Institute of Health Science, Faculty of Public Health

Department of Environmental Health Science and Technology

Challenges of Solid Waste Management practice and Factors Influencing its Effectiveness: A case study in Jimma city municipality.

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A thesis submitted to the Department of Environmental Science and Technology Chair, Public Health Faculty in Partial Fulfillment of the Requirement for the Degree of Masters of Science in Environmental Science and Technology.

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Approval sheet

As thesis research advisors, we hereby certify that we have read and evaluated this thesis prepared under our guidance by Sinishaw Teshome entitled 'Challenges of solid waste management practice and factors influencing its effectiveness in Jimma city municipality. We recommended that it could be submitted as fulfilling the thesis requirement.

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As member of the board of examiners of the MSc. thesis open defense examination, we certify that we have read and evaluated the thesis prepared by <u>Sinishaw Teshome</u> and examined the candidate. We recommend that the thesis be accepted as fulfilling the thesis requirement for the degree of Master of Science in Environmental Science and Technology.

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Department of Environmental Health Science and Technology appreciates the successful completion of his thesis

Abstract

Background: *Solid waste refers to the range of garbage materials arising from animal and human activities that are discarded as unwanted and useless. Ethiopia is one of the low-income countries facing the consequence of improper solid waste management. Solid waste in Jimma city is accumulated and is poorly managed. Solid waste has become an important issue in Jimma city. Currently in Jimma, solid waste is increasing beyond the management capacity of the municipal governors.*

Objectives: *The general research objective of this study is to assess the current solid waste management practice and identify the potential factors influencing its effectiveness in Jimma city municipality.*

Methodology: *The study was conducted starting from January to December, 2021. A cross-sectional survey research design was adopted for the purpose of this study. The target population of this study were workers in solid waste management system at jimma central and branch municipalities. In this study, the researcher used questionnaires, interviews, focused group discussion and observation methods of data collection to collect primary (original) data. Descriptive statistics (frequency, percentages) and inferential statistics (correlation and regression analysis) were used to find out the influencing factors that affect the effectiveness of solid waste management practice in Jimma city municipality. Analysis was conducted by using SPSS version 23.00 software.*

Results: *The result shows that financial condition, technical condition, social condition, and institutional conditions and political conditions have a positive relationship with solid waste management. From multiple regression analysis, it was identified that all the considered independent variables; financial, technical, social, institutional and political conditions have a positive as well as significant effect on the effectiveness of solid waste management practice.*

Conclusion: *In this research it was concluded that financial, technical, social, political and institutional conditions or all the influencing factors had a significant effect on effective solid waste management practice in Jimma city municipality. The local government should ensure provision of adequate and modern solid waste management system that will facilitate the process of collection, transportation and disposal of waste.*

Key words: *Effectiveness, Awareness, solid waste, solid waste management*

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List of abbreviations and acronym

ADB   Asia Development Bank

ISWA   International Solid Waste Association

MSWM   Municipal Solid Waste Management

NGO   Nongovernmental Organization

SWM   Solid Waste Management

UN   United Nations

UNDP   United Nations Development Bank

UNEP   United Nations Environmental Program

UNIDO   United Nations Industrial Development Organization

WHO   World Health Organization

Chapter One: Introduction

1.1 Background of the study

Human actions at all times produce waste. This was not a substantial issue when the human residents were relatively minor and traveling but became a severe problem with rapid growth of urbanization and population. Poor administration of waste led to the uncleanness of water, soil, and atmosphere and impact on public health. The features of left-over material streams changed and increased dramatically in line with lifestyle changes and the number of new chemical materials present in the waste. The long-term health effects of exposure to substances present in the waste or produced at waste removal facilities are more difficult to measure, predominantly when their concentrations are very small and when there are other exposure pathways (Singh., *et al.,* 2018).

Rock-hard waste refers to the range of junk materials arising from animal and human activities that are cast-off as unwanted and useless. Solid waste is produced from industrial, housing and profitable activities in a given area and held in a variety of ways. Landfills are typically classified as sanitary, municipal, construction and demolition or industrial waste sites (World Bank, 2020). Degradation of the environment is among the key difficulties of today's life. The need to protect our surroundings and the environment has developed more important than anything else (McAllister, 2015).

Solid waste management is defined as control of generation, storage, assembly, transport or transfer, dealing out, and disposal of solid waste materials in a way that best addresses the range of public health, conservation, economic, aesthetic, engineering and other environmental considerations (World bank, 2020). Throughout the world, volume of waste is increasing at an alarming rate. In 2016, the worlds' cities made 2.01 billion tons of solid waste, amounting to a footmark of 0.74 kg per person per day, with fast residents' growth and urbanization, yearly waste generation is projected to increase by 70 percent from 2016 levels to 3.40 billion tones in 2050 (Marques L. 2020).

Associated with those in industrialized nations, residents in developing countries, especially the urban poor, are more severely impacted by unsustainably managed waste. In low-income countries over 90 percent of waste is often disposed of in unregulated dumps or openly burned. These practices create serious health, safety, and environmental problems. Unwell managed waste serves

as a breeding ground for disease vectors, contributes to global climate change through methane generation, and can even promote urban violence (Marques, 2020). Yet, solid waste administration is an enormous task and responsibilities of the local authority that needs organizational capacity building and cooperation between the private and public sector (McAllister, 2015).

The necessity for managing this increasing solid waste is very vital in a naturally effective, economically affordable, and on a social basis acceptable manner (Achankeg, 2004). Nevertheless, protection of the environment is very essential for public health, solid waste management, in most municipalities of developing countries, is disappointing particularly in African cities (McAllister J, 2015). So, properly managing, collecting, transporting and disposing of MSW is very important to ensuring a clean and healthy environment (Pattnaik & Reddy, 2010). Moreover, the rise in population and urbanization increases annual waste generation proportionally (Hassan, 2004).

Solid waste management is becoming a big concern for city administration tasks in developing countries mainly due to the magnitude of rapid urbanization and increasing population growth which in turn have greatly accelerated municipal solid waste generation rate in the urban environment. The United Nation Environment Program (UNEP, 2005) notes that the management of solid waste in Africa is often weak due to lack of appropriate planning, inadequate governance, poor technology, weak enforcement of existing legislation and the lack of economic incentives to promote environmentally sound development.

Even if the features and number of solid wastes generated are not only the true measure of the living standard and lifestyle of the region's residents, they are proved to have direct relations (Nations & Programmed, 2005). Growth in urbanization affects the overall rate of solid waste production in many countries in the world. However, collection, disposal methods, and dumping sites for municipal solid waste (MSW) exists unsolved and complex to find a solution in many large cities (Hassan, 2004) that is why the problem of solid waste management is more severe in African countries (Hufane, 2015). Municipal wastes are not well managed in developing countries due to the alarmingly increasing solid waste products which are more than the capacity of the city municipalities. It was reported that waste collection rates are often lower than 70% in low-income countries and more than 50% of the collected waste is often disposed of through uncontrolled landfilling (Lema et al., 2019).

Ethiopia is one of the low-income nations facing the consequence of unsuitable solid waste management. It was stated that about 20 to 30 percent of the waste produced in Addis Ababa, the capital city, leftovers uncollected. Good solid waste management needs the obligation of the city municipality and the active participation of the public members. There are many initiatives taking place in Ethiopia, to recover environmental health, specifically in the capital city. In Addis Ababa, the mindfulness of the community members about solid waste management is improved and more than 70 percent of the community residents were willing to pay for door-to-door solid waste collection service which is one of the creativities introduced by the government (Lema et al., 2019).

As one of the cities in the developing countries, quick population growth and Urbanization pose numerous environmental encounters on Jimma city. One characteristic of urban growth posturing a threat to sustainable development is poor solid waste management which results in ecological pollution. The total waste generated daily in Jimma city was 88,000 kilograms (jimma city municipality, 2019) on the bases of an average per capita generation rate of 0.55 kg/capita/day. Where 87 percent of the waste was generated by households, 13 percent by organizations and an insignificant fraction which is about (0.1%) was generated by road sweepings. During the rainy season, forty percent more waste was generated than in the dry season for the reason of the increased availability of farm food products. The non-biodegradable components (plastic bags and bottles) establish 46 percent of which 30 percent of them were non-recyclable material. Only 25 percent of the community uses municipal containers for disposal at the selected landfill site, 5percent of the houses disposed of their waste in separately chosen spots whereas 22 percent burned their waste in their own compound or at nearby areas (Getahun et al., 2012).

1.2 Statement of the problem

Currently, the population growth and the rate of urbanization are terrifyingly increasing throughout the world including Africa. These population growth and urbanization are the major reasons for the rising quantity of solid waste in a country. There are also cultural, social, financial and official features considered to be additional causes for the increasing quantity of solid waste in the world. As Ethiopia is one of the countries in Africa it is unquestionable that it faces the consequence of these factors. The study area is a trade root for three regional states (Oromia, south west region and Gambela) that it provides service to large number of passengers crossing the city which poses additional burden to the city by adding waste to the existing one.

Hence, due to the aforementioned reason and researches conducted by different scholars, the study area was proved to be one of the most potential solid waste sites that disturb the environment as a whole (water contamination, soil and air pollution) and specifically health status of the public (different deceases such as typhoid, thyphus, asthma and influenza, cholera and other vector born diseases).

One of the most discouraging challenges of urban centers in developing countries like Ethiopia is the good waste management challenge (Nigatu et al 2011).

The variety of solid waste management problems including insufficient waste collection, transportation systems, inadequate waste handling and inappropriate final disposal are consequences for environmental pollution around urban areas. These difficulties are worsening by the growing waste generation rates associated with population growth, quick urbanization, change of arrangement of waste and economic condition of the population (Degnet, 2008; Getahun, 2011).

Many cities in the developing world cannot encounter the need for solid waste management. Although, investing a large proportion of their budget the service coverage is still less than fifty percent of the total area allocated which clearly shows the presence of a need for timely intervention to avoid the negative impact of environmental degradation.

In the absence of effective solid waste management, the accumulated waste risks public health and societal well-being. Solid waste in Jimma city is accumulated and is poorly managed that it become a series problem of the city that needs due attention before causing a devastating consequence. Masses of wastes generated in the city are often found by roads sides, rivers, ditches and other open spaces causing significant health and environmental problems. This fact can be observed by walking on the street of Jimma city where residents might not find it strange to see overflowing garbage skips often rendered for their putrefied smell. The best remedies individuals can do in such a scenario is to cover their nose or hold their breaths and walk (Misrak, 2016).

The current condition of the city sets an alarm to the government officials to pay a due attention and design an appropriate strategy to avoid the danger to be encountered by reckless handling of waste generated which in turn resulted in the accumulation going to be beyond the management capacity of the municipal governors.

Due to the above core reason, the government had structured a process where SMEs and privately-owned sanitation companies work with the government's sanitation entities in line with Proclamation No.513/2007. Despite government's procedural mechanisms put in place to cope with the above problem, the matter of solid waste disposal seems far from being resolved due to the lack of technology, technical know-how, financial capacity, institutional structure, and understanding of the community required to properly manage solid wastes by the service providers.

The previous studies could not manifest the basic factors which have hindered the management of solid waste in Jimma city which enabled deterioration of an efficient and effective means of SWM (solid waste management) capacity. If these factors are not clearly stated, it becomes difficult to design appropriate SWM strategies in the study area. This gap directed the researcher to assess the current solid waste management practice and influencing factors at the level of the city.

Therefore, it is an appropriate issue that needs timely research based intervention to address the problems in the city and provide improved and sustainable solid waste management service.

1.3 Research Questions

This study is attempted to answer the following specific research questions.

- What is the current status of solid waste management practice of Jimma city?
- What are the significant factors that influence the effectiveness of solid waste management practice in Jimma city?
- What is the association between influencing factors and the effectiveness of solid waste management?

1.4 Significance of the Study

The findings of this study will contribute to the current solid waste management practice and its influencing factors in Jimma town. The study will contribute a better theoretical understanding of the overall features of solid waste and socio-economic factors on the process of solid waste management on the whole population. Practically, the study will show the following significances. It will reveal the current practice of solid waste management and give a clear understanding of how financial, technical, social, institutional and political aspects influences solid waste

management effectiveness such as collection, transportation and disposal which could help the local government officials to make a better decision to plans on behalf of MSWM (municipal solid waste management) system through a better understanding of the issue. It may also be important in putting baseline information to the next work who would like to conduct detailed and comprehensive studies in Jimma city or another study area.

1.5 Scope of the study

The study was conducted in Jimma city central and branch municipality waste management workers of four purposively selected kebeles: Gingo, Ginjo gudru mendera qochi and Becho bore based on the following selection criteria.

1-SME's (small and micro enterprises) year of establishment.

2- Based on number of HH clients registered for the service to be rendered by waste collectors

The time taken to accomplish the study: the researcher spent six months of time to accomplish the thesis.

1.6 Conceptual frame work

This conceptual frame work illustrates the relationship between influencing factors and effective SWM. The influencing factors were financial aspects, technical aspects, social aspects, institutional aspects and political aspects and the effective SWM were collection, transportation and disposal. However, financial aspects were (financial cost, operating cost, and cost recovery and investment on capital) while technical aspects were modern vehicle and equipment's, skilled personnel for waste collection, transfer, and waste disposal. Social aspect was the condition of the workers, beneficiaries' attitudes and awareness raising programs. Institutional aspects were conceptualized as integrated SWM, proper institutional framework, and elongated contract. Political aspects were conceptualized as proper authority regulations and rules, proper enforcement, and government priority. The conceptual framework shows that the status of

financial condition, institutional condition, technical condition, social condition, political

condition that directly influence the collection, transportation and disposal

Independent variable   **dependent variable**

Influencing Factors

Financial factor
- Operating and financial cost
- Management of funds
- Cost recovery

Technical factor

- Knowledge of waste Collection /Transportation

- Modern vehicle/equipment

- Skilled labour.

Social factor

- Condition of workers
- Beneficiaries' attitude
- Awareness raising program

Institutional factor

- Elongated contract
- Municipality capacity
- Institutional set up

Political factor

- Authority regulations
- And rules enforcement
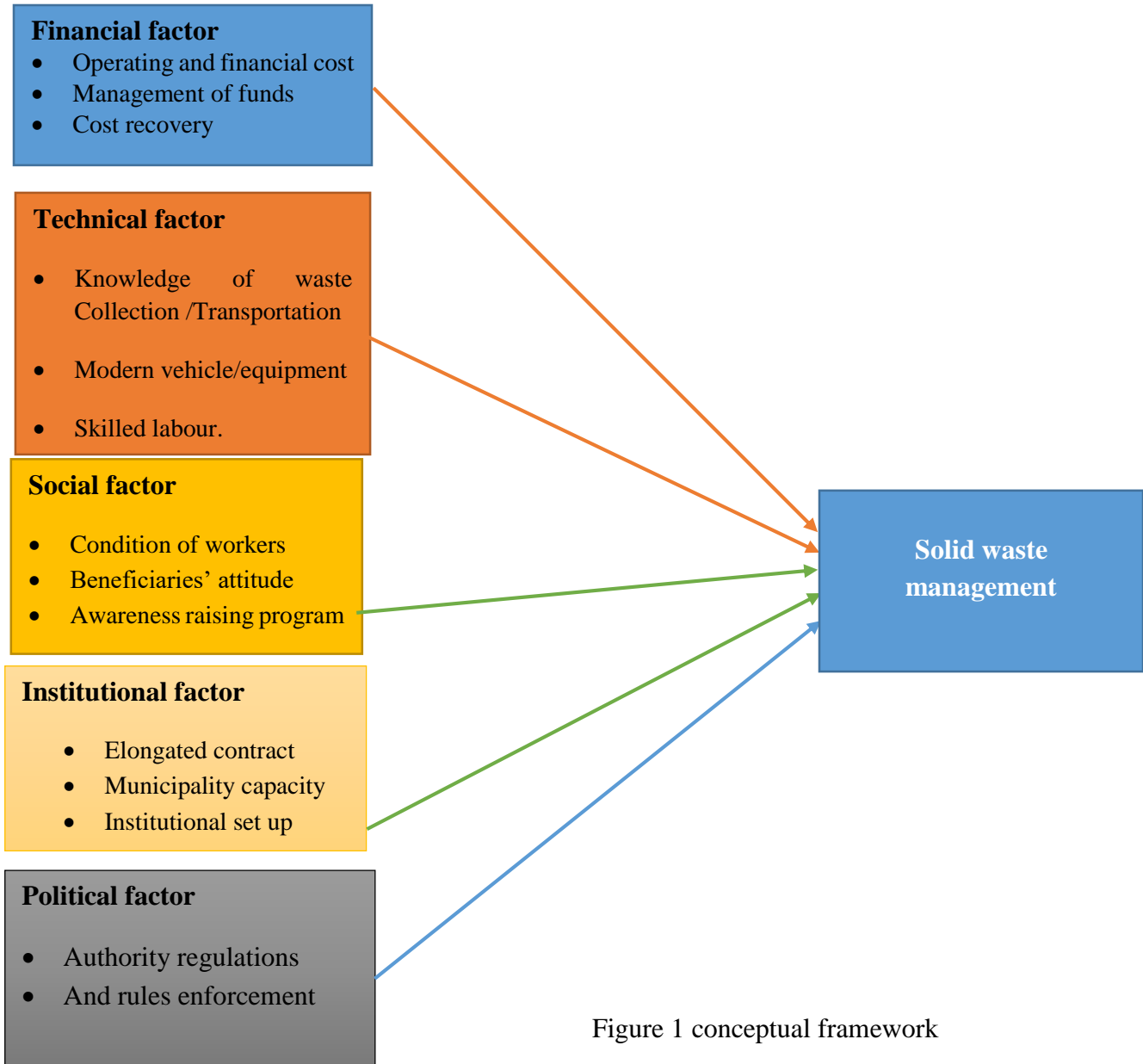
Solid waste management

Figure 1 conceptual framework

Chapter Two: Literature Review

2.1 Solid Waste Management Concept

Solid wastes by definition include refuse from households, non-hazardous solid waste from industrial, commercial establishments, and refuse from institutions, market waste, yard waste and thus the road sweepings. Broadly, household wastes otherwise called residential or domestic wastes are made of wastes that are consequences of household activities. It includes food preparation, sweeping, cleaning, fuel burning, gardening wastes, old clothing, old furnishings, retired appliances, packaging and reading materials, diapers or bucket latrines are used and household waste include fecal material (White et al., 2012)

Municipal waste is generated by households, commercial activities and other sources whose activities are almost like those of households and commercial enterprises. Municipal waste is created up to residual waste, bulky waste, secondary materials from separate collection like paper and glass, household hazardous waste, street sweepings and litter collections. It's product of materials like paper, cardboard, metals, textiles, organics from food and garden waste and wood (European Environment Agency, 2013).

Solid Waste Management (SWM) could even be a challenging issue for low-income countries, affecting the environment, health, socio-economic, aesthetics and infrastructure, due to the quantity of Waste generated disposal and treatment methods. This global trend of waste management problems caused by population inflation, higher living standards in cities, expansion of urban areas, and changes in consumption behavior, which are resulted unsustainable methods of waste disposal, which is ultimately a result of inadequate planning and implementation (Al-Salem et al.,2018; Ghinea et al., 2016, Iyamu et al., 2020).

Because waste generation rate is predicted to rise with economic development and growth in lower and middle-income countries are likely to experience the only growth in waste production. The fastest growing regions are South Asians, where total waste generation is anticipated to triple than double by 2050, respectively, making up 35% of the world's waste. The center East region is additionally expected to double waste generation by 2050. Upper-middle and high-income countries provide nearly universal waste collection and quite one-third of waste in high-income countries is recovered through recycling and composting. Low-Income countries collect about

48% of waste in cities, but only 26% in rural areas, and only 4% is recycled. Overall, 13.5% of worldwide waste is recycled and 5.5% is composted (World Bank, 2018).

The solid waste handling hierarchy, internationally accepted and recommended, following the ascending order of preference are; open-burning, dump, landfill, incinerate, recycle, reuse and stop or reduce. Where, open burning and dumping are least preferred and truly not recommended while many un-developed countries are highly using it. (Achankeng, 2004). The matter of municipal solid waste management varies in magnitude in several regions, nations and cities of the planet. Currently, an estimated 54 per cent of the world's population lives in urban areas and this can be often expected to extend to 66 per cent by 2050, about one third or to two thirds of the solid waste generated is uncollected which then dumped within the streets and in drains, contributing to flooding, breeding of insects and contributing to the spread of diseases (Awosan, 2017)

According to (Awosan, 2017): Residential and municipal wastes are those who originates from dominion like houses and apartments. The waste consists of food leftovers, vegetables, Peeled materials, plastics, wood pieces, clothes. It also includes waste originated from demolition, construction, and street cleaning. Commercial and institutional: it's the waste that comes from stores, hotels, shops, markets and medical facilities then on. The waste that originates from any institution is thought as institutional waste like papers, food, glasses, metals etc.

2.2 Financial factors and SWM

If a system is to be fully sustainable it's important that future financial costs similarly as short term operating costs are taken under consideration. Financial aspects for Solid Waste Management concern budgeting, accounting, capital investment, cost reduction, and value recovery. Financial resources are concerned with overhead for waste collection, financial cost, cost reduction and control, cost recovery and operational financing (coffey & Coad, 2010).

Therefore, adequate budgeting, accounting, financial monitoring and financial evaluation are vital to the effectiveness of the management of solid waste systems. However, in step with stated that officials to blame of municipal solid waste management don't have accurate information concerning the 000 costs of operations and this may be often thanks to the shortage of capacity to use available financial tools and methods. Furthermore, financial constraints is that the foremost

reason for inadequate collection and disposal of solid waste in most of the buildup countries where local councils are weak and lack of finance (Zurbrugg,2002; Hufane,2015).

Operating costs are labor cost, fuel cost and maintenance cost. Additionally, financial cost includes costs to possess vehicle including their depreciation and also the worth of recovery includes refuses collection charge, government grants, and littering fines (Coffey & Coad, 2010). Generally, the biggest proportion of overall solid waste management expenditures are absorbed by the sweeping and collection services (Coffey, Coad, 2010). The foremost reasons for poor collection and disposal of waste are associated with insufficient funding, and causes inadequate capacity to handle solid waste, low morale of waste workers because of poor remuneration, lack of coaching, and eventually lack of experience and manpower to run solid waste (Ogwueleka, 2009).

Budgetary constraints are often felt in developing countries where resources are scarce and dissemination of these limited resource are mishandled where many municipalities are struggling to know acceptable quality service because of these financial problems (McAllister ,2015). Another major constraint seen throughout the developing world is that the dearth of educational awareness and effective waste management practice (McAllister, 2015). The due to improve waste management is to spice up the status of monetary resources, disbursal, and management of cost recovery (Hufane, 2015). Solid waste management in developing countries is principally attributed to technical inefficiencies and it also supports the view of Solid waste management system in developing countries display array of problems, but one major of contributing factor of this setback is poor and inappropriateness of technical aspects. The financial pressures experienced by the bulk local governments encourage the tendency to concentrate only on the short-term operating costs and ignore the longer-term financial costs. However, this tendency will cause a crisis in fewer years' time (Coffey & Coad, 2010).

Financially, town government should allocate enough money for the availability of solid waste management, improving rate for collectors, providing incentives and designing revenue generation mechanism (Muche, 2016). Financial constraints, inadequate service coverage and operational inefficiencies, ineffective technologies and equipment, inadequate landfill disposal, and limited utilization of recycling initiatives are all the budget constraints of solid waste management (McAllister, 2015).

To improve financial situation, it's a necessity for the municipalities to adopt strategies like, waste segregation, door to door collection, with waste being collected daily or twice weekly and also the waste which couldn't be composted or recycled, should be land filled (Yadav et a ,2010). Rapidly and Financial effectiveness of MSWM is laid on life cycle costs and long-term economic impacts. Consequently, financial analysis is extremely crucial input to the strategic planning and investment programming (Yadav et al., 2010). Furthermore, unless funds are continuously available with none postpone or delay, it's impossible to run a daily collection service and any system which has been founded will collapse are available to forestall (Coffey & Coad, 2010).

As (Zurbrugg, 2003) shows one in every of main reasons of inadequate collection services is that the dearth of monetary resources to cater to the increasing amount of generated waste produced. the foremost important portion of the financial cost is spent on street sweeping, waste collection, and waste transportation and no financial cost allocated for contemporary disposal system like land filling or incineration because of insufficient funding (Alem et al., 2008). In step with Christen and Berne (1996) stated that improvement of monetary aspects in MSWM are often achieved by attaching solid waste fees to the billing for yet another service, like water (Schubeler, 2016).

Due to non-availability of funds and resources, MSW management is becoming a difficult task as they're generated in huge. Unscientific disposal of MSW has adverse impacts on environment and human health (Gupta et al., 2007, Rathi, 2006 and Bundela et al., 2010). The foremost sustainable method of MSW management is difficult to identify thanks to legislative, environmental, economic and social restrictions (Adani et al., 2000 and Bundela et al., 2010).

2.3 Technical factor and SWM

Technical aspect of Solid Waste Management is involved the planning, implementation, and maintenance of collection and transfer systems, waste recovery, final disposal and unsafe waste management (Schubeler, 2016). Ineffective technologies and equipment are another source which could contribute to the inadequate service coverage and operational inefficiencies (Mcallister, 2015). The poor collection, disposal and transfer of waste is that the results of poor status of technical aspects (Hufane, 2015). The gathering comprises household containers, primary and secondary collection vehicles and equipment (Muche, 2016). Lack of adequate modern waste disposal equipment, lack of normal training, and inaccessibility of spare parts for damaged and

broken vehicles and equipment are more or less negatively influencing factors on the proper waste disposal practice (Muche, 2016). If the container is shared by households, there is a risk that waste is visiting be dumped near it and this might discourage others from putting their waste inside the container (Coffey & Coad, 2010). All forms of waste are the results of the absence of management and control of waste, the management and control of solid and liquid waste remain major problem in every town in Ethiopia (Health, 2010).

Therefore, for waste management to be technically effective the local authorities should provide proper waste collection systems with qualified personal, and availability of recent vehicle and equipment to chop back environmental health hazards (Muche, 2016). However, techniques that have often proven effective in developed world are ineffective in developing world because they're doing not have needed infrastructure and knowledge to properly manage these technologies (McAllister, 2015). Accumulation countries lack sanitary landfills and their disposal sites situated long distance from communities and this creates more financial difficulties because costs to collect, transport, and find eliminate waste considerably hard to afford (McAlister, 2015).

Due to lack of spare parts and insufficient funds makes MSWM ineffective for the management of storage, collection, and transportation of solid waste management (Alam et al., 2008). In line with (Ogwueleka, 2009) stated that traffic congestion; city infrastructure, narrow roads, and harsh conditions of the road to the disposal site contribute to the inefficient of solid waste collection. So on boost technical aspect of MSWM technical facilities must be selected carefully to their regard like performance, maintenance requirement, and expected life cycle costs, and sources of hazardous materials must be identified to forestall infectious healthcare wastes (Zurbrügg, 2003).

2.4 Social factor and SWM

Social aspects of MSWM involve waste generation and handling community-based waste management and therefore the social conditions of waste workers. Public awareness and attitudes to waste influence the people's willingness to cooperate and participate in adequate waste management practice (Zurbrügg, 2003). Per Marshal and Farahbakhsh (2013) the most problems of solid waste management comes from lack of public awareness, poor condition of waste workers, and lack of personal sector and social involvement. Lack of public awareness, lack of adequate salary and benefits and low-level attitudes for waste workers are all factors influencing the

effectiveness of solid waste management (Muche, 2016). There is series lack of information concerning an interest in safe and reliable waste disposal among most medical examiners and there's no adequate funding available for the effective implementation of safe disposal procedures for medical waste (Alam et al., 2008).

Social aspects of SWM will be improved by building social awareness and academic program, waste workers are subject to health problems therefore, giving support in their earnings, and access to social services will make SWM efficient (Zurbrügg, 2003).

2.5 Institutional factor and SWM

Institutional aspects concern the distribution of functions and responsibilities and correspond to organizational structures, procedures, methods, institutional capacities and personal sector involvement. Successful solid waste management requires integration of the many organizations and groups into partnership like national government, government, private sector, and informal sector. Regime is generally to blame for SWM, or handed over to personal sector which is responsible actual sweeping, collection and disposal services (Coffey, & Coad, 2010). Primary collection which is door to door collection, and transport to the purpose of collection are often managed by community-based organizations or small enterprises and infrequently initiated by the residents desperately need for a group service and also willing to pay monthly collection charge (Zurbrügg, 2003).

So as to boost effectiveness of MSWM the institution should do decentralization of responsibility, capacity building for strategic planning and financial management, private sector involvement like competitive bidding, regulatory instruments and monitoring and control systems (Zurbrügg, 2003).

2.6 Political factor and SWM

Political aspect includes the formulation of goals and priorities, determination of roles and jurisdiction and also the legal and regulatory framework (Zurbrügg, 2003). National government have little to mention in waste collection services but rather play a big role in policy decisions like to what extent the private sector should involve, and it should control the expenditures on solid waste management, and sometimes cover employment payment in some cases (Coffey & Coad, 2010).

Local government often involve solid waste collection services, and infrequently work under a national legal framework instead of an area one and this makes difficult to vary framework to suit local conditions like private sector involvement and community involvement (Coffey,& Coad, 2010). Out-dated policies and lack of information in re- use and recycling with effective enforcement of the law have all contributed to the ineffectiveness of MSWM (Rode, 2011). So as to extend the quality living of population, such policies are required on immediate basis as an example public private partnership is such an answer to the lack to handle solid waste management operations (Rode, 2011). For the sustainable management of waste, policy and regulations have to be clear and implementable; it must have also oversight body to observe the enactment and therefore the implementation of these policies (Rode, 2011).

Lack of enforcement of policies of solid waste is that the real challenge to sustainable waste management. However, straightforward, unambiguous legal and regulatory framework, involving functioning and enforcement procedures at the national, provincial, and a neighborhood level is extremely important to the correct functioning of MSWM (McAlister, 2015). Several challenges starting from financial constraint, inappropriate technology, inadequate manpower, and enforcement have play a major role against effective solid waste management practice (Fei-baffoe , Nyankson, & Gorkeh-miah, 2014).

2.6 Solid waste generation (SWG)

The quantity of generated waste mainly depends on population and people's living standard. Thus, the full solid waste generated per day in national capital is estimated to be 0.5kg per capita per day. As a result, an outsized proportion of the waste is remained uncollected which are disposed of in open spaces (Amiga, 2002).

Nevertheless, generation rates for the African countries within the major cities are estimated to range from 0.3-1.4 kg per capita per day. The solid waste generation per capita in (Benin, state, Burundi, Cameroon, Egypt, Ghana, Morocco and Uganda are, 0.5, 0.7, 1.4, 0.7, 0.5, 0.4, 0.6 and 0.6 respectively) (Habitat, Nairobi 1997). According to Tinmaz & Demir (2006) municipal solid waste management in Corlu town in turkey generated 170tonnes of waste daily or 1.15kg per capita per day. However, Taylor & Koushki (2011) stated that a mean household in Kuwait produces 1.55 large bags and a pair of.46 small bags of solid waste per day.

Furthermore, the study shows that a median household in Kuwait produces 8.39kg of waste per day. It's also vital to notice that the speed a mean household comprising of 6 persons generates 1.4kg/person/day. On the opposite hand, Americans produce 1.2kg which is a smaller amount than 17% what was produced in Kuwait. Approximately 57% of household in Kuwait produces one large bag daily. Furthermore, 29% produce two large bags. And 4 per cent produce minimum of two large bags. In keeping with Cointreau (1982), the characteristics and generation of solid waste in low-income countries: The waste generated 0.4 – 0.6 kg/cap/day, waste density 250-500kg/m3, and water content 40-80%. Furthermore, the waste composition is organic 40-85%, paper, cardboard 110%, Glass & ceramics 1-10%. Metal 1-5%, plastics 1-5% and dirt & Ash 1-40%. (Taylor P. & Koushki P., 2011) in Kuwait also stated that food stuff consists of over half (51.1%) of the daily wastes. Paper material waste 19% of the entire daily waste.

Similarly, plastic materials comprise 13.4% of the general. The household daily solid waste is positively related with the age of family head, income of the family, and family car ownership. which means that, families with older heads, higher earnings with higher car ownership generate larger quantities of solid waste day after day However, families whose heads are well educated generated fewer bags of solid waste day after day. Families with higher rate of employment produce larger amounts of solid waste on an everyday. Upgrading and giving general public awareness concerning the matter of urban solid waste management should be variety one priority of the ruling policy makers.

In Freetown, African nation, (Sankoh & Yan, 2014) found that percentage weights are organic garbage (69%), plastic 7.7%, metal 2.9% glass 3% paper and cardboard 9.2%. these results support the studies that assemblage countries waste stream is majority organic materials. in step with (Adeniran, Nubi, and Adelopo, 2017) in Lagos Nigeria, Solid waste types were found to be Polythene bags 24% (7.73 tons/day), Paper 15% (4.83 tons/day) organic matters 15%, (4.83%) plastic 9% (2.9tons/day). Inert materials 8% (2.58 tons/day), sanitary7% (2.25tons/day), textile 7% (2.25 tons/day) et al. 6% (1.93tons/day), leather 4%(1.29tons/day), Metals 3% (0.97 tons/day), glass 2%(0.64tons/day), E waste0% (0.0tons/day).

As stated by (Ojeda-ben, Vega & Marquez, 2008) in Mexico, employed in his study three differing types of family typology including clan, extended and mono-parental families. A whole number of households within the study was 125, 67 nuclear families, 45 extended, 13 were mono parental

families. The results showed that the per capita and thus the typical family waste generation varies in line with family typology and to the socioeconomic stratum the results showed that the per capita and also the common family waste generation varies per family typology and to the socioeconomic stratum. Daily waste generation of the relations was 1.1kg, relations generate 0.78kg and thus the mono parental family generate 1.35kg of waste.

Generally, waste collections are meted out in two systems secondary collection and first collection. Primary collection involves storage and transportation of the waste from the households to local collection points and this may be however, achieved in various means (Qing, Keat, & Gersberg, 2010). Furthermore, secondary collection is where the waste from type of primary collections is taken from the transfer station to the final word disposal site (Qing et al., 2010).

Therefore, waste collection methods are communal systems where containers located publicly places, block collection, curbside collection and door to door collection. Nevertheless, source separation implies that the solid waste is classed as several different parts like composting materials (foods), combustible materials (fiber and paper) and recyclable materials like plastic, metal, glass (Hui, Li'ao, Fenwei, & Gang, 2006). It has been estimated that waste transportation, including labour and machinery, accounts for 70% to 80% of the cost of solid waste management (Imam et al., 2008).

There has been variation exists among countries in costs allocated for waste collection, transportation and disposal. Collection of wastes many countries has attained 100% in collection although collection declining in automatic techniques. For instance, Japan collection accounts for 4%, treatment 45% and disposal 6%. While in developing countries like Malaysia collection alone accounts for 70% (Achankeng, 2004). A literature within the last twenty years suggest that countries with high density populations like Japan, Kingdom of The Netherlands, the UK, and Switzerland to adopt incineration because the most important solid waste management method, whereas low population densities as an example, Australia, Canada, and also the US display high rates of waste land filling (Sakai et al. 1996; OECD 2004).

Japan opts for incineration as its main waste disposal practice, it generates 51 million plenty of domestic waste p.a. and 400 million tons of industrial solid waste, 30% is recycled (wright, 2000). Sankoh and Yan, (2014) In Freetown, Sierra Leone, stated that the bulk of the dispose waste in

dumpsites, drains and streets are uneducated people while folks that retain waste in bags or bury and burn it at the rear yard are generally those with educational background. (Isa, Asaari, Ramli, Ahmad, & Siew, 2005) revealed in his study using questionnaires and interviews and on-site observations he concluded that stated that majority of town inhibits show interest about recycling and like to try to more about this regard.

According to Adeniran et al., (2017) strategic policy and community involvement are highly needed for waste reduction and segregation with improved recycling waste. Solid waste management can be a serious problem to most countries especially the developing ones, obviously, increment additionally to urbanization will mean generation of solid waste would air the increase (Adzawla et al., 2019). However, the structure of solid waste has gained two key changes, firstly the number of wastes generated by households and secondly, the composition of waste generated has changed from organic waste to mix of synthetic and organic matter (Faris & Scott, 2007).

However, there are variables affect the amount of solid waste generation. However, age play a serious role as maturity could influence the quantity of awareness on the environment and health sanitation (Longe E, 2015). Education of households on solid waste management is extremely important to alleviate the extent of households' decision into collecting wastes except open dumping or burning (Adzawla et al., 2019). Thus, the tutorial attainment could be a vital factor that may influence people's perception on solid waste management. Sujauddin (2008) stated the socio-economic variables affect, the quantity of Solid waste management generated daily which are religion, family size, family employment, age, education, land status and duration of stay. According to (Taylor and Koushki, 2011) the household daily solid waste is positively related with the age of family head, income of the family, and family car ownership. This suggests that, families with older heads, higher earnings with higher car ownership generate larger quantities of solid waste day after day.

According to Sankoh .and Yan (2014) shows that there is positive relationship between socioeconomic and waste generation such as, average family size, income and marital status as well as educational level. However, there is negative relationship between age and occupation (Sankoh and Yan, 2014). Mukama *et al* (2016) concludes that the categories of major waste generation in households were food (38%) and plastics (37%) and most household store their waste in polythene bags (59.1%) and sacks (20.2%) and (10.3%) of the households do not have waste

storage containers and most of them keep their wastes outside the house in the open atmosphere (Mukama *et al*., 2016).

Chapter Three: Objectives of the study

3.1 General objective

The general objective of this study was to determine challenges of the current solid waste management practice and identify the potential factors influencing its effectiveness in Jimma city municipality.

3.2 Specific Objectives

The specific objectives of this study were:

- To identify factors that influence effective solid waste management practice in Jimma city municipality.
- To assess the association between influencing factors and the effectiveness of solid waste management.
- To assess challenges of the current solid waste management practice in Jimma city municipality.

Chapter Four: Methods and Material

4.1 Back ground of the study area

Jimma city is found in Oromia regional state which geographically lies at south-western part of Ethiopia.Geographical coordinates are between 7° 13'- 8° 56N latitude and 35°49'-38°38'E longitude with an estimated area of 19,506.24 km^2. Jimma town is found in an area of average altitude of about 5400 ft (1780 m) above sea level and it occupied by a total population of 229,151 and it is cash crop area.
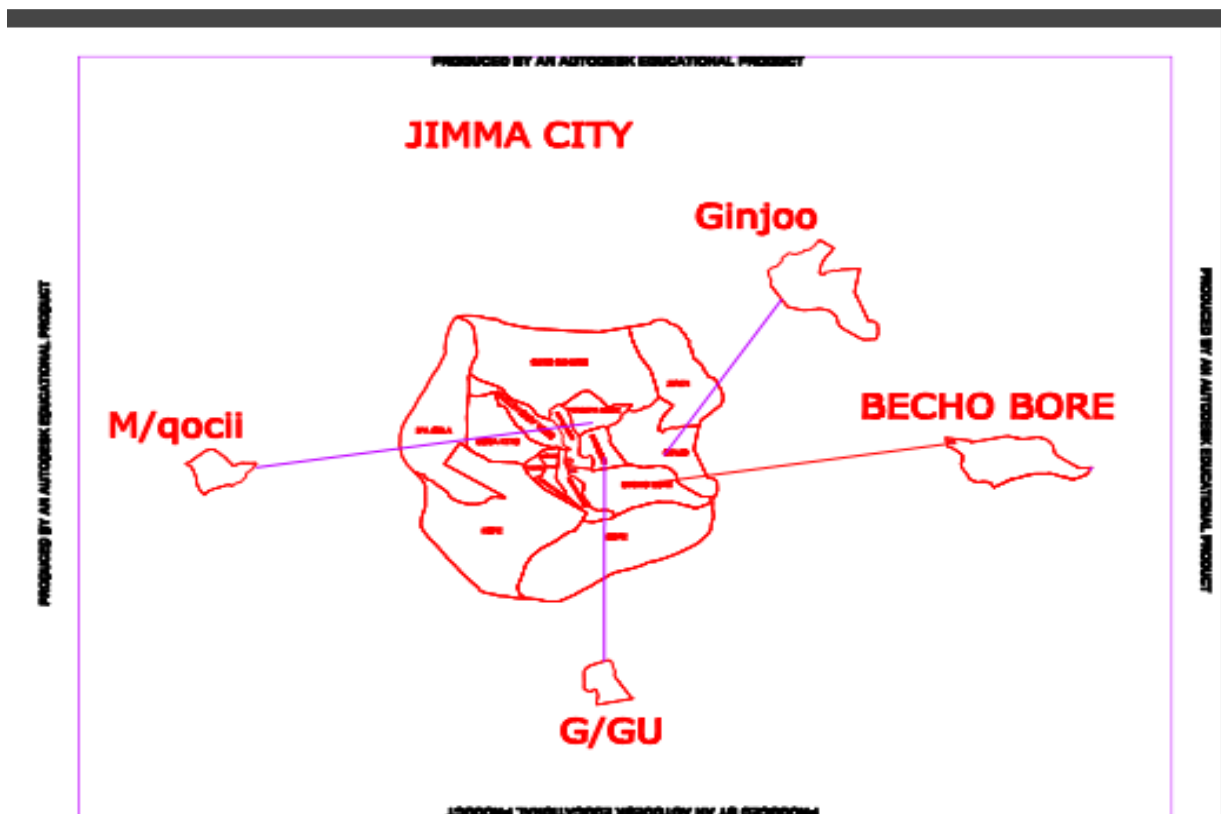

Figure 2 Figure Map of Study Area

4.2 Study period

The study was conducted starting from June 15- July 25, 2021.

4.3 Research Approach

This study, for the purpose of achieving the stated research objectives, used both qualitative and quantitative research approaches.

4.4 Study design

A cross-sectional descriptive design was employed to gather information about the current practice of solid waste management system in Jimma city.

4.5 Sources of data

The data for this research was obtained from both primary and secondary sources of Jimma city municipality. The primary source of data was collected through questionnaire, interview and actual observation. Questionnaires was open and close ended held mainly for SMEs and sanitation dept to assess waste collection system, transportation, disposal system. The secondary data for this research was gathered from related published and unpublished materials, books, journals, manuals, various research papers and government publications which were found in the library, department of sanitary and beautification documented report, website and report from the environmental protection agency.

4.6 Method of data collection

4.6.1 Quantitative data collection

Data was collected based on the following collection procedure: steps to be followed in collecting data on the existing solid waste management practice and its influencing factors.

1st -scheduled preliminary interview was conducted with key informants from the four selected kebeles SMEs municipality solid waste management workers. At this stage the researcher was informed about the existing waste management structure and main involvers. The list SME waste collectors, their service year, coverage and address were known.

2nd-preparation of schedule for preliminary interview: After selecting SME with limited number of members based on the given selection criteria:

The criteria used here was service year and size or coverage, the longest the service year and the largest the coverage were assumed the highest exposure for many challenges or influencing

factors. Reliability of data to be collected was checked while conducting interview by distributing 5-10 questioner.

NB-Questioner should first be changed to an appropriate media (oromifa) to collect reliable data!

3rd-Questioner was given to field assistants to be filled and collected.

Questionnaires, interviews, and observation methods was employed to collect primary (original) and secondary data from municipality and the four selected kebeles SME's solid waste workers in Jimma city.

4.6.2 Qualitative data collection

Among the number of qualitative instruments key-informant in-depth-interview, focus group discussion and observation were employed for collecting data of this study.

4.6.3 Key informant

Key informant in-depth-interview was conducted with waste collecting workers (SME's) in the area and key administrative staffs in the city administration/municipality that were selected purposively through purposive sampling. An interview guide (see Annex: 2) was used as a check list of the issues to be covered.

4.6.4 Observation

The observation method is the most commonly used technique in collecting primary data. The main advantage of this method is that subjective bias is eliminated and the information obtained under this method relates to what is currently happening; it is not complicated by either the past behavior or future intentions (Kothari, 2004). Thus, it was employed to observe solid waste management practices at the municipality and SME's in Jimma town. This technique was carried out personally through transect walk in the field area. The observation is intended to see the practice of waste management process.

4.6.5 Focus group discussion (FGD)

The focus group discussion was conducted for gathering information from the waste collection workers in the study area. Two focus group discussions with SME's workers, each containing 6 and 8, were conducted with purposively selected respondents.

4.7 Study variables

4.7.1 Dependent variable

- Solid waste management

4.7.2 Independent variable

- Financial factor

- Technical factor

- Social factor

- Institutional factor

- Political factor

4.8 Operational definition

- Industrial solid waste generation: Industrial solid waste is defined as waste that is generated by businesses from an industrial or manufacturing process or waste generated from non-manufacturing activities that are managed as a separate waste stream. Businesses that utilize manufacturing or industrial processes, or that are service or commercial establishments, are likely producing industrial solid waste. This is a special classification of non-hazardous, non-household waste that requires, by state law, special evaluation to determine the proper disposal method.

- Residential solid waste generation: Residential waste means any refuse generated on the premises as a result of residential activities. The term includes landscape waste grown on the premises or deposited thereon by the elements, but excludes garbage, tires, trade wastes and any locally recyclable goods or plastics.

- Commercial solid waste generation: commercial wastes are those produced from businesses such as food and drink establishments, shops, banks and by public administration offices. These wastes contain similar materials to residential waste, although the proportions may vary. For example, a restaurant will produce more food waste than a normal household and an insurance office will produce more paper and less food waste.

4.9 Data analysis

In this study, SPSS (version 26.00) software was used in order to get descriptive information of each variable considered in the study by applying descriptive statistics (mean, standard deviations, frequency and percentage) and inferential statistics (correlation and regression analysis). We also tested whether the data was from normal population (normality test) or through recommended techniques such Histogram, Skewness, Kurtosis and standard error. In this study, the correlation coefficient was used to determine whether the dependent variable and independent variables have positive or negative relationship. Multiple linear regression was also used to identify the potential factors influencing solid waste management effectiveness in Jimma city municipality.

4.10 Data quality assurance
- Double data entry
- Completeness and consistency of each question is checked
- Training is given for the data collectors

4.11 Ethical consideration
- Formal letter of permission was obtained from Jimma University to communicate with local administrative bodies in the study site.
- Letter of cooperation from Jimma city municipality and kebele administrators was also be obtained.
- The community, institutions and individual's consent looked for and confidentiality would be secured.

4.12 Dissemination plan

The final study which is being done right away for holding the master of degree in Environmental Science and Technology from Jimma University will be presented to Jimma University Institute of Public Health. Next, since the main goal of studying on Challenges of Solid Waste Management and Factors Influencing Its Effectiveness: A Case Study in Jimma Municipality is to tackle every potential damage to our environment, aesthetic value and above all maintaining the ecological stability of the ecosystem is among the crucial and fundamental thing, the paper will also be submitted for responsible organizations, institutions, or individuals. Presenting the study at different seminars, research conferences or workshops will be considered. Publishing on local and international journals so as to reach the end-users will be considered too.

4.13 Reliability test

One of the methods to estimate the reliability of the scores on a test or measurements is Cronbach's coefficients alpha method. Hence, Cronbach's coefficients alpha refers to the extent to which there is interrelatedness among the responses to the multiple items comprising in the Likert scale. Hence, as explored by Field (2009), if Alpha Coefficients were above 0.70, consistency and suitability were considered high. Accordingly, the reliability measures of each of the major variables are presented in the following table to ease the process of the data analysis.

Thus, as shown in table 1 the reliability of the scores was evident by strong Cronbach's alpha coefficients for all variables, which used as independent and dependent variables of the study. The Cronbach's alpha ranged from 0.703 to 0.791, indicating that items are highly reliable to measure the variables they are expected to measure after removing some of the items under each of the variables

Table 1 Reliability statistics

	Cronbach's Alpha	Number of items Included	Number of items deleted
Financial constraint indicators	.703	3	0
Technical condition indicators	.710	4	0
Social condition indicators	.730	5	0
Institutional condition indicators	.708	4	0
Political condition indicators	.754	3	0
Solid waste management	.791	14	0

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Chapter Five: Results

This chapter focuses on the analysis of the data collected from the field as well as the discussions of the findings. The results of the study are based on the general objective of the study which was to determine the challenges of the current solid waste management practice and identify the potential factors influencing its effectiveness in Jimma city municipality and SME'S in branches municipality in the kebeles of city administration. The results of the study are presented in both tabular and graphical formats. Once the primary data was collected, prior to the analysis, the questionnaire was reviewed for certification of its proper filling. Any incomplete or missing responses were rejected from the subsequent analysis.

The survey questionnaires were distributed to the selected 150 solid waste workers in Jimma city Municipality and SEM's in the branches of municipality in the selected kebeles. Two of them could not be returned and out of the returned total, one response was excluded from analysis due to irrelevant information and in appropriate filling of the questionnaires. Thus, the analysis was conducted on only 147 responses of solid waste workers, which resulted in a sufficient percentage (98%) of response. Beside the questionnaire, four respondents (two from Municipality and two from the selected kebele's SEM's) were interviewed. Two focus group discussions are conducted with purposively selected respondents from SEM's each containing 6 and 8 members. Hence, the data gathered were organized and analysed in a way that enables to answer the basic research questions raised at the beginning of the study by using SPSS version 23.

5.1 Demographic characteristics of sample respondents

In order to have clear understanding about the result of the study, it is important to be familiar with demographic characteristics of the respondents in Jimma city Municipality and SEM's in the selected kebeles. The demographic characteristic consists of sex, age, and educational background of the respondents. This aspect of the analysis deals with the personal data which was briefly described through tables and charts found below.

Table 2 the composition of the respondents in terms of sex

Statistics

N		Gender	Age	Education
	Valid	147	147	147
	Missing	0	0	0
	Mean	1.5034	1.8776	2.3605
	Std. Error of Mean	.04138	.04413	.07474
	Std. Deviation	.50170	.53505	.90619
	Variance	.252	.286	.821

The above (table 2) gives information on the composition of the respondents in terms of sex. The reason that the researcher included this part is for example, to make sure that respondents are in appropriate mix in terms of gender. As a result, the responses to the items in the instrument are also expected to be balanced. The survey showed that there were slightly more females as compared to males. Female respondents represented 50.34%; on the other hand, 49.66% were males.

Table 3 Gender of respondents

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	73	49.7	49.7	49.7
Female	74	50.3	50.3	100.0
Total	147	100.0	100.0	

According to (table 3) majority of the respondents, about 51.5%, were within the age range of 26-35 years having the primary level of education, 25.2% of them secondary level of education, 13.6% of them were at university level and the rest, which is about 9.7%, of them were uneducated. Similarly, for those respondents whose age ranging from 16- 25 years, 45.2% were at secondary level of education, 38.7% of them were at university level of education, 16 % were at primary level and the others were illiterate. For respondents whose age ranging between 36 and 45 years, 46.2% of them were at university level of education, 7.7% of them were at secondary level, 38.5% were at primary level and 7.7% of them were uneducated.

The result indicated that most of the respondents were young, with in the age range of 26 and 35 years, which implies that they are active work force that can act readily when ever need arises. In addition, they are in the age group capable of acting accordingly under any circumstance and make a difference. This implies that majority of the solid waste workers have the capacity of keeping sanitation of the city and create a safe environment for the residents provide that they were properly motivated properly.

Table 4 Age of respondents

Age	Frequency	Percent	Valid Percent	Cumulative Percent
16-25 years	31	21.1	21.1	21.1
26-35 years	103	70.1	70.1	91.2
36-45 years	13	8.8	8.8	100.0
Total	147	100.0	100.0	

Table 5 Rank of the organization versus sex of the respondent's cross tabulation

Rank of the organization		Gender		
		Male	**Female**	**Total**
Collectors	Count	33	54	87
	% of Total	22.5%	36.7%	59.2%
Drivers	Count	24	------	24
	% of Total	16.3%	------	16.3%
Administrators	Count	7	2	9
	% of Total	4.8%	1.36%	6.1%
Others	Count	14	13	27
	% of Total	9.5%	8.84%	18.34%
Total	Count	78	69	147
	% of Total	53.1%	46.94%	100.0%

Table 5 shows the distribution of respondents based on their position and sex. It shows that majority 87 (out of 59.2%; 22.5%were Male and 36.7% were female) of the respondents were collectors; 24 (out of 16.3%; 16.3% were male) were drivers, 9(6.1%; 4.8% male and 1.36% female) were administrators and the remaining 27(18.3%) were assigned in other auxiliary works.

The above tabulated data clearly shows numbers of employees need to engage in the duty of garbage collection by far greater than that of all of the employees of the sector.

5.3 Respondents opinion on factors that influence effective solid waste management practice

In order to see the general perception of the respondents regarding factors that influence effective solid waste management practice in Jimma city municipality, the researcher has included the measures stated in the following tables and followed by analysis & interpretation.

5.3.1: Financial constraint indicators

This section investigates some of the financial constraint on effective solid waste management practice. The research sought to establish the extent to which respondents agreed with the following statements relating to the financial constraint indicators. Results are shown in table 5.3

The survey result indicated in Table 3 shows that, majority of the respondents (38.1%) were responded disagree on the existing of adequate revenue generation in their respective institution for effective solid waste management with the mean of 3.22, 21.8 percent of the respondents also strongly disagreed, and as opposed to only (25.2%) of respondents agreed on the existing of adequate revenue generation (disagreed and strongly disagreed in total). This has an indication that there is no adequate revenue generation so that solid waste disposal service is not provided effectively.

Secondly, the indicator ('vehicle have fuel always and ready for use), was scored as agree with mean value 2.11. This was also confirmed in percentiles that 57.1% were agreed that their vehicles always have fuel and ready for use all the time. On the other hand, (7.5%) of the respondents are not sure whether their vehicles always have fuel or not. Moreover, only (11.6%) of the respondents disagree with the statement and believe that their vehicles always have fuel and ready for use all the time. Regarding attractive business, 47.6% of the respondents disagreed that working on the solid waste collection and transportation business service is attractive business. The remaining 25.6% of the respondents were agreed on this statement.

In addition, the statistical response on the indicator (sufficient money for the promotion of waste reduction, recycling and recovery programs), respondents rated 53.7% as strongly disagreed agree

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with a mean of 4.14. People who strongly agreed constitute about 2.7% and those who agreed to constitute 10.2% as well, while 11.6% choose neutral and do not know whether there is sufficient money for the promotion of waste reduction, recycling and recovery programs. On the other hand, people who disagreed constitute about 21.8% of the total. This indicates that there is no sufficient money for the promotion of waste reduction, recycling and recovery programs. Therefore, it can be concluded, from the above indicators, that solid waste management practice is highly influenced by financial conditions.

In a summary, the overall analysis result of the financial constraint indicator variables turned out to be disagreeing with a grand mean of 3.25 and a standard deviation of 0.085.

An interview was conducted with purposively selected three sme's working on solid waste, in four different kebeles municipality branch mse's and municipality solid waste workers, related to the indicators of financial constraint as well indicate poor condition. Particularly interviewees claimed; the existing payment as unfair. They furthermore added their complaint on the waste management of the city and concerned SME's. According to the interviewees', the city municipality promised to improve the existing worst condition based on economic development of the country but in the case of SME's improvement of the current situation depends on willingness of the community to pay for the service rendered. As a result, every solid waste worker is seeking for another job for better livelihood which clearly shows the dependence of effective solid waste management on financial condition.

Table 6 Financial conditions of solid waste management practice.

No.	Item	SA	A	N	D	SD	Mean	Std.
1	There is adequate revenue generation, for provision of effective SWM in the institution	16(10.9)	21(14.3)	22(15.0)	56(38.1)	32(21.8)	3.22	1.24
2	Our vehicles always have fuel and ready for use all the time.	35(23.8)	84(57.1)	11(7.5)	10(6.8)	7(4.8)	2.11	1.03
3	Working on the solid waste collection and transportation business service is attractive business	10(6.8)	28(19.0)	21(14.3)	70(47.6)	18(12.2)	3.39	1.13
4	There is sufficient money for the promotion of waste reduction, recycling and recovery programs	4(2.7)	15(10.2)	17(11.6)	32(21.8)	79(53.7)	4.14	1.14
Grand Mean							**3.25**	**0.085**

Where SA is strongly agreed, A is agreed, N is neutral, DA is disagreed and SD is strongly disagreed. N=147

5.3.2: Technical conditions of solid waste management practice

This section investigates some of the technical conditions on effective solid waste management practice. The research sought to establish the extent to which respondents agreed with the following statements relating to the technical condition's indicators. Results are shown in table 4

As presented in table 7, all in five indicators were scored as disagree with the average mean of above 3. In the first question people strongly dis agreed 52.4% and dis agreed 27.2% that their institution has no adequate and modern waste management equipment but 1.4% of the respondents strongly agreed and 13.6% agreed on the statement and the remaining 5.4% answered neutrally.

This indicates that the institution has no adequate and modern waste management equipment according to the respondents.

The second indicator which is "the institution usually uses environmentally adaptable and maintainable equipment's" majority of the respondents 38.1% expressed their view point as strongly disagree and 29.9% disagree whereas 10.2% agree including 12.2% strong agreement while only 9.5% have the view point of neutral. This shows that the institution has no environmentally adaptable and maintainable equipment's to maintain modern waste management practice.

The third indicator which is "Jimma town is well planned with appropriate infrastructure to collect and transport waste.'' Most of the respondents (46.3%) strongly disagreed the indicator which is Jimma town is well planned with appropriate infrastructure to collect and transport waste. On the other hand, 13.6% of the respondents agreed and 6.1% of the respondents strongly agreed with the statement that Jimma town is well planned with appropriate infrastructure. However, only (6.1%) remained silent and responded neutral.

The fourth indicator shows, waste personnel in our company are regularly getting training, 47.6% respondents disagreed and 13.6% of the respondents strongly disagreed while 25.2% of the respondents are strongly agreed. Whereas, 8.2% of the respondents said they strongly agreed with the statement. Finally, this means that employees who are involved in the solid waste management were not regularly getting training.

Lastly, majority of the respondents 54.4% disagreed and 8.8% strongly dis agreed with the statement "there are accessible spare parts when vehicles and equipment are a breakdown". While the rest constitute 16.3% and 13.3% of the respondents agreed and strongly agreed respectively. This indicates that there were no accessible spare parts when vehicles and equipment's are breakdown.

In summary, the respondents mark all the indicators of technical aspect as disagreed and the average mean of these indicators turned to be 3.68. It is evident that there was no adequate modern waste management and the city itself is not being well planned with appropriate infrastructure.

Table 7 technical conditions of solid waste management practice

No.	Item	SA (%)	A (%)	N (%)	D (%)	SD (%)	Mean	Std.
1	Our institution has adequate and modern waste management equipment.	2(1.4)	20(13.6)	8(5.4)	40(27.2)	77(52.4)	4.15	1.12
2	Our institution usually uses environmentally adaptable and maintainable equipment's.	15(10.2)	18(12.2)	14(9.5)	44(29.9)	56(38.1)	3.73	1.35
3	Jimma town is well planned with appropriate infrastructure to collect and transport waste.	9(6.1)	20(13.6)	9(6.1)	41(27.9)	68(46.3)	3.94	1.27
4	Waste personnel in our institution are regularly getting training.	12(8.2)	37(25.2)	8(5.4)	70(47.6)	20(13.6)	3.33	1.22
5	There are accessible spare parts when vehicles and equipment s are breakdown.	20(13.6)	24(16.3)	10(6.8)	80(54.4)	13(8.8)	3.28	1.23
Overall Mean							**3.68**	**0.083**

Where SA is strongly agreeing, A is agreeing, N is neutral, DA is dis agree and SD is strongly dis agree. N=147

5.3.2: Social condition of solid waste management practice

This section investigates some of the social conditions on effective solid waste management practice. The research sought to establish the extent to which respondents agreed with the following statements relating to the social condition's indicators. Results are shown in table 5.

According to table 6 of social conditions, the first indicator related to paying an adequate salary and sufficient additional benefits for work in the institution, majority of the respondents (51.7%) were disagreed and 18.4% strongly disagreed with the mean of 3.58. While, (10.2%) remained

silent and do not want to tell whether their salary is adequate and sufficient, whereas, only 10.2% of the respondents were strongly agreed and the remaining 9.5% of the respondents were agreed. Therefore, based on the result majority of the respondents believed that their salary is not adequate and sufficient and do not get any additional benefits.

The second indicator related to waste workers always wear safe and protective gloves and clothing during their work in the institution, majority of the respondents were disagreed 55.8%) with mean value of 3.31, whereas 21.1% of the respondents were agreed with only (8.2%) remained neutral. This indicates that majority of waste workers wear not safe and protective gloves and clothes during their work in the institution protective gloves during their working time.

The third indicator related to good attitude for waste workers, majority of the respondents (49%) were strongly disagreed and 19.7% disagree with the mean of 3.84. While, 8.8% remained silent and do not want to tell whether beneficiaries have good attitude for waste workers, whereas, only 10.9% of the respondents were strongly agreed and the remaining 11.6% of the respondents were agreed. Therefore, based on the result majority of the respondents believed that beneficiaries have no good attitude for waste workers.

On the indicator of (Municipality carries out awareness-raising programs on general public health and management of waste) was scored with mean value of 3.10. The respondent who has answered neutral view point on the statement was (8.8%) of the total, followed by those who answered agree (12.2%) and strongly agree (28.6%). More precisely, people who responded disagree (37.4%) and strongly disagree constitute (12.9%) of the total. Therefore, based on the result, majority of the respondents believed that there is no awareness raising programs on general public health and management of waste.

Regarding to household collects, transfers, and disposes of its solid wastes at common points, majority of the respondents were disagreed on this statement with mean of 3.27. Only 13.6 percent of the total remained silent while 22.4 percent of the respondents agreed and 9.5 strongly agreed with the statement. This indicates that majority of the households didn't collect, transfer and dispose of their solid wastes. Generally, concerning the social condition indicators of solid waste management of jimma city, the respondents have shown the absence good social condition with the overall mean response of 3.14

Table 8 Social conditions of solid waste management practice

No.	Item	SA(%)	A(%)	N(%)	D(%)	SD(%)	Mean	Std.
1	I am paid adequate salary and sufficient additional benefits for my work at our institution.	15(10.2)	14(9.5)	15(10.2)	76(51.7)	27(18.4)	3.58	1.19
2	Waste workers always wear safe and protective gloves and clothes during their work at our institution	12(8.2)	31(21.1)	12(8.2)	82(55.8)	10(6.8)	3.31	1.12
3	Beneficiaries have good attitude for waste workers.	16(10.9)	17(11.6)	13(8.8)	29(19.7)	72(49.0)	3.84	1.41
4	Municipality carries out awareness raising programs on general public health and management of waste.	18(12.2)	42(28.6)	13(8.8)	55(37.4)	19(12.9)	3.10	1.29
5	Each household collects, transfers, and disposes of its solid wastes at common points	14(9.5)	33(22.4)	20(13.6)	58(39.5)	22(15.0)	3.27	1.23
Overall Mean							**3.42**	**0.109**

Where SA is strongly agreeing, A is agree, N is neutral, DA is dis agree and SD is strongly dis agree. N=147

5.3.3: Institutional conditions of solid waste management practice

This section investigates some of the institutional conditions on effective solid waste management practice. The research sought to establish the extent to which respondents agreed with the following statements relating to the institutional condition's indicators.

As shown in table 7, the fourth independent variable was institutional condition indicators which consisted of four questions. In the first Question, majority of the respondents (62.6%) were agreed including strongly agree that there is no proper institutional set-up for solid waste management service with a mean of 2.45 and standard deviation of 1.36, and followed by 7.5% of neutral. On the other hand, 20.4% of the respondents agreed and 9.5% of the respondents were strongly disagreed by believing that there was no proper institutional set up for solid waste management service.

Question two asked the respondents if the company has carried out safe and reliable SWM in Jimma with a mean of 3.79 and standard deviation of 1.50. Majority of the respondents were strongly disagreed (45.6%) and disagree (28.6%). Meanwhile, 4.8% remained silent and only 2.0% of the people agree and 19.0% strongly agree the statement.

In the third question, respondents choose 45.6% disagree and 10.9% strongly disagree that the municipality does not provide clear authority and sanitation rules with a mean of 3.14 and a standard deviation of 1.32. Meanwhile, 7.5% remained silent and only 19% of the people agree and 17.0% strongly agree the statement. This indicates that, majority of the people believe that municipality have clear authority and concrete sanitation rules.

In the fourth question majority of the respondents disagree 34% that their institution has faced frequent customer complaint about solid waste management on its assigned jurisdictions with a mean of 2.67 and standard deviation of 1.30, respectively. Only 34.0% of the respondents were disagreed and 4.7% strongly disagreed on the statement, 10.9% remained silent and choose neutral. While 24.5% agreed and 25.9% strongly agreed. In summary, the overall mean and standard deviation of the institutional condition indicators of the variable turned out to be somewhat neutral with a mean of 3.01 and a standard deviation of 0.09

Table 9 Institutional conditions of solid waste management practice

No	Item	SA (%)	A (%)	N (%)	D (%)	SD (%)	Mean	Std.
1	No proper institutional set-up for solid waste management service.	46(31.3)	46(31.3)	11(7.5)	30(20.4)	14(9.5)	2.45	1.36
2	The municipality has carried out safe and reliable SWM in jimma town to the full satisfaction of residents.	28(19.0)	3(2.0)	7(4.8)	42(28.6)	67(45.6)	3.79	1.50
3	Municipality does not provide clear authority and sanitation Rules.	25(17.0)	28(19.0)	11(7.5)	67(45.6)	16(10.9)	3.14	1.32
4	Municipality has faced frequent customer complaint about solid waste management on its assigned jurisdictions.	38(25.9)	36(24.5)	16(10.9)	50(34.0)	7(4.8)	2.67	1.30
Overall Mean							**3.01**	**0.09**

Where SA is strongly agreeing, A is agreeing, N is neutral, DA is dis agree and SD is strongly dis agree, N=147.

5.3.4: Political conditions of solid waste management practice

This section investigates some of the political conditions on effective solid waste management practice. The research sought to establish the extent to which respondents agreed with the following statements relating to the political condition's indicators. Results are shown in table 7.

As shown in table 10, political condition indicators were asked for respondents which consisted of three questions. In the first question, 35.4% respondents disagreed and 5.4% of the respondents strongly disagreed with the statement that there is adequate policies, laws that promote effective SWM with a mean of 2.94 and a standard deviation of 1.18 followed by 18.4% of the people who responded neutral and are not sure whether there is adequate policies, laws that promote effective

Solid waste management. Therefore, only 25.9% of the respondents agreed and 13.6% strongly agreed with the statement.

Question two was asked if the assembly enforces to implement the existing SWM law and the answer turns to be neutral 8.2% with a mean of 3.97 and standard deviation of 1.30, followed by 49% of the people who responded strongly disagree and 25.2% of the respondents dis agreed. On the other hand, 9.5% agree including 8.2% strongly agree with the statement.

In question three, respondents agree 53.1% and strongly agree 16.3% that the government gives high priority to SWM with a mean of 2.52 and standard deviation of 1.24 respectively. Only 2.7% of the respondents remained neutral about the statement. While 17.7% of the people disagreed and 10.2% strongly disagreed.   Therefore, the overall mean and standard deviation of the political condition indicators variable turns to be dis agreed with mean of 3.14 and standard deviation of 0.06.

Table 10 Political conditions of solid waste management practice

No	Item	SA (%)	A (%)	N (%)	D (%)	SD (%)	Mean	Std.
1	There are adequate policies, laws that promote for effective SWM	20(13.6)	38(25.9)	27(18.4)	52(35.4)	8(5.4)	2.94	1.18
2	The assembly enforces to implement the existing SWM law.	12(8.2)	14(9.5)	12(8.2)	37(25.2)	72(49.0)	3.97	1.30
3	The government gives high priority to SWM	24(16.3)	78(53.1)	4(2.7)	26(17.7)	15(10.2)	2.52	1.24
Overall Mean							**3.14**	**0.06**

Where SA is strongly agree, A is agree, N is neutral, DA is dis agree and SD is strongly dis agree.

N=147

5.4 Solid waste management practice

This section investigates solid waste management practice**.** The research sought to establish the extent to which respondents agreed with the following statements relating to solid waste management practice.

Effective solid waste collection indicator:

As shown in table 10, the first dependent variable was effective Solid waste collection indicators which consisted of four questions. In the first question, majority of the respondents were strongly agreed 34.7% and 30.6% agreed with the frequencies of waste pick-up are strictly followed by their institution with a mean of 2.27 and standard deviation of 1.25, respectively. The number of respondents that answers disagree 25.9% and strongly disagree constitutes 2%t and only 5.4 per cent responded neutral.

The researcher asked, respondents, the presence of continuous training on solid waste collection in their institution. Therefore, majority of the respondents were disagreed 59.9% and 11.6% strongly disagreed with mean of 3.57 and standard deviation of 1.01. On the other hand, 6.1% responded neutral while 19.7% of the respondents recorded agree and 2.7% strongly agree. This indicates that majority of the people believe that there is no full and continuous training on solid waste collection.

Question three was asked to know whether the company has facilitated enough number of collection points near to all beneficiaries. Majority of the respondents 44.9%were strongly disagreed and 23.8% disagreed on the number of collection points near to all beneficiaries with mean of 3.79. And 6.1% responded neutral. While the remaining 8.8% of the respondents were strongly agree and 16.3% agree with the statement.

In the question four, respondents agree 55.8% and 10.9% that their institution maintains waste spillover cleaned with the mean of 2.57 and standard deviation of 1.16,5 respectively. However, only 19% of the people disagrees and 8.2% strongly disagreed with the statement. The overall mean and standard deviation of the effective solid waste collection indicators turns out to be somewhat disagreed with a mean of 3.05 and standard deviation of 0.155, respectively.

Table 11 Effective Solid waste collection indicators

No.	Item	SA (%)	A (%)	N (%)	D (%)	SD (%)	Mean	Std.
1	Frequency of waste pick-up are strictly followed by our institution	51(34.7)	45(30.6)	8(5.4)	38(25.9)	3(2.0)	2.27	1.25
2	There is full and continuous training on solid waste collection in our institution	4(2.7)	29(19.7)	9(6.1)	88(59.9)	17(11.6)	3.57	1.01
3	Municipality has facilitated enough number of collection points near to all beneficiaries	13(8.8)	24(16.3)	9(6.1)	35(23.8)	66(44.9)	3.79	1.38
4	Municipality maintains waste spillover to the ground at collection is cleaned	16(10.9)	82(55.8)	9(6.1)	28(19.0)	12(8.2)	2.57	1.16
Overall Mean							**3.05**	**0.155**

Where SA is strongly agreeing, A is agreeing, N is neutral, DA is dis agree and SD is strongly dis agree. N=147

5.5 Effective solid waste transportation

Table 10 shows the effective solid waste transportation, which consist of five questions. The first question was to know whether the institution has sufficient manpower and vehicle to transport solid waste, majority of the respondents were disagreed 66.7% and strongly disagreed 4.8% with mean of 3.48 and standard deviation of .981, while 20.4% of the respondents agree and 3.4% of the respondents were strongly agree.

In the second question, 44.2% of the respondents agree and 11.6% of the respondents strongly agree that the nature of traffic condition along the collection route has a jam with a mean of 2.71 and standard deviation of 1.14, respectively. Only 4.8% of the respondents strongly disagree and 29.3% of the respondents were disagreed with the statement while 10.2% remained silent.

Question three seeks to know whether the supervisor records the daily number of trips, the tonnage of waste and route plan to drivers. However, majority of the respondents 50.3% strongly disagreed and 22.4% disagreed on the statement with a mean of 3.53 and standard deviation of 1.13, while 7.3% of the respondents strongly agree and 9% of the respondents were agreed on the statement.

Question four asked respondents if the institution uses covered vehicles and there is no spillover of solid waste upon transport. Majority of the respondents 46.9% of the respondents disagree and 8.2% of the respondents were strongly disagree on the statement with mean of 3.23 and standard deviation 1.09, while 34% of the respondents agreed and 2.7% of the respondents were strongly agreed that there is no spillover of solid waste upon transport. Only 8.2 per cent of the total remained undecided and chose neutral.

Question five was to know whether there are no adequate internal roads and traffic condition along the collection route has overcrowding, therefore, the answer became 38.8% of the respondents disagree and 27.2% of the respondents were strongly disagree with the statement with a mean of 3.62 and standard deviation of 1.23, respectively. Meanwhile, 5.4% strongly agree and 19.7% agree with the statement. This indicates that majority of the responds confirmed the absence of adequate internal roads which resulted in traffic overcrowding and accident. In addition, the overall mean and standard deviation of the effective solid waste transportation indicators turns out to dis agreed with mean of 3.314 and standard deviation 0.09.

Table 2 Effective Solid waste transportation indicators

No.	Item	SA (%)	A (%)	N (%)	DA (%)	SD (%)	Mean	Std.
1	Municipality has sufficient manpower and vehicle to transport solid waste	5(3.4)	30(20.4)	7(4.8)	98(66.7)	7(4.8)	3.48	.981
2	Nature of traffic condition along collection route has jam.	17(11.6)	65(44.2)	15(10.2)	43(29.3)	7(4.8)	2.71	1.14
3	Supervisor records the daily number of trips,	10(7.3)	14(9.0)	16(10.9)	33(22.4)	74(50.3)	3.53	1.13

	tonnage of waste and route plan to drivers						
4	Municipality use covered vehicles and there is no spillover of solid waste up on transport	4(2.7)	50(34.0)	12(8.2)	69(46.9)	12(8.2)	3.23	1.09
5	There are no adequate internal roads (alternative roads) and traffic condition along collection route has overcrowding.	8(5.4)	29(19.7)	13(8.8)	57(38.8)	40(27.2)	3.62	1.23
Overall Mean							**3.314**	**0.090**

Where SA is strongly agreeing, A is agreeing, N is neutral, DA is dis agree and SD is strongly dis agree. N=147

5.6 Effective solid waste disposal indicators:

As shown in table 11, the researcher asked about the effective solid waste disposal using five indicators. In the first question 37.4% of the respondents agree and 23.8% strongly agreed that the existing disposal site is far-away from their collection point with a mean of 2.59 and standard deviation of 1.29, respectively, 4.8% of the respondents strongly disagree and 33.3% disagreed with the statement while the remaining 0.7 percent of the respondents was undecided.

The researcher asked for respondents whether the municipality did not provide designated and accessible land fill site or not. 57.1% of the respondents strongly disagree and 17% disagree that the municipality did not provide designated and accessible landfill site with a mean of 3.99 and a standard deviation of 1.14, respectively. However, 12.9% of the employees agreed and 9.5% strongly agreed with the statement, while 3.4% undecided and recorded neutral.

Question three was to know whether the existing disposal site is open and it has a bad smell to the community; majority 46.9% of the total responded strongly disagree and 21.8% disagree with mean of 3.78 and standard deviation 1.44. However, 12.2% of the people strongly agree and 12.2% agree with the statement while 6.8% responded neutral (undecided).

Question four was asked respondents if the institution disposes waste at the designated landfill and it is environmentally safe; majority of the respondents 47.6% responded agree and 27.2% of the respondents strongly agree on the statement with a mean of 2.23 and standard deviation of 1.19. Only 8.2% responded disagree and 8.8% strongly disagree while 8.2% responded undecided.

In the fifth question, (35.4%) of the respondents strongly disagree and (33.3%) of the respondents were disagree that the presence of the animal on the disposal site is common with a mean of 3.68 and standard deviation of 1.36, respectively. However, (10.2%) of the people responded strongly agree and 15.6% of the respondents agree of the statement while 5.4% responded neutral. Moreover, the overall mean and standard deviation of effective solid waste disposal indicators turns out disagree with mean of 3.25 and standard deviation of 0.101.

Table 3 Effective Solid waste disposal indicators

No.	Item	SA (%)	A (%)	N (%)	DA (%)	SD (%)	Mean	Std.
1	The existing disposal site is far-away from our collection point	35(23.8)	55(37.4)	1(.7)	49(33.3)	7(4.8)	2.57	1.29
2	Municipality did not provide designated and accessible land fill site	14(9.5)	19(12.9)	5(3.4)	25(17.0)	84(57.1)	3.99	1.41
3	The existing disposal site is open and it has bad smell to the community	18(12.2)	18(12.2)	10(6.8)	32(21.8)	69(46.9)	3.78	1.44
4	Municipality disposes waste at designated land fill and it is Environmentally safe	40(27.2)	70(47.6)	12(8.2)	12(8.2)	13(8.8)	2.23	1.19
5	Presence of animal on the disposal site is common	15(10.2)	23(15.6)	8(5.4)	49(33.3)	52(35.4)	3.68	1.36
Overall Mean							**3.25**	**0.101**

Where SA is strongly agreeing, A is agreeing, N is neutral, DA is dis agree and SD is strongly dis agree. N=147

5.7 Correlations between Solid waste management and influencing factors

After the descriptive analysis, the study conducted Pearson correlation analysis to indicate a linear association between the predictive and explanatory variables. Thus, it helps in determining the strength of association in the model, which explained the relationship between solid waste management and influencing factors in Jimma city municipality.

According to Wajahat (2010), before the start of regression analysis it is important to check the correlation test between dependent variable and independent variables. The Pearson correlation scale ranges from -1 to 1. Any value greater than zero indicate a positive direct relationship between the two variables, which implies that every increase in the independent variable will lead to an increase in the dependent variable, while any value less than zero indicate a negative indirect relationship between two variables, this means that every increase in the independent variable will lead to the decrease on the dependent variable (Hafiz, 2007). Different authors suggest different interpretations; However, (Saunders *et.al*, 2009) suggests about strength of relationship as: r = 0 to 0.39 or 0 to -0.39 small (weak) relationship, r = 0.4 to 0.69 or -0.40 to -0.69 medium (moderate) relationship and 0.70 to 1 or -0.70 to -1 large (strong) relationship. The following table shows the relationship between each variable.

The table 12 above explains the relationship between the independent variable and solid waste management practice. Based on the output of the correlation matrix; financial constraint (r=0.653, p<0.01), Technical condition (r=0.584, p-value<0.01), and social condition (r=0.611, p-value<0.01), and institutional condition (r=0.447, p-value<0.01) each have a moderate positive relationship with solid waste management, but political condition (r=0.222, p<0.01) has a weak positive relationship with solid waste management. In general, this result show, financial constraint, technical condition, social condition, and institutional condition have a moderate positive effect on solid waste management in Jimma city municipality, but political condition has a weak positive effect on solid waste management in Jimma city municipality.

Table 4 Correlations between solid waste management and influencing factors

		Financial constraint indicators	Technical condition indicators	Social condition indicators	Institutional condition indicators	Political condition indicators
Solid waste management	Pearson Correlation	.653[**]	.584[**]	.611[**]	.447[**]	.222[**]
	Sig. (2-tailed)	.000	.000	.000	.000	.007
**. Correlation is significant at the 0.01 level (2-tailed).						

5.8 Regression analysis

In the previous section of this paper the descriptive and correlation analysis was carried out separately with the existence of association between the dependent and independent variables with the intension of investigating the influencing factors that affect effectiveness of solid waste management in Jimma city. However, identification of these factors is not enough for meaningful conclusion. Therefore, the determinant of each independent variable must be assessed and identified sequentially by using multiple linear regressions. Multiple regression analysis was conducted to find out the influencing factors that affect effectiveness of solid waste management in Jimma city municipality. These analyses assisted the researcher in examining the inter correlations of the five influencing factors for the effectiveness of solid waste management. Multiple regression technique gave a more detailed analysis as it enabled the examination of the influence of each of the five independent variables on the effectiveness of solid waste management controlling all other factors. It also allowed the researcher to determine the combined effect of the variables (Gay, Mills, & Airasian, 2006).

In this section and the subsequent sections on regression results, the coefficient of determination (R square) was used as a measure of the explanatory power to show how the independent variables explain the dependent variable. The F statistics (ANOVA) was used as a measure of the model goodness of fit. Pearson correlation and the regression coefficient summary were used to explain the nature of the relationship between the dependent and independent variables. The significance levels of the regression results were also taken into account for proper interpretations.

5.8.1 Assumption tests

Testing assumption of multiple linear regression analysis models is very important before running regression analysis. So, each assumption results were discussed in the following sub topics. The researcher used multiple linear regression models assumptions as follow.

5.8.1.1 Multi-collinearity test between independent variables

According to Gujrati (2003) Multi collinearity tests helps identify the high correlation between explanatory variables and to avoid double effect of independent variable from the model. When independent variables are multi collinear there is overlap or sharing of predictive power. Predictor variable should be strongly related to dependent variable but not strongly related to each other. This may lead to the paradoxical effect, whereby the regression model fits the data well but, none of the explanatory variables (individually) has a significant impact in predicting the dependent variable. For this purpose, variance inflation factor (VIF) and tolerance test were used to check Multi collinearity for variables if the value of VIF is less than 10 there is no Multi collinearity and on the other hand if VIF greater than or equal to 10 there is a serious Multi collinearity problem.

According to Gujarati, (2003) to avoid serious problem of Multi collinearity omitting the variable with 10 and more from the analysis, in addition tolerance is an indicator how much of the variability of independent variable is not explained by the other independent variable in the model and is calculated using the formula 1- R^2 for each variable. If the value is very small (less 0.1), it shows the multiple correlation with another variable is high.

Table 13 shows the division result that the value of VIF all variables were by far less than 10 and the value of tolerance statistics being above 0.1 they were accepted entered in to regression model for the estimation of variables

Table 5 Multi collinearity test between independent variables

Independent variables	Collinearity Statistics	
	Tolerance	VIF
Financial constraint indicators	.438	2.284
Technical condition indicators	.445	2.245
Social condition indicators	.411	2.435

Institutional condition indicators	.582	1.719
Political condition indicators	.655	1.526

5.9 Result of Multiple Linear regression

After the model assumption was checked presentation and interpretation of the analysis output is mandatory.

Table 13 shows the R^2 of 0.533. This means that 53.3% of the variation in the effectiveness of solid waste management is explained by the regression on the predictors (Financial constraint, technical condition, social condition, Institutional condition, and Political condition indicators). The Multiple R of 0.731 shows that the model has a good strength when all predictor variables are combined appropriately.

 From table 14, it is apparent that the regression model was significant using 'between the independent variable and dependent variable. An F statistic of 32.447 and a probability value of 0.000 clearly indicate that the model was significant and good fit.

Table 6 Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.731[a]	.535	.519	.39485
a. Predictors: (Constant), Political condition indicators, social condition indicators, Institutional condition indicators, technical condition indicators, financial constraint indicators				
b. Dependent Variable: Solid waste management				

Table 7: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	25.293	5	5.059	32.447	.000[b]
	Residual	21.983	141	.156		
	Total	47.276	146			
a. Dependent Variable: Solid waste management						
b. Predictors: (Constant), Political condition indicators, social condition indicators, Institutional condition indicators, technical condition indicators, financial constraint indicators						

Table 8 **Result of Multiple linear regression**

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.268	.172		7.368	.000*	.927	1.608
	Financial constraint indicators	.213	.061	.304	3.499	.001*	.092	.333
	Technical condition indicators	.170	.060	.244	2.836	.005*	.052	.289
	Social condition indicators	.119	.056	.190	2.120	.036*	.008	.231
	Institutional condition indicators	.143	.043	.249	3.313	.001*	.058	.229
	Political condition indicators	.098	.046	.151	2.123	.036*	.007	.190

*Indicates significance at 5% level of significance (sig. < 0.05)

In this study, five explanatory variables were assessed to identify the effectiveness of solid waste management in Jimma city municipality at 5% level of significance.

The fitted multiple regression model was:

Effectiveness of Solid waste management = 1.268 + 0.213 *Financial constraint + 0.17*Technical condition + 0.119* social condition + 0.143 *Institutional condition + 0.098* political condition

Table15 shows all the p-value for independent variables is less than 0.05. All the **β** values are positive that shows financial constraint, technical, social, Institutional, and political conditions have a positive effect on the effectiveness of solid waste management in Jimma city municipality. The largest beta coefficient was 0.213, which was for financial constraint. This means that this variable makes the strongest unique contribution of 21.3% time's increment to explain the effectiveness of solid waste management, when the variance explained by all other variables in the model was controlled. The Beta value for technical, Institutional, social, and political conditions were resulted in beta coefficient of 0.17, 0.143, 0.119, and 0.098 respectively, indicating that independently they made the second, third, fourth, fifth higher contribution to the effectiveness of solid waste management to explain it with 17% times, 14% times, 11.9%times and 9.8% increment, respectively, keeping other variables constant for each. In general, financial, technical, social, institutional and political conditions have a positive influence on effectiveness of solid waste management in Jimma city municipality.

5.10 The challenges of the current solid waste management practice in Jimma city municipality

Based on the field observation by the researcher, the key informants and the FGD, the household solid waste transportation process in Jimma city took place as follow: the solid waste collected from every house would be put on the communal waste collection box placed at a nearby considered to be convenient for temporary waste collection for waste collection workers (SME's) to be picked up by waste collection trucks and transported to dumping site (sanitary landfill) However, the waste is sometimes left on temporary collection site when transportation track(skip loader) is down for at least two or three days to a week depending on the technical ease and availability of spare part . This caused a stink and animals such as dogs, cows, cats, donkeys, children (looking for recyclable waste) and scavengers would spread it around the collection box seeking to feed from it which is both unhealthy and unpleasant to see.

Figure 3 Communal waste collection box

According to the interviews and the FGD data, the waste was not collected on time because of two main reasons. First, the collection workers (SME's) have no engine driven transportation system to arrive on time and also not programmed. Second, skip loaders were not ready or available to pick up the waste on time because they were small in number and out dated (old) that they got broken all the time. This caused a stink and animals such as dogs, cats, donkeys and scavengers would spread it around the collection box seeking to feed from it which is both unhealthy and unpleasant to see.

The FGD participants also mentioned that the main challenge in the current waste management work was that people are not changed and most people are still trapped in the traditional dumping management system. The traditional waste management trend was to mean a trends such as dumping on plain sites and on backyards, on streets, valleys and rivers in Jimma town which was equally crossing the town from its beginning to its end burning of the solid waste when accumulated at their living compound.

The problem of the community members was explained to be lacking a sense of belongingness and a sense of responsibility. The current practice of community members is like "what is not in my backyard is not my problem! The key informant municipality worker in the solid waste section coordinator, a 50-year-old man with a bachelor degree, said that it is impossible to say that the community becomes knowledgeable about waste handling due to lack of awareness and every person wants to get their waste out of their compounded without properly handling it. The sensitization and awareness creation expert in the department confirmed the presence of the gaps in the community members' awareness by clearly showing the current practice of the throwing their mixed waste out of their compound with properly storing it. Many people just want the waste out of their own house but are not yet concerned about the general cleanness of the town or the environment.

According to one of the interviewed key informant respondents, the community waste bins were avoided for the sake of some community members such as street children and mentally-ill people for feeding from it. Therefore, the solid waste generated by the household was stored inside the compound, around the house or dumped on plain sights until the collection service workers from organized SME's came to collect it. The waste is sometimes left in their own compound or simply thrown out of their compound to their surrounding or the nearby ditch or road side. Once picked from all over the places, the waste would be directly driven to the dumping site (sanitary landfill) used by the Jimma city municipality.

Lack of public awareness and attitudes creation was another challenge for the municipal solid waste management in Jimma town. The survey result shows that awareness creation by the municipality of the town on solid waste management is very low. This is agreed with study conducted by (Abi, 2004) who mentioned that the majority of the households about (83.1 %) reported that they did not have any awareness and education concerning solid waste management.

Generally, the data from FGD and interview showed that the most difficult proper waste management challenge was irregular waste collection service. The second problem was said to be just bad habit by community members, lack of public awareness and attitudes creation and unavailability of waste collection service and affordable collection price were also mentioned as a challenge.

Chapter six: Discussion

In this section of discussion, the study findings were discussed in detail in comparison with the other literatures result.

To accomplish the research, several possible indicators related to status of financial resources were included; adequate revenue generation, sufficient money for the promotion of waste reduction, recycling and recovery programs where the respondents asked. The survey result indicated that the status of financial resources of solid waste management in Jimma city municipality is not good as majority of the respondents (59.9%) disagreed on the adequate revenue generation of waste management in Jimma city municipality. In this study financial factor has a significant effect on effective Solid waste management (Collection, transportation and disposal) (B= 0.213, $P = 0.000$). These findings are in line with the study of (Muche, 2016) the status of financial conditions at the SWM in Addis Ababa is poor because of lack of financial resources. This study also found that there is a significant positive correlation between financial condition and solid waste practice.

In this study technical condition was measured with indicators like skilled personnel and adequate infrastructure using environmentally adaptable and maintainable equipment's and accessible spare parts. The survey result indicated that the status of technical condition for SWM in Jimma city municipality is not good. Moreover, this relationship has an indication that the current ineffective solid waste management is associated with low technological conditions in jimma city. This finding is in line with study of (Muche, 2016) as it indicated that lack good technical condition including lack of adequate modern waste disposal equipment, lack of regular training, and inaccessibility of spare parts for damaged and broken vehicles and equipment are also positively influencing factors on the effectiveness of solid waste management.

Regarding the effect of social condition on the effectiveness of solid waste management, the study found that the status of social aspects for SWM in Jimma city is not good and it has been found that it has significant effect on effective solid waste management practice. This result is reliable with those of (Shubeler, 2016; Coffey and Coad, 2012; Fianko, 2014; Edmealem Bewuket, 2013; and Hufane, 2015).

Institutional aspects concern the distribution of functions and responsibilities and correspond to organizational structures, procedures, methods, institutional capacities and private sector

involvement. The survey result indicated that the status of institutional aspects for SWM in Jimma city is low as 31.3% of the respondents strongly agreed and 31.3% agreed on the absence of proper institutional set-up for solid waste management service in the city. It has been found that institutional aspect has positive significant effect on effective solid waste management. This result is in line with those of previous studies that reveals the lack of effective public participation and inadequate governance in the waste management system were institutional aspect weakness (hayal Desta et al., 2014; Shubler, 2016; Coffey and Coad, 2012; Fianko, 2014; Hufane, 2015).

In this study, Political aspect was measured with indicators like formulation of goals and priorities, determination of roles and jurisdiction and the legal and regulatory framework. It has been found that political condition has a positive significant effect on effectiveness of solid waste management practice. This result is consistent with study done by Schübeler, (2016).

According to the FGD held with waste collection workers in the study area, there were   variations in the amount of waste produced by different households. They mentioned that some people did not even produce one sack a month, and others especially those who were rich produced more waste. This result was in line with the nor consult (1996) research finding that showed waste generated at the household level comprised more than half of the total municipal solid waste generated in Jamaica, and the average daily per capita generation rate was approximately 0.39 kilograms.

The finding of this study has agreed with the result obtained in Nigeria where domestic waste is collected weekly from households by the Municipality trucks (Nkwocha & Okeoma, 2009). This finding, however, does not agree with the Modebe *et al* (2009), which showed that the majority of the respondents (75.9%) have a centralized place for dumping solid waste and the commonest means of transports of waste was by wheel barrow (70.2%). The nearby roadside, ditches, streams (local name known as Dololo) and Awetu River had been the main place of dumping wastes produced especially by households since it is near to most households. The result of this study agreed with the findings of other studies (Etengeneng, 2012; Aderemi and Falade, 2012 & Modebe *et al.,* 2009)). This practice raises some public health concern as it encourages proliferation of houseflies, mosquitoes, rats and other vermin and aid in the spread of infectious diseases amongst other hazards that present threats to human health and the environment (Modebe, Onyeonoro , Ezeama, Ogbuagu & Agam,2009). This implies that instead of using ideal sanitary landfill

equipped with features such as leachate collection system and being sited far from human settlements and existing water bodies to help avert public health nuisance, (Puopiel & Owusu-Ansah, 2014), most of the waste generated in the study area is deposited in environmentally unsafe sites.

Chapter seven 7: Conclusions and recommendation

7.1. Conclusions

The purpose of this study was to determine the challenges facing the SWM and factors influencing its effectiveness in Jimma city municipality specifically focusing on financial resources, technical aspects, social aspects, institutional aspects and political aspects. The study found out that the financial aspects, technical aspects, institutional aspect, political aspect and social aspects were all not in a good condition from the survey result.

Solid waste management has a positive and moderate linear relationship between all variables; financial, technical, social and institutional conditions whereas it has small positive correlation with political condition.

From the regression analysis result, it can be concluded that all the considered independent variables; financial, technical, social, political and institutional conditions have a significant effect on the effectiveness of solid waste management practice in Jimma city. Financial condition makes the strongest unique contribution of 21.3 % time's increment to explain the effectiveness of solid waste management, when the variance explained by all other variables in the model was controlled. Technical, social, institutional and political conditions independently made the second, third, fourth and fifth higher positive contribution respectively to the effectiveness of solid waste management. In general, all of the independent variables considered in this study, have a positive influence on effectiveness of solid waste management in Jimma city municipality. This indicates that the current ineffective SWM practice was associated with factors of financial constraint, technical problems, social condition, political condition, and institutional conditions.

The interview result show that bad habit by community members, lack of public awareness and attitudes creation, unavailability of waste collection service, the absence of law enforcement and the absence of clearly stated structure of solid waste management were mentioned as a challenge of the current solid waste management practice in Jimma city municipality. Financial constraints, inadequate service coverage and operational inefficiencies, ineffective technologies and equipment, inadequate landfill disposal and limited utilization of recycling initiatives are all found to be challenges to the infrastructure of waste management systems in jimma city. These gaps in

service relate not merely to availability of infrastructure and investments, but also to inappropriate management of the service. Major interventions need to take into account the circumstances and needs of the communities for which they are implemented. Improvements to infrastructure and technology within the waste management system need to be accompanied with community involvement and participation as well as educational and awareness campaigns in order to be successful in creating sustainable waste management systems.

7.2. Recommendations

Based on the findings of the study, the researcher has presented those financial resources, technical aspects, social aspects, political aspects and institutional aspects has significantly affect the SWM in Jimma city municipality. However, the following recommendations were made in the study.

1-The government should clearly allocate an independent budget for the improvement of solid waste management, setting encouraging service, salary increment for solid waste workers, service charge increments for waste collectors (SME's), providing incentives, designing revenue generations mechanisms and capacitating access to credit systems for SME's are required. Therefore, adequate budgeting, cost accounting, financial monitoring and financial evaluation are very important to the effectiveness of the management of solid waste systems.

In addition, Solid waste fees should be collected by attaching to water supply service bills and sanitation service charges collected from plastic bottle soft drinks and water whole sellers and must be employed for the intended purpose through clear political decision and autonomous accounting procedures.

2-Integration of environmental education centered on SWM and the environment into the school curriculum beginning with the elementary schools. Public awareness can also be improved through some low-cost methods such as seminars, workshops, newsletters, speeches and church bulletins. Solid waste planners can also make the best use of all available community resources which include elected officials, the news media, interested groups and community organizations all of which have the ability to generate community support.

Governments should take steps to educate the citizenry on waste reduction and separation as a matter of national policy and they should enact waste-minimization legislation as a first step. Emphasis on the need for information about environmentally responsible behaviors, such as recycling and waste minimization, needs to be presented in a culturally and emotionally appropriate context. Behavior change and waste prevention policy needs to be designed with convenience in mind based on the needs of today's engage in waste management practices. Provided that such a scheme is well publicized. Socio-economic characteristics (especially wealth) may determine attitudes such as the perceived ability or

willingness to recycle municipal solid waste, but these attitudes may be positively influenced by awareness-building campaigns and educational measures.

The solid waste workers should be trained on waste management and environmental issues in order to enable them work effectively. Monitoring and evaluation should be conducted yearly to ascertain the impact in the management of solid waste. The researcher believes that if these solid waste workers are permanently employed and motivated well, they will assist waste collection and disposal.

3-Poor conditions of containers and inadequate maintenance and replacement of worn-out collection vehicles contributed to behaviours 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. Therefore, condition of containers and waste collection vehicles should be properly managed and worn-out waste collection vehicles should be replaced on time.

Techniques that have often proven effective in developed countries prove to be ineffective in many situations in developing countries that do not have the needed infrastructure, need, or know-how to properly implement these technologies. The lack of overall plans for SWM at the local and national levels results in solid waste technologies that are often selected without due consideration to their appropriateness in the overall SWMS.

Misuse of technology, which has been documented in numerous cases, where sophisticated and expensive technological machineries and waste collection vehicles will lead to wastage of scarce resources of municipalities resulting in inefficient waste management. Therefore, adoption of technologies from developed countries should be carried out by adequately and extensively consulting the public and relevant stakeholders.

Jimma municipality should ensure to provide adequate and modern solid waste management by recruiting qualified personnel and providing modern and environment friendly machineries and vehicles (equipment) which will reduce environmental pollution and prevent health hazards. In addition, Jimma city municipality should provide training to the waste workers on how to collect, transport and dispose of waste.

4-The absence of proper waste management structure in the institution leads to a lack of communication and dialogue among private and public stakeholders and the resource users which clearly create a gap and weaken the overall waste management system of the municipality. Therefore, for the municipality waste management system to be efficient and effective, it should be suited with proper waste management structure.

In addition, there should be continuous assessment of satisfaction about the service delivery and supervision function as well.

5-Lack of enforcement of policies and laws is a major institutional issue that greatly contributes to the mismanagement of solid waste in jimma city municipality. Therefore, the municipality should enforce policies and laws of solid waste management for improvement of the current poor waste management practice.

Generally

When thinking about prospective interventions concerning the political and institutional aspects of waste management, one can look at four specific areas for improvement: the role of institutions, better enforcement and/or enactment of policies and regulations, privatization and decentralization of waste systems, and finally, more public involvement and cooperation in the waste management systems is underlined.

7.3 Recommendations for further research

This current study has focused on only five independent variables (financial, social, institutional, technical and political) and solid waste management. However, the current study has only focused in Jimma city Municipality and it's just localized in Jimma city municipality. Therefore, time and other resource limitation restricted this research to narrow scope which only focused in municipality of Jimma. The researcher therefore recommends the study to be done in a larger scale to cover more areas beyond Jimma city municipality with more variables and dimensions other than our research variables. Such a study should adopt more experimental methodologies since this current research looks only beliefs and opinions of the respondents.

Basic field works

Figure 4 Filling questionnaire

Figure 5 Discussion with stakeholders

Figure 6 Filling questionnaire

Figure 7 Discussion with solid waste workers

Figure 8 Field assistants on questionnaire dissemination

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Appendixes

A. Questionnaire

Introduction

Dear respondents, this questionnaire aims to collect information about the challenges of solid waste management and factors influencing its effectiveness in Jimma Municipality, Oromia, Ethiopia. However, this study is a partial requirement for the award of the degree of Master at Jimma University. Your views as a worker of solid waste management are considered as a part and parcel of this study. Please provide the following information to the best of your ability, and return the completed questionnaire to the researcher. Any information provided is strictly confidential and will not be relayed to the third party or used for any other purpose other than making this academic report for this study.

For jimma city administration municipality solid waste workers

Part I: Background information

1. Your Gender: Male ☐ Female ☐

2. Your Age. 16 – 25 years ☐ 26 – 35 years ☐ 36 – 45 years ☐ Above 45 years ☐

3. Your highest level of education: University ☐ Secondary ☐ Primary ☐ None ☐ Others ☐

4. Your rank in the organization: Collector ☐ driver ☐ Administrator ☐ Others ☐

Part II: Solid Waste Management

SDA=Strongly Disagree, DA= Disagree, , N= Neutral, A=Agree, SA=Strongly Agree, SWM= Solid Waste Management.

Direction: Please tick (√) to the statements given in the table by checking the alternative most applicable to you. Do not choose more than one alternative in one statement.

1	Financial constraint indicators	SD	DA	N	A	SA
a)	There is adequate revenue generation, for provision of effective SWM in the institution.					
b)	Our vehicles always have fuel and ready for use all the time.					
C	Working on the solid waste collection and transportation business service is attractive business.					
D	There is sufficient money for the promotion of waste reduction, recycling and recovery programs.					
2.	Technical condition indicators					
A	Our institution has adequate and modern waste management equipment.					
B	Our institution usually uses environmentally adaptable and maintainable equipment's.					
C	Jimma town is well planned with appropriate infrastructure to collect and transport waste.					
D	Waste personnel in our institution are regularly getting training.					
E	There are accessible spare parts when vehicles and equipment s are breakdown.					
3.	Social condition indicators					
A	I am paid adequate salary and sufficient additional benefits for my work at our institution.					
B	Waste workers always wear safe and protective gloves and clothes during their work at our institution.					
C	Beneficiaries have good attitude for waste workers.					
D	municipality carries out awareness raising programs on general public health and management of waste.					
E	Each household collects, transfers, and disposes of its solid wastes at common points.					

4.	Institutional condition indicators					
A	No proper institutional set-up for solid waste management service.					
B	The municipality has carried out safe and reliable SWM in jimma town to the full satisfaction of residents.					
C	Municipality does not provide clear authority and sanitation Rules.					
D	Municipality has faced frequent customer complaint about solid waste management on its assigned jurisdictions.					
5.	**Political condition indicators**					
A	There are adequate policies, laws that promote for effective SWM					
B	The assembly enforces to implement the existing SWM law.					
C	The government gives high priority to SWM.					
6.	Effective Solid waste collection indicators					
A	Frequency of waste pick-up are strictly followed by our institution.					
B	There is full and continuous training on solid waste collection in our institution.					
C	Municipality has facilitated enough number of collection points near to all beneficiaries.					
D	Municipality maintains waste spillover to the ground at collection is cleaned.					
7.	**Effective Solid waste transportation indicators**					
A	Municipality has sufficient manpower and vehicle to transport solid waste.					
B	Nature of traffic condition along collection route has jam.					

C	Supervisor records the daily number of trips, tonnage of waste and route plan to drivers.					
D	Municipality use covered vehicles and there is no spillover of solid waste up on transport.					
E	There are no adequate internal roads (alternative roads) and traffic condition along collection route has overcrowding.					
8.	Effective Solid waste disposal indicators					
A	The existing disposal site is far-away from our collection point.					
B	Municipality did not provide designated and accessible land fill site.					
C	The existing disposal site is open and it has bad smell to the community.					
D	Municipality disposes waste at designated land fill and it is Environmentally safe.					
E	Presence of animal on the disposal site is common.					

Annex: 2 Key informant interview guide

Part I: Background Information

I. Name of the respondent---

ii. Sex of the respondent---------------------------------------

iii. Age of the respondent--------------------------------------

iv. Responsibility of the respondent-------------------------------

v. Educational background of the respondent--------------------

Vi. Years of service in the current position----

Part II: Interview Questions on Solid Waste Management Practice of the Town.

1. The problem of solid waste management practice.

2. The responsible body for the problem of solid waste management.

3. Solid waste collection service availability.

4. Solid waste management education to the public.

5. Factors that affect municipal solid waste management practice in the town.

6. Attitude of community members towards solid waste management.

7. Level of community member's participation to proper solid waste management.

8. Rules and regulations regarding waste management in the town.

9. Future plans regarding to solid waste management problem at the household level.

10. Recommendation on improving the existing solid waste management practice in the town. 11. Consequences for refusing waste collection service.

Annex: 3

FGD Guide for Household Waste Collection Workers

• The problem of solid waste management practice.

• The responsible body for the problem of solid waste management.

• Major problems faced by collectors form the community members while working.

• Attitude of community members towards solid waste collection service.

• Traditional practices in the community that made the waste collection service difficult.

• Process of collection when, where, how and to where.

•What kinds of wastes?

• Are the wastes easily manageable?

• Are the wastes difficult to manage?

 • The amount and type of waste produced by different households. (According to the status and number of family)

 • Seasonal variations in type and amount of waste.

• Rules and regulations regarding waste management in the town at household level.

 • Consequences for refusing waste collection service.

Dear respondent, using the following space you can put your general idea about the current SWM service delivering practice and its basic challenges you regard as necessary

----

Thank you for your positive comments

~~~End~~~~   NB: -the questionnaires will be changed to oromifa for convenience!

A. **Gaaffiiwwan Qorannoo**

Seensa

Kayyoonni waraaqa qorannoo kana akkata qabatama Itoopiyaa, oromiyaa fi m/qopheessa m/jimmatti rakkoolee galma gahinsa qabinsa fi gatinsa balfa jajabboo irratti qorannoo kan barattoota digirii lamaaffaa yuniversitii jimmattin akka hojjetamu ajjajjamedha. Hojjettoonni qabinsa balfa jajjabboo irratti hojjetan yaada(ilaalchaa) keessani akka kennitanif hirmaatoota qorannoo kana taatanii jirtu.

Hirmaattoni gaaffiwwan kana hordoftani sirrittii erga guutani booda akka nuuf deebbiftan kabajaan isin gaafana.

Hojjettoota qulqullina M/qopheessatiif:

I) Waa'ee (Seenaa) oddeeffanno kennittoota

  1. Saalaa: dhiira ☐   Dubara ☐

  2. Umurii: wagga16 – 25 ☐   wagga 26 –35 ☐   wagga 45oli ☐

  3. Sadarka barnootaa:- yuuniversi ☐   sad. 2ffa ☐   sad. 1ᶠᶠ ☐   kan bir ☐

  4. Itti gaaffatamummaa:- sassaabaa/du balf ☐   konkolachaaisa ☐ Hoggannaa ☐ kan biroo ☐

II: **Sirna qabinsa balfa gogaa**

DO=Daran Olaanaa, O= Olaanaa, HB= Hin beekamu, GA= Gad aanaa, DGA = Daran Gad aanaa, QBG= Qabinsa balfa gogaa.

Hubachiisa: Gaaffiiwwan qorannoo dhiyyatanif (kennamanif) kan ilaalchaa keessanitti fakkatu mallattoo (√) ibsachuu keessan agarsiisaa. Gaaffiiwwan dhiyyatanif filaannoo tokko oli filaachuun hin danda'amu.

1	Agarsiistu Dhimma Bajataa	DO	O	HB	GA	DGA
a)	Maddii gaalii (bajatni) gahaa ta'e qabinsii balfa gogaa ittin hojjetamu ni jiraa.					

b)	Yeroo hunda konkolaataan balfa geejjibuun bobba'an guutameefi hojiif qophaa'adha.					
C	Maallaqnii taajajilli hojii balfa sassaabuu fi geejjibuun argamu hawwachiisaadhaa ?					
D	Mallaqni gahaa ta'e beeksiisa balfa hir'isuu,,naanneessanii itti fayyadamuu fi deebbisani itti faayidamuudhaaf olu ni raammadamaa .					
2.	**Agarsiiftu haala tekniikaa**					
A	Wajjirrii kenya meshaalee qabiinsa balfa gogaa gahaafi hammayyaa'aa ta'an qabaa					
B	Wajjiri meeshaalee naannoo isaanitti argamu fi suuphaamun ni faayidamaa					
C	Magaalli jimmaa bu'uuralee misoomaa balfa sirritti sassaabuu fi geejjibuuf gargaaran ni qaba.					
D	Hojjetoota qulqullina Leenjii itti fufinsa qabu kennamuu					
E	Hojjetootni qulqullina yeroo konkolaata fi meeshaaleen hojii miidhaman ittin suuphaamuu argachuu.					
3.	**Agarsiistu dhimma Hawaasummaa**					
A	Mindaa gahaa fi faayida dabaalata hojiichaaf kaffalamuu					
B	Hojjetootni qulqullina yeroo hundaa uffata daambii seeraa hojiichaa kana akka golgaa harka ffi qaama haguguu uffachuu.					
C	Hawaasni hojjetoota qulqullinaaf ilaalchaa gaarii qabaachuu.					
D	Manni qopheessa hubaannoo fayya hawaasaa fi haala qabinsa balfa jajjabboo irratti ni kennaa.					
E	Jiraatotnii balfa mana dhunfaa isaaniirraa sassaabanii bakka kusaa kosii waliinii yeeroodhaaf qophaa'eetti geejjibu.					

4.	**Agarsiistuu haala wajjiraa mana qopheessa.**					
A	Wajjirri taajajilaa qabinsa balfa kennu sirritti hundeeffamee jiraachuu.					
B	Wajjirri mana qopheessa sirnaa qabinsa balfa jajjabboo sirritti dhugummaa fi qulqullina isaa eegamee jiraatoota magaalaa gammachiisuu kennu.					
C	Manni qopheessa aangoo fi seera qulqullina magaalaa ittin hojjeetu baase hin jiru					
D	Manni qopheessa maamiltoota yeroo adda addaa irra deeddebiin waa'ee qabinsa balfa jajjabboo himaatan keessumeesuuf bulchinsaa isaa jiraachuu.					
5.	**AGARSIISTUU HAALA SIYAASAA**					
A	Qajjeelfani fi heerri gahaa qabinsa balfa jajjabboo bu'aa qabeessa taasiisuu jiraachuu.					
B	Waltajjiin hojiirra oolmaa sirnaa qabinsa balfa jajjabeesuu jiraachuu.					
C	Mootummaan xiyyeeffaannoo jalqaba sirnaa qabinsa balfa jajjabboottif kennuu.					
6.	**Agarsiistu Sassaabii balfa jajjabboo milkeessuu**					
A	Wajjirri keessan yeroo hundaa balfa kaasisuu ni hordoofa.					
B	Leenjiin waa'ee sassaabii balfa jajjabboo guutuu fi itti fufiinsa qabu ni jiraata.					
C	Manni qopheessa bakka ummaani hundi itti dhiyyeenyan yeroo muraasaf balfa jajjabboo waliitti qabatuu qopheesse jira.					
D	.Mannii qophessaa bakka gongaa kosii fi naannoo isaa qulqullinaan ni eegaa					
7.	**Agarsiistuu milkaa'ina geejjiba balfa jajjabboo**					

A	Manni qopheessa human namaa fi konkoolaataa gahaa balfa jajjbboo geejjibuu qabachuu.					
B	Haali ummama daandii tiraafikaa balfa geejjibuuf oolu konkolaatoota birootin ni cuccuufamaa.					
C	Guyyaa guyyaan konkolatan balfa geejjibuu hanga inni deeddebi'uu, ulfaatina balfa fi karoora isaa waliin hogganaan ni hordoofa.					
D	Mannii qopheessaa konkolaataa qabiinsa balfa gogaatiif mijataa ta'en fayyadamuudhaan harca'insa tokko malee bakka gatiinsa kosiidhaan gaha.					
E	Mannii qopheessaa geejjibuu koosii saffiisudhaaf karaa keessoo akka filannoo dabalataatti itti fayyadamu qabaa					
8.	**Agarsiistu milkaa'ina Gatinsaa balfa jajjabboo**					
A	Bakki gatinsa balfaf qophaa'ee jiruu bakka balfi yeroof walitti qabamu irraa ni fagaata.					
B	Manni qopheessa bakka bulfi itti gatamuu(land filii) qopheessa hin jiru					
C	Bakki balfi itti gatamu haala saayinsawaa ta'en ulaaga barbaachisaa ta'e guttatee kan hinhojjatamne waan ta'ef hawaasa nannoo sana jiraatuf foolii gadhee ni qaba.					
D	Manni qopheessa balfa gogaa magaalaa seera egumsa naannoo irratti hundaa'udhaan faalamnii naannoo akka hin umamne of eeggannoo cimaadhaan bakka balfi itti gataamuf qophaa'etti ni ittisa (nigata).					
E	Bakka balfi itti gatamuu bineeldooni yeroo hunda ni argamuu.					