed in open field near the Sunitary Landfill which is found about 5 km from the town in Ifa-Bula kebele on the side of Jimma--Agaro road. The existing disposal system in open field and its management is inadequate and below the standard. (Sourse: From Enterview of Municipality officores of January 2020)

Plates7.. Partial view of the new Built and none Functioning Sanitary Land fill

4.6. Factors Affecting Effective SWM

4.6.1. Distance

One of the many variables which was associated with SWM was distance of SW storage containers from houses of the HHs. Distance was taken as independent variable and SWM as dependent variable.

Table7. Distance of Waste Dump (Public waste container)

Variable	Category	Number	Percentage
The distance of transfer station/container/ from HH in meter	- < 100 m	-	-
	- 101-200m	-	-
	- 201-300m	-	-
	- 301-400m	-	-
	- 401-500m	9	2. 2
	-501-600m	15	4
	- >600m	356	93.8

As shown in table 7, from the total respondents about (93.8%) were travelled a distance of above 600m to get public waste containers. So the finding indicated most of the respondents had to move a distance over 600 m from their house to put off the waste and that lead them to dispose their waste illegally.

4.6.2. Unreliable service and Poor Coordination

As shown in Table 8, Responses of the HHs on the question asked about how much could be Unreliable service and poor coordination affected the town`s SWM?, From the total respondents about(36%) said very strongly affect, about (30%) said affect strongly and about (23%) answered tat as it averagely affect the town`s SWM. As the finding shown the largest number of the HHs agreed that unreliable service provision was one of the influential factors that hindered community participation in solid waste management. Moreover, the poor performance of the municipalities in this respect was rooted in short supply of funds, inappropriate equipment, inefficient management and unskilled personnel. As the researcher observed during the interviews of the institutional officials, there was very weak coordination between the municipality officials of the Selected Kebeles, MSSE and other stakeholders involved in the environmental protection issues. Municipal waste management is a complex task that requires appropriate organizational integration between numerous stakeholders.

Table8. Responses on the Levels of Factors Affecting SWM

Factors		Factor Level (How much can it influence the town SWM ?)				
		Very strong	Strong	Average	Less influence	No influence
Unreliable service and Poor Coordination	No	137	113	87	35	8
	Perc.(%)	36%	30%	23%	9%	2%
Lack of Rules and Regulations	No.	58	91	105	58	68
	Perc.(%)	15%	24%	28%	15%	18%

4.6.3. Lack of Rules and Regulations

As shown in Table 8.When the respondents asked to put their suggestion about the impact of lack of rule and regulations on the SWM in the town with its level of strength, from the total of asked HHs about (15%) said very strong factor, about (24%) said strong facto and about (28%) said it was average factor for SWM of the town. The finding shown that lack of adequate rules and regulations and their implementation program in Selected Kebeles of the town was weak. On the other hand, as the results from interview shown, there was no enough effort made to create awareness about solid waste management in the community including the rules and regulations and associated penalties in a regular basis.

4.6.4. Financial Constraint

According to the interviews finding, municipal solid waste management was given low priority and very limited funds were allocated to the sector by the government. Lack of financial management and planning, particularly when the limited resources available for the sector were completed quickly it caused solid waste management services to halt for some periods, Also result in losing trust of service users. Therefore financial constraint was one of the factors affecting effective SWM in the study area.

4.7. Measures to be taken

For questions asked to raise community participation in SWM "what actions must be taken sequentially to be ranked were responded as follow: As shown in Table9. below, from the total of respondents about (39%) respondents were selected Strongly Agree to increasing awareness creation of community in the first rank, and (36%) respondents selected "Facilitating public waste containers in near distance and transporting with fixed time schedule" and ranked 2nd. About (34%) respondents selected Strongly Agree for taking strong punitive action. Therefore, the respondents agree strongly on penalizing the HHs who dispose SW illegally, those who did not keep their surroundings clean and those who do not participate in campaign of solid waste management. Increasing human power and supporting with material and Finance and Needs designation and discussion of rules and regulation with community were selected taking 4^{th} and 5^{th} rank sequential positions.

Table9. Responses about Measures to be taken

The main aim	Actions to be taken	No of respondents and percentage select at each level						
			SA	A	U	D	SD	Rank
To raise community participation	Facilitating public waste containers in near distance and transporting with fixed schedule	No	137	114	87	34	8	2
		%	36%	30%	23%	9%	2%	
	- Taking strong punitive action	No	129	114	76	42	19	3
		%	34%	30%	20%	11%	5%	
	Increasing human power and supporting with material and Finance	No	106	160	61	42	11	4
		%	28%	42%	16%	11%	3%	
	- Increasing awareness creation of community	No	148	110	72	30	20	1
		%	39%	29%	19%	8%	5%	
	Needs designation & discussion of rules & regulation with community	No	103	106	80	72	19	5
		%	27%	28%	21%	19%	5%	

SA : Strongly Agree ,A: Agree , U : undecided , D: Disagree , SD : Strongly Disagree

Chapter five: Conclusion and Recommendations

5.1. Conclusion

The study has been conducted to address the current status of solid waste management practice, its challenges and factors influencing its effectiveness in Selected kebeles of Jimma town. The study found that key element of effective SWM such as waste collection, transportation and disposal practiced by the Households and also by the municipality of the town was ineffective. Based on the literature revised, the data collected, the analysis made, the findings obtained and discussions helped to develop important conclusions as follows:

Analysis based on the key elements of solid waste management such as waste collection, handling waste transportation and disposal practiced in the study area was ineffective and inadequate.. Majority of respondents dispose their solid wastes inside drainage channel river sides and some others on the street and other vacant places.

This study also indicated that Jimma town municipal solid waste management service was very weak in terms of status, spatial coverage and solid waste management facility. Currently in the Selected three kebeles of the town there were only 4 public solid waste storage containers and as substitution of these facilities there were 2 temporal solid waste transfer stations that give service only to Micro and Small Scale Enterprise (MSSE) waste collectors only at night time.. Besides this, those transfer stations were also characterized by uneven distribution both in terms of distance from beneficiaries and kebelle specific locations. Furthermore, municipal solid waste collection and transportation activity of the town was carried out by two types of collection methods such as door to door and transfer stations solid waste collection. Door-to-door collection system is provided by MSSE waste collectors and rarely by municipality collection truck. But, the status and spatial coverage of that service was very unsatisfactory, only covers residents who were living in the center of the town and along accessible streets. Whereas the transfer stations collection method was directly performed by the Municipality of the town using only one collection truck for containers and Cino truck for Transfer stations. As a result of this, huge amounts of uncollected solid wastes were indiscriminately disposed in unauthorized areas. In addition to poor solid waste collection and transportation practice, Even if a Sanitary Landfill built before 3 years it cannot start functioning yet, and the town disposal site is also found in unacceptable and very risky situation.

As this finding, the first weakness of households was poor handling of temporary SW storage material in their houses. Apart from this they regularly apply illegal solid waste disposal. Moreover, they have also low emphasis to clean their surrounding area and nearby road. Lack training about the importance of proper solid waste management were crucial factors for failure for SWM practices in the Selected Kebeles of Jimma.

The study also indicated that the major problems aggravating HH level solid waste management in the town include: lack of institutional coordination, insufficient and unskilled man power, very low financial capacity, weak enforcement of rules and regulations, socio-cultural factors and lack of awareness among the community. The other problem is very limited participation and contribution of stakeholders. The provision of municipal solid waste management of the town is dominantly performed by municipality with very limited contribution of MSSE and communities. Besides this, there was no involvement of NGOs, and private sector.

5.2. Recommendations

- Based on the findings of this study, the following measures are very important to overcome MSWM problems of Jimma town:
- Improving the standards of SWM system has a great effect on the issue of environmental protection. Therefore the Town needs proper organizational structure that enables to manage SW and attain clean environment that suites to live in.. Therefore, assignment of skilled man power and enough budget is the fundamental factors that affects management of SW in the Jimma town.
- One of the basic obstacles to proper solid waste management in the study area was inefficiency and inaccessibility of storages. Therefore, the municipality should establish additional disposal containers in every 500 to 600 m interval.
- In addition to the above fundamentals the enforcement of the existing policies, rules and regulations to act as desired is the one side role of the government and municipality. Besides to this, the participating role of community in planning, acting, decision making, awareness creation and training are the activities that should be done by this responsible body. Through continues monitoring and evaluation, the effective remedy measure must be taken.
- In other side, responsible bodies, stakeholder's participation and sustainable solid waste management options should strictly enforce these rules and regulations under close supervision and inter organizational linkage.
- For effective SWM, user participation is essential for the factors such as proper storage of HH waste, placement of HH containers and discipline in the use of public SW collecting containers. Therefore, the community has to stand safeguard to keep the surrounding clean. This must be the responsibility of each community member in controlling of the illegal waste dumping individual and enforcing to be penalized for his acts as well as provision of advice and education.
- As the practice of municipal solid waste management is a complex activity that involves collection, segregation, transportation and final disposal. It needs strong coordination among concerned institutions with a brief roles and responsibilities. So that the community has to develop awareness on SWM in order to benefit from the recommendations.

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Appendix I

Questionnaire prepared for sample households in selected Kebeles of Jimma town, southwest Ethiopia

Jimma University

College of Natural Science

Post Graduate Studies

Department of Biology

Dear respondent,

This Questionnaire are prepared aiming to assess the status and challenges ,and also institutional capacity of municipal solid waste management service of Jimma town in selected Kebeles of Jimma town . This study will be for the Partial fulfillment of the Requirements for the Award of MSC degree in Biology in Iimma University. It focuses on assessing the solid waste management of selected Kebeles in Jimma Town. Any information given will be kept confidential and you are not required to write your name.

Thank you for your co-operation.

Part I : Background information about the respondents

Instruction: In order to answer the following questions, put a right sign (√) in the boxes that located in front of your choice.

1. Sex □ Male □ Female.

2. Age: □ below 20 □ 20-30 □ 31-40□ 41-50□ 51-60□ 61 and above

3. Educational status: □Illiterate □ read & write only □(1-8) □(9-10/12)

□ Certificate (10/12+1) □ Diploma □ Degree □ Above degree

4. Family size: □ 1to3 □ 4–6 □ 7–9 □ 10 and above

5. Monthly average HH (household) income in birr. □ 1,000 and less □ 1,001 to 2,000

□2,001 – 3,000 □ 3,001 – 4,000 □ 4,001 – 5,000 □5,001 and above

6. Employment condition: □ Private sector □ Self-employee □ Government

(Public) Un employee

7. Kebelle _____

Questions related to nature and magnitude of the solid waste management problem in selected Kebeles of Jimma Town.

Nature:

1. Do you have waste storage for your daily generated wastes? Yes No

2. How do you put your daily solid wastes? All together Separated

3. Which of the following solid waste storage system is used in your HH?

local basket Sacks (Madaberia) Plastic bag Plastic bucket Pill or Pit

4. For how long the HH waste stayed without picking?

2 days 3 days 5 days A week more than a week

5.Types of wastes produced and reused in your HH:

Organic or food wastes Paper, wood and plastics Tin cans and bottles Others

The Status (Magnitude):-

6. How do you evaluate the problem of solid waste in your town?

Very high High Moderate Little No problem

7. How much kilogram SW per month do you generate?

0-2 3-4 5-6 7-8 9-10 Above 10

8. How much of SW generated from your HH did you use it (Reuse and recycling)?

Almost all ¾ of it Half of it Quarter of it Very small none of it

9. How much birr did you pay for SWM per month?

Below 5 6-10 11-15 16-20 Above 20 birr No payment

10. Which disposal system do you use around your residence? (Ranking them in their sequential order in a box: Burning in River (ditch) Burying

Open space Left for collection Other, spec

Questions Related To Practice

11. To what extent and area of activities below is your HH doing in SWM activities. (Indicate by making 'X' at available level).

	Extent of Pa ticipatio				
	V ry strongly ( )	Strongly (4)	Averagely (3)	Poorly/weakly (2)	Almost No participation (1)
I collect waste from the beginning / source					
I properly store all the wastes in home.					
I recycle and reuse the solid waste from my home					
I burn the waste from my home					
I bury the waste from my home					
I transport and dump the stored waste myself					

12. How is waste managed in your house? ☐ properly Managed ☐ improperly managed

13. To raise community based SWM what action should be taken? Rank them in assigning numbers for the best means **1**, to the next better **2**, and so on including what you assume as a means out of those below:

☐ Including awareness creation ☐ Reusing the existing policy and regulation, ☐ Transferring totally SWM to informal social organization, ☐ Taking punitive action,

☐ Designing new rules and regulation in participating of community,

☐ Increasing governmental support in finance, materials and human resources,

Appendix II

Interview questions prepared for Sanitation, Beautification and Parks Development Department workers of Jimma town.

Dear respondent,

This Questionnaire are prepared aiming to assess the status and challenges and also institutional capacity of municipal solid waste management service of Jimma town in selected Kebeles of Jimma town. This study will be for the Partial fulfillment of the Requirements for the Award of MSC degree in Biology in Iimma University. It focuses on assessing the solid waste management of selected Kebeles in Jimma Town. Any information given will be kept confidentialand you are not required to write your name.

Thank you for your co-operation.

Part one**:** Background information about the respondents

1. Job title in your department _____.

2. Employment condition □Permanent □ contract

3. Educational level □No formal education □1-4 grade complete

□5-8 grades complete □9-12 grades complete

□Certificate diploma □ First degree □Seconddegree and above

4. Work experience_____.

5. Monthly salary _____.

6. Family size _____

The Status (Magnitude):-

7. How do you evaluate your Kebeles' service provision in SWM system? □ Very good □ Good □ Fair □ Poor □ None

8. Is there local rules and regulation concerning SWM between the neighborhoods?

□ Yes □ No

9. If your answer for question 8 is 'Yes' how is it's practicality? □ Very strong □Strong □ Moderate □ Weak □ Not practical

10. Is there rules and regulations concerning SWM in municipality and government level?

□ Yes □ No

11. If your response for your question No 14 above is 'yes' how do you evaluate its application level? □ strong□ Moderate □ Weak □ Not to mention □Completely no

12. How far does the transfer station (SW containers) from each HH approximately in meter?

□ Below 100 □ 100-200 □ 201-300 □ 301-400 □ 401-500

□ 501-600 □ Above 600

Part two: structured Questions prepared for investigating MSWM practice and capacity together with their attitude regarding solid waste management of the town.

1. Have you ever been participated in solid waste management trainings or education?
2. Does your institution give incentives, promotions and salary increment to you?
3. Does your institution work with other government and non- government organization inits solid waste management operations? If it works, please list the organization and their activities on solid waste management of the town.
4. How do you evaluate your institution status on interaction with other government and non-government organizations regarding MSWM of the town?
5. How do you see the institutional arrangement of the municipality? Is there any problem on the efficient performance of your division? If it has please explain it?
6. Do you feel your organization has efficient capacity to handle MSWM responsibilities?
7. Do you think the controlling mechanism of municipality is effective? If your answer is "no", what do you think the reasons?
8. Do you work on Saturday and Sunday per time? If you work, do you get over time payment?
9. Do your collection, transportation and disposal service cover all parts of the town? If it not covered, please specify the major reasons?
10. Are you provided with medical care, safety wares, and other materials that are necessary to keep your health?
11. Do you think residents of Jimma Town have clear and adequate awareness about solid waste management systems?
12. What do you think should be done to improve the situation of MSWM of the town in general?

If you have any additional comments, suggestions, or would like to elaborate on any of your previous answers, please include it here, or attach a separate sheet.

Appendix III

Interview questions prepared for head of Sanitation, Beautification and Parks Development Department (Municipality office) of Jimma town

Dear respondent,

This Questionnaire are prepared aiming to assess the status and challenges and also institutional capacity of municipal solid waste management service of Jimma town in selected Kebeles of Jimma town . This study will be for the Partial fulfillment of the Requirements for the Award of MSC degree in Biology in Iimma University. It focuses on assessing the solid waste management of selected Kebeles in Jimma Town. Any information given will be kept confidential and you are not required to write your name.

Thank you for your co-operation.

Part one: The Status (Magnitude)

1. How do you evaluate your Kebeles' service provision in SWM system?

□ Very good □ Good □ Fair □ Poor □ None

2. Is there local rules and regulation concerning SWM between the neighborhoods?

□ Yes □ No

3.If your answer for question no.2 is 'Yes' how is it's practicality? □ Very strong

□Strong □ Moderate □ Weak □ Not practical

4. Is there rules and regulations concerning SWM in municipality and government level? □ Yes □ No

5. If your response for your question No 14 above is 'yes' how do you evaluate its application level? □ strong□ Moderate □ Weak □ Not to mention □ Completely no

6. How far does the transfer station (SW containers) from each HH approximatel in meter?

□ Below 100 □ 100-200 □ 201-300 □ 301-400 □ 401-500□ 501-600 □ Above 600

Part two: structured Questions prepared for investigating MSWM practice and capacity together with their attitude regarding solid waste management of the town.

1. What types of solid waste collection methods does your institution adopt?

2. Mention the types and total number of equipment that your department used for collection, transportation and disposal of municipal solid waste of the town?

3. Is there a mismatch between the amounts of municipal solid waste that regularly generated in the town and, total quantity of solid waste that is collected and disposed by your department? If there, please discuss the major reasons of a mismatch.

4. Does Jimma town sanitation, beautification and parks development department practice different types of resource recovery, waste minimization or waste treatment activities? If any, please describe those activities and, if not please mention the major reasons?

5. Did your department carry out the following surveys on disposal sites of the town in order to evaluate its suitability? If your department under take the survey, specify the outcomes. But if didn't carry out, please specify the major reasons.

6. Explain the overall institutional structure, mandate and functions of sanitation, beautification and parks development department and, the major positive and negative impact of these arrangement on the existing performance municipal solid waste management of the town.

7. Describe the total budget and revenue of municipal solid waste management related with their sources and the major challenges that faced your Institution about it?

8. Does your Institution collect charge from the residents of the town for its municipal solid waste management service delivery?

9. Do you think that there is inadequacy of man power in your organization? If there is, what do you think the reason behind this?

10. Do employees leave your department frequently? If yes, please specify their number yearly, major reasons and your Institution response for it.

11. Do you think that your organization has sufficient autonomy from other levels of government in its every day decision making.

12. Does your department invited different stake holders of solid waste management to participate both in planning and implementation process of municipal solid waste management? If yes, please describe those actors and their significant activity.

13. Did your Organization give education to the community about solid waste management and prepared cleanup campaigns? If you did, for how many times and describe your method of delivery.

14. List challenges of your department.

If you have any additional comments, suggestions, or would like to elaborate on any of your previous answers, please include it here, or attach a separate sheet.