

Domestic and Industrial Solid Waste Management Efforts for Greener Development in Shashemane Municipality, Ethiopia

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Abstract

Waste management contributes to two third of employment opportunity in the developed world though it is at infant stage in Ethiopia. This study was designed to assess the status of solid waste management in Shashemane city. 3% of the inhabitants were selected by stratified random sampling from representative ketenas of the sample sub-cities. Field survey, measurements, interview, focus group discussion and consultative workshops were used to gather information. The result showed the types of waste generated, as expressed by 80.3% of the respondent, is mostly organic. 29% of the respondents were served by trash collectors; 17% were packing the waste and dispose to the final disposal containers and 45.1% of the respondents were mainly disposing in the open field. Regulating waste management, as 42.3% of the respondents, is not know. Therefore, awareness raising, public involvement and commitment of the concerned actors are crucial.

Keywords: Shashemane, organic, trash collectors, solid wastes, house service type

1. Background and justification

Solid wastes are all the wastes arising from human and animal activities that are normally solid and are discarded as useless or unwanted (Takele, 2004). Schübeler et al. (1996) states that solid waste encompass refuse from households, non-hazardous solid waste from industrial, commercial and institutional establishments, market waste, yard waste and street sweepings; and its management incorporates the functions of collection, transfer, treatment, recycling, resource recovery and disposal. From the time life introduced on the planet Earth, humans and animals have been using resources to support life and producing waste. However, in the ancient times the disposal of wastes did not pose significant effect due to the fact that the assimilation capacity of the ecosystem was not exceeded. Increased human population and efforts made to fulfil basic needs were however change the quantity and complexity of industrial and domestic solid waste production.

Waste management is recognized as one of an integral component to sustainable urban development by international aid organizations and world population. The UN conference on environment and development pinpoint that solid waste production should be minimized, reuse and recycling maximized, system of environmentally sound waste disposal and treatment techniques promoted and waste service coverage extended to keep environment health (Schübeler, et al. 1996). However, practical implementation is limited. For instance, in the America a single person produces over 2kg of solid waste, 5-10 times higher than most developing countries; and Ethiopia generates 0.33kg/person/day solid waste in 2010 (FDRE, 2011). A linear relationship between volume and complexity of waste generated associated with economic growth is not undermined.

Most developed countries forbid open dumping at least in urban areas, yet developing countries including Ethiopia open, unregulated dumping are the predominant methods of solid waste disposal (Cunningham and Ann, 2011). For example, according to the solid waste management study conducted in Ethiopia in 2009, only 70% of solid waste is collected and disposed to open landfills in urban centres with population number more than 100,000 (Nega, 2010). Generally the function of solid waste management is not well recognized; though it is one of the labour intensive sectors contributing to an annual employment rate increment by 7% (EEA, 2011).

The amount of greenhouse gas (GHG) produce, according to the Ethiopian Climate resilient green economy development strategy (FDRE, 2011), from solid waste fuelled by increasing number of population in urban centres and per capita gross domestic production is another challenge. And appropriate solid waste management strategy is set as an option to minimize the rate of GHG emission.

Uncontrolled Pollutants emissions to the environment affect health, productivity, ecosystem and aesthetic value of the environment. The individual or resources affected is not part of the emitter; and the owner is benefiting more as a cost of the environment and victimized society (World Bank, 1999). Furthermore, every individual is producing waste with the efforts made to produce their basic needs or goods and services required to maintain life. Whether these wastes are emitting from individual household and/or industries (factories), they need a balance that the emitter must manage his/her waste to the final disposal point. However, system of waste management is still lacking may be due to weak compliance and enforcement techniques, commitment, and poor consideration of environment, lack of awareness, integration and public participation. Therefore, there is a need for effective solid waste management strategies and means to settle constraints faced by the municipality, the general public and stakeholders involved before it brings severe environmental, social, economic and other interlinked problems that can harness sustainable development. This calls for assessing the type, management

systems and per-capita solid waste generation of Shashemane town through field survey, interview and measurement in order to contribute for safe and health urban development

2. Materials and methods

2.1 Description of the study area

This study was conducted in Shashemane city from December 2011 to June 2013. The city is the capital of West Arsi zone, Ethiopia situated between 7° 12' latitudes north and 38° 36' longitudes east in an area ranging from 1672 to 2722 meters above sea level. It receives an annual rain fall 700-950mm and an annual temperature of 12 -17⁰c (Getachew and Habtamu, 2015). The population of the city, according to the national central statistics projection of the 2013, was 140,717 of whom 70,378 were male and 70,339 were women (CSA, 2013). There are four major roads crossing the city from the four direction (Figure) resulted in around 40,000 individuals visiting the city daily.

2.2 Research methods

Shashemane is one of the fast growing cities in the region, Oromia. The city has one trash collector cooperatives working in the seven sub-cities in 2011. However the number of trash collectors has increased to seven (one per sub-city) in 2012 though they were not fully involved in trash collection. The trash collection service was organized in a way that the households and/or commercial centres collect their solid waste and put in sacs in order that the trash collectors will pick and store at secondary waste collection containers. The municipality is responsible to dispose the trash collected at secondary waste disposal sites to the open landfill, 5km from the city centre to the west.

There is no any document available on solid waste and its management related topics in the locality. Therefore, out of the seven sub-cities two sub-cities, namely: Awasho and Arada were selected following criteria developed after a thorough discussion and pre-test survey with the municipality, line sectors and key informants. The criteria followed include an estimate amount and types of waste generated, access to the secondary waste disposal containers and landfill site, closer to the nearby water bodies (river), future city development direction and sites where mass people found (market places, bus stations and other commercial centres) were used among others.

From the two selected sub-cities three ketenas (the smallest administrative unit in the city) (Ketena 1, 2 and 3 from Arada sub-city and ketena 3, 4, and 6 from Awasho sub-city) were selected based on the criteria set for sub-city selection. The number of residential and commercial houses were identified and 3% of residential and 20% of commercial houses were randomly selected based on a list of owners obtained from the sub-cities as indicated in figure 2.1.

Two trash collectors cooperatives (one per each sub-city) having 19 members each were established, trained on the cooperatives concepts and solid waste management system for two days in order to engage them in data collection process. One day stakeholders' consultation workshop was organized for a total of 53 city senior administrative bodies and other actors who have a direct link with solid waste management.

95 interviews were undertaken, out which 71 were household heads and owners of the selected commercial centres and 16 interviewees were city administrative bodies, experts working on solid waste management and line sector professionals (city water board, health office, culture and tourism office, NGOs and land and environment protection office experts) who have a direct link with solid waste management. Data collected from interview of residents of the sub-cities were analysed using SPSS, interpreted and presented using descriptive statistics.

3. Results and discussion

3.1 Industrial and domestic solid waste generation, collection, transport and disposal

3.1.1 Solid waste generation:

The type of waste generated by the local inhabitants as expressed by 80.3% of the respondent, are organic matter mainly composed of house and compound sweepings, vegetables and cow dung. Plastic is one of the most devastating waste used in packaging and handling goods while shopping and disposed after once used. 40.8% of the respondents pinpoint that plastic waste is among the emerging and alarmingly increasing waste which need due consideration. Additionally, the proportion of glass and paper waste production is not undermined. Among the types of wastes generated in low, middle and high income countries 65%, 43% and 30% is organic/biomass; 10%, 28%, and 33% is paper and cardboard; and 9%, 11% and 13% are plastics respectively (UNEP, 2011). This is typically in line with the type of waste generated by developing countries which must depend on the types of resources consumed. Table 3.1: summarizes the types of waste generated by different inhabitants.

The type of waste generated show limited awareness level of personnel in the waste management hierarchy and the society.

3.1.2 Solid waste collection and transport

Solid waste collection in most cities of developing countries is aided by trash collectors at a nominal payment though the methods of payment collection vary. According to the survey result, summarized in the figure 3.1 below, 29% of the respondents were served by trash collectors and only 17% of the households were packing the waste they generate and dispose to the final disposal containers allocated for this purpose. Nearly half (45%) of the respondents were disposing waste to open field and few of them were burning and others use it as energy source. Inhabitants closer to open waste dumping sites were exposed to bad smell, pathogens, rabbits and other related hazards. Runoff and wind can easily transport it and alter infrastructure, rivers and river buffer and constructions including residential and commercial centres of the city.

The trash collectors were gathering by travelling house-to-house and taking the collected waste to secondary waste disposal container. In collection process the trash collectors use either cart hauled by animal, hand cart pushed by human or carry by themselves. As indicated in the figure 3.1 B above, almost half of the respondents are carrying solid waste by themselves and some 33.8% uses cart hauled by animal. This implies that how the process of waste transportation is challenging and the urban poor were exposing to disease. Solid waste hauled by draft animals is an emerging technology practiced by limited urban centres and it is monopolized by limited small enterprises and individuals.

3.1.3 Solid waste disposal

The municipality has an arranged secondary waste disposal containers in each sub-city. The trash collectors as well as individuals who are not served by trash collectors are expected to dispose their waste in these containers. However, most of them were not disposing their waste to the allocated containers since the containers were far from them; wastes stored in the containers were not transported timely to the final waste disposal sites and these who were disposing to the secondary containers did not properly put in the containers. Consequently, area closer to the secondary waste disposal containers were full of waste for which some cannot easily get access to the containers. Animal and people scavenging the disposed waste also distribute the waste from the containers. This created immense challenge in municipal solid waste disposal to the secondary waste disposal containers. Figure 3. 2 below shows the status of waste disposal to the secondary waste disposal containers, animal and human scavenging on solid waste, its closeness to residential and river buffer.

3.1.4 Payment for trash collectors (solid waste collection, transport and disposal service)

As indicated in the table below, individuals served by trash collectors are paying at different time; daily, weekly, monthly and on yearly basis. Among the individuals paying for the services, weekly once and weekly three times outweighs the other. The amount of the payment is fixed on quintal basis (as 32.4% of the respondent), per type as 14.1%, per kg as 7% and as one respondent based on labour availability. This fee according to 32.4% or 23 respondents is collected with receipt and without receipt as of 33.8% or 24 respondents. The amounts of payment according to the respondents vary between 5-20birr/week.

Variation in waste collection service payment amount and time (daily, weekly, monthly or yearly) is key point that invites robberies and illegal acts. Furthermore, the cost per waste generated need further determination since the poor and the rich are not generating equal amount as well as same type of waste. This can enhance responsibility and accountability among the community members.

3.1.5 Compliance promotion and enforcement mechanisms

According to 42.3% of the respondents, it was not known whether there was control in solid waste management. Other respondents expressed that health extension and the ketenas (sub-city administrative unit) play decisive role in municipal solid waste management. Here it is clear that there is either lack of awareness or involvement of concerned personnel in municipal solid waste management and the awareness level was weak at all level, the community as well as concerned offices.

3.1.6 Organizational set-up and legal framework in solid waste management

As indicated in the figure 3. 4, the constitution promulgated and enacted state three core articles on environment and development among others (FDRE, 1995a) followed by the establishment of environmental protection authority of Ethiopia (FDRE, 1995b) who approved the environmental policy of Ethiopia in 1997 with the objective to improve and enhance the *health and quality* of life of all Ethiopians through sound management of natural resources to attain sustainable development (EPA, 1997). **The policy calls among other for:**

- collection, recycling of wastes for the production of fertilizers, energy, and other uses;
- promotion of waste minimization,
- identification of suitable sanitary landfill sites,
- safe disposal services and
- An involvement of private entrepreneurs.

Furthermore, solid waste management proclamation No. 513/2007; ensures that the urban administration, in municipal solid waste management call for (FDRE, 2007):

- the *participation* of local people,
- take measures to prevent pollution arising from mishandling of solid waste,

- availability of adequate household solid waste collection facilities,
- availability of adequate solid waste management prior to construction of residential house,
- existence of enabling condition for investment in solid waste management
- execution of environmental impact assessment for new and/or modification of solid waste facility ... among others

Environmental pollution control proclamation No. 3000/2002 (FDRE, 2002) and public health proclamation No. 2000/2000 (FDRE, 2000) of Ethiopia also affirm the right, responsibilities and integrated waste management system that contribute in ensuring clean and health environment suitable for life.

From this one can conclude that the legal framework is set in a way that can ensure participatory solid waste management that involve the general public in each and every facets of waste management though its practicality was harnessed by a number bottlenecks including but not limited to awareness level, commitment and organizational setup. In solid waste management compliance monitoring and enforcement of bypassed rules and illegal acts, there is local rules but not implemented. Therefore, devising suitable policy instruments to monitor nonconformities and promote best achievements should need further consideration at all level in administrative hierarchy.

4. Conclusion and recommendations

Solid waste management status in the municipality was intertwined with multiple challenges in each waste management hierarchy. For instance, waste collection, transport and disposal mechanisms observed and identified was carried on in unsafe manner that can harm both the inhabitants and the environment. From this it is possible to conclude that the shift from conventional to integrated municipal solid waste management in the city is at an infant stage. Individuals involved on waste collection were jobless youths and females who were not economically capable to buy carts and draft animals that enhance their efficiency. Straight sweepings should be supplemented with dust bins in order to develop the culture of putting tissue papers and other on straight produced waste at sites allocated for it, minimize time spent on straight sweepings, reduce the chance of blocking urban drainage structures and risks of pathogenic organisms multiplication. The municipality should have developed and enforced local bylaw to regulate the system. Therefore, if waste separation, source reduction and composting introduced, the types of wastes generated are considered as economically important goods. Participatory waste management system should have valuable contribution in minimizing waste disposal at unsafe sites.

5. References

- CSA (2013) Population Projection of Ethiopia for All Regions At Wereda Level from 2014 – 2017. Federal Democratic Republic of Ethiopia Central Statistical Agency; Addis Ababa, Ethiopia
- Cunningham and Mary Ann Cunningham (2011) Environmental Science, A global concern; 11th edition, ISBN 978-0-07-338321-7, New York, America
- EEA (2011) Earnings, jobs and innovation: the role of recycling in a green economy; EEA Report No 8/2011, ISSN 1725-9177, Copenhagen, Denmark
- EPA (1997) Environmental policy of Ethiopia: Environmental Protection Authority in collaboration with the Ministry of Economic Development and cooperation, Addis Ababa, Ethiopia.
- FDRE (1995a) Proclamation of the Constitution of the Federal Democratic Republic of Ethiopia: Proclamation №.1/1995. In: FDRE (ed) Federal Negarit Gazeta, Addis Ababa - pp. 38.
- FDRE (1995b) Environmental Protection Authority Establishment Proclamation: №. 9/1995 Federal Negarit Gazeta, Addis Ababa, pp. 73.
- FDRE (2000) Public Health Proclamation №.200/2000. In: FDRE (ed) Federal Negarit Gazeta, Addis Ababa, pp. 1281.
- FDRE (2002) Environmental Pollution Control Proclamation: №.300/2002. In: FDRE (ed) Federal Negarit Gazeta, Addis Ababa, pp. 1966.
- FDRE (2007) Solid Waste Management Proclamation: №.513/2007. In: FDRE (ed) Federal Negarit Gazeta, Addis Ababa, pp. 3531.
- FDRE (2011) Ethiopia's Climate-Resilient Green Economy Green economy strategy: Federal Democratic Republic of Ethiopia; Addis Ababa, September 2011
- Getachew and Habtamu (2015) Heavy Metal Pollution of Soil around Solid Waste Dumping Sites and Its Impact on adjacent Community: the case of Shashemane Open Landfill, Ethiopia; Journal of Environment and Earth Science www.iiste.org, ISSN 2224-3216 (Paper) ISSN 2225-0948; Vol.5, No.15, 2015; Shashemane, Ethiopia
- Nega (2010) Survey on the status of solid waste and its management in Nifas-Silk Lafto sub-city, Addis Ababa; A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfilment of the Requirement for the Degree of Master of Science in Environmental Science; Addis Ababa,

Ethiopia

Peter Schübeler, et al. (1996) Conceptual Framework for Municipal Solid Waste Management in Low-Income Countries in collaboration, Working Paper No. 9, UNDP/UNCHS/WORLD BANK-UMP, Nairobi, Kenya

Takele (2004) Solid Waste Management; lecture notes for Environmental and Occupational Health Students; In collaboration with the Ethiopia Public Health Training Initiative, The Carter Center, the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education. Funded under USAID Cooperative Agreement No. 663-A-00-00-0358-00. Addis Ababa, Ethiopia

UNEP (2011) Towards a green economy: United Nation Environment Program; Waste: Investing in energy and resources efficiency, France, Paris

World Bank (1999) Composting and its applicability in developing countries; Working Paper Series 8; Published for the Urban Development Division The World Bank, Washington DC

Author's Biographies

I am Habtamu Degefa Debelie born on October 10, 1975 from a farmer family in Bale zone Adaba woreda. I completed my secondary education at Adaba high school, 10kms from my birth place. The detail of my academic background is as explained below.

- MSc degree in Environmental Science, specialization; Environmental Planning and Management- 27, April 2011, UNESCO-IHE, Delft, the Netherlands (October 2009 to April 2011)
- BSc degree in Forestry with distinction -17, July 2005, Hawassa University Wondo Genet College of Forestry and Natural Resources; Shashemane, Ethiopia (Oct. 2002-July 2005)
- Diploma in Forestry with distinction- 07, July 2001- Debub University Wondo Genet College of Forestry; Shashemane, Ethiopia (Oct. 1999-July 2001)
- Completed high school lesson in 1992-Adaba high school; Adaba, Ethiopia (Sept. 1986-Sept. 1992)

Figures and Tables

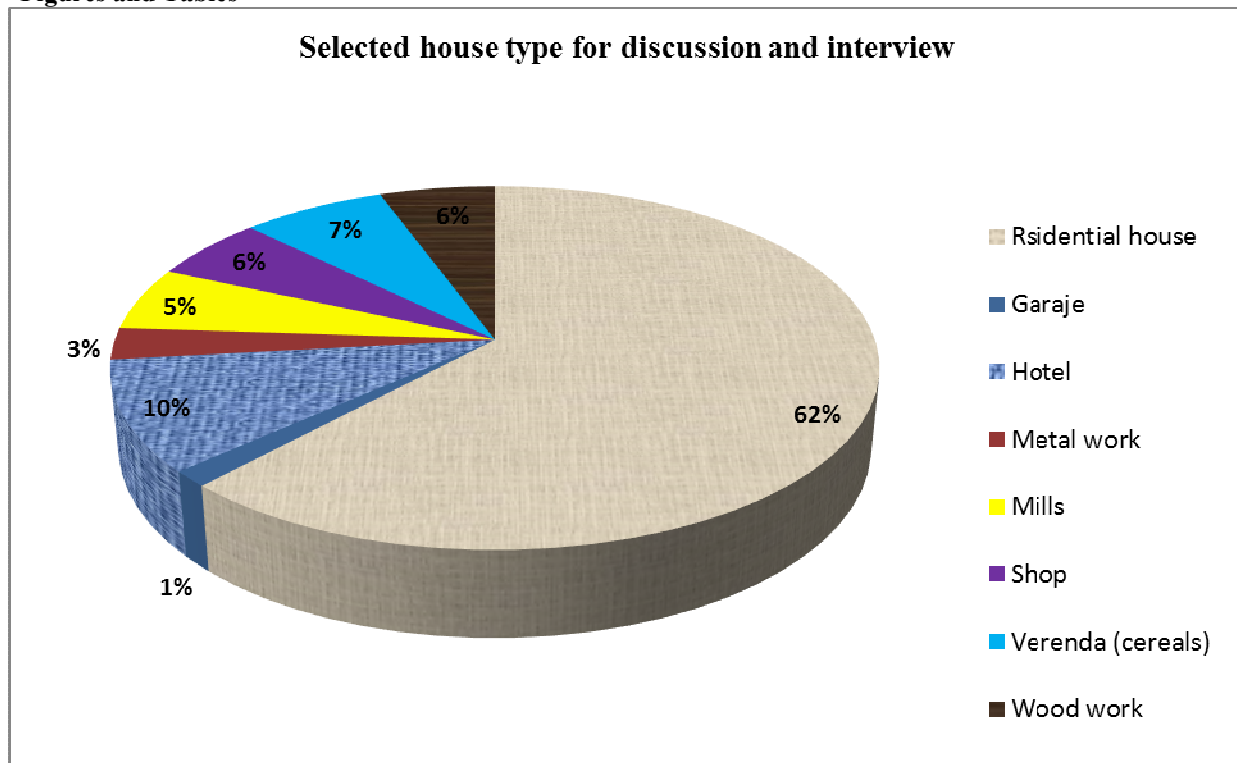


Figure-2.1: House type visited for the study

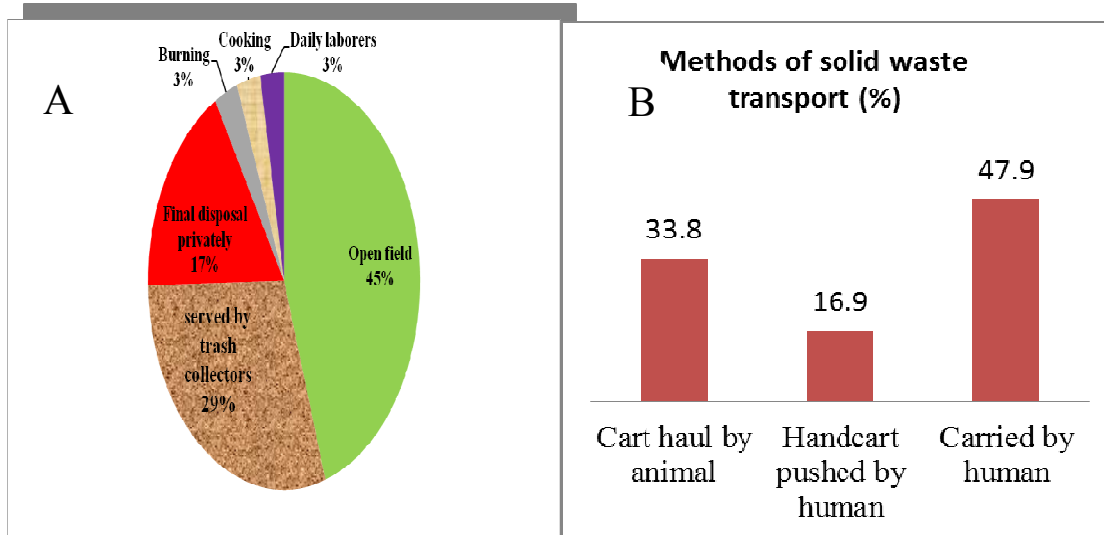


Figure 3.1: Solid waste collection techniques (A) and Solid waste transportation methods mainly practiced (B)



Figure 3.2: Unsafe waste disposal and storage in the secondary containers

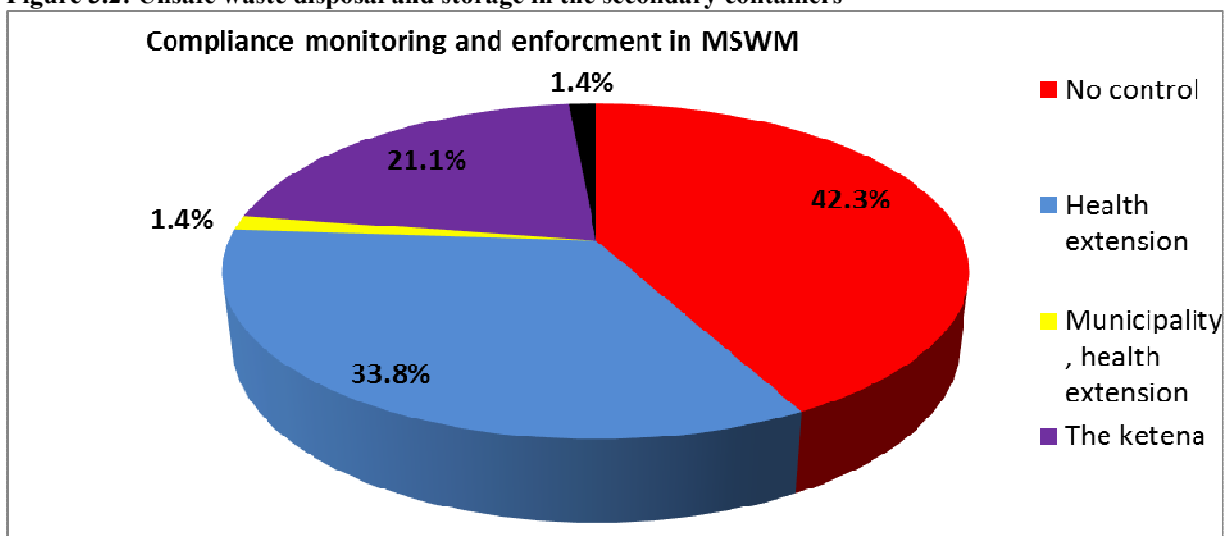


Figure 3.3: Percentage distribution of actors involving in municipal solid waste management compliance promotion and enforcement

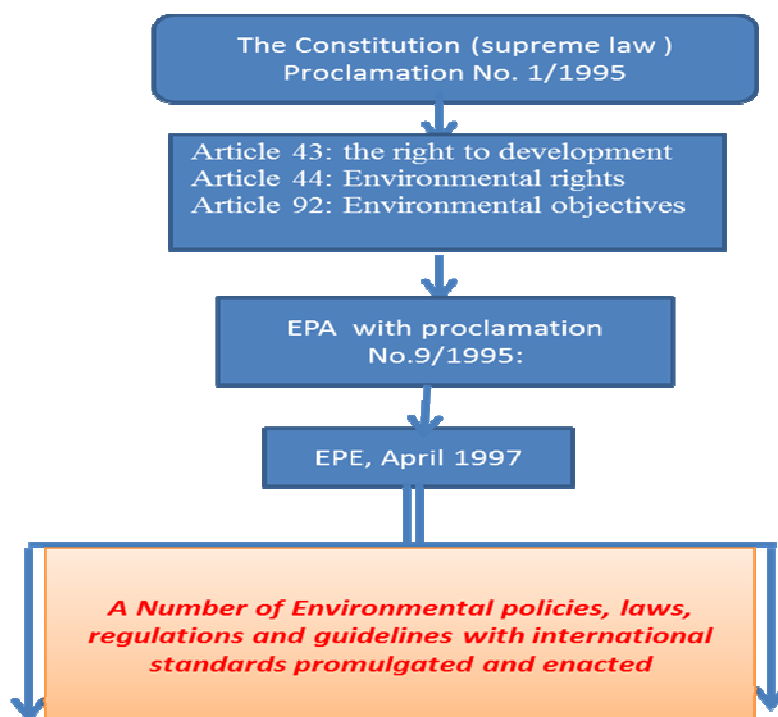


Figure 3.4: Solid waste management (constitutional base of environmental policy of Ethiopia)

Table 3.1: Types of solid waste generation

S.N	Types of waste	Frequency	Percent
1	Paper of any type, organic waste (animal dung and food waste)	10	14.1
2	Paper, glass, organic and plastic wastes	9	12.7
3	Organic waste	28	39.4
4	Organic waste and glasses	2	2.8
5	Organic wastes and plastics	14	19.7
6	Organic wastes, glasses and plastics	1	1.4
7	Glasses and plastics	3	4.2
8	Plastics	2	2.8
9	Metal	2	2.8
	Total	71	100.0

Table 3.2: Payment system for trash collection service

S.N	Description	Frequency	Percent	Cumulative Percent
1	Not served by trash collectors	43	60.6	60.6
2	Pay daily	2	2.8	63.4
3	Pay monthly	5	7.0	70.4
4	Pay yearly	3	4.2	74.6
5	Pay weekly	8	11.3	85.9
6	Weekly 3 times	9	12.7	87.3
7	Weekly 4 times	1	1.4	88.7
	Total	71	100	

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