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CHALLENGES AND PRACTICE OF PLASTIC BOTTLES, PAPER AND CARTON GENERATION AND COLLECTION IN ADDIS ABABA CITY, ETHIOPIA

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Abstract: High urbanization rates and changes in the life styles and steady rise in living standards have resulted in the increase of solid waste both in type and volume. The rapid growth of spring water industry, trade and services has accelerated the generation of plastic bottles. Plastic recycling is the process of recovering scrap of waste plastic and reprocessing the material into useful products. Since the vast majority of plastic is non-biodegradable, recycling is a part of global efforts to reduce plastic in the waste stream. 2, 983 ton of waste plastic have collected and recycled in 2010 E.C half year. Those organizations have a major impact on solid waste management of the city basically they have a capacity to reduce the recyclable waste not to dispose at landfill. 42,705 ton plastic is generated annually and 43,526 ton paper was generated. Regardless, this study has also quantified the amount of waste plastic and paper and card board collection in Addis Ababa. Thus, the cleansing association replied that an average of 16,888.55 ton of plastic and 2,701 ton of paper were collected per annum.

Key words: plastic, urbanization, lifestyle, standard, spring water industry

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1. INTRODUCTION

In many developing countries solid waste management has become a serious challenge. High urbanization rates and changes in the life styles and steady rise in living standards have resulted in the increase of solid waste both in type and volume. Some studies, for example, Palczynski

(2002)p;2, estimated that with the existing level of urbanization in developing countries, there would be two fold increase of solid waste generation in the current decade.

More serious threat is the disposal of this waste. According to the report by UNIDO (2006), i.e. United Nations Environmental Program

Division of Industry, Technology and Economics, in most African cities on average only 50% of the total generated solid waste is collected. Nevertheless, 95% of the collected waste is indiscriminately thrown away at land fill sites without proper measures to control silts or hazardous gas emission. The open dumping sites are excellent breeding places for rodents and insects which can cause or transmit some deadly diseases. Moreover, as the existing dumping sites are filled quickly, finding other new sites becomes more and more difficult. Hence, the cost of disposing solid waste increases. This in turn brings about additional strain on the already marginal budgets of local authorities (UNIDO, 2006)

Basically, waste management is the responsibility of government or municipalities. Nevertheless, small private groups/individuals are seen involved in the work. Municipalities carry out the solid waste management service under legally established local authorities, but it is costly and relatively unaffordable for the majority of the citizens in the overcrowded slums. On the other hand, the small private groups and individuals that operate informally base their livelihoods on city Addis Ababa, whose population grew from about 2.1 million in the year 1994 to 2.7 million in 2007, is one of the fastest growing cities in Africa. Its current population is estimated to be exceeding 3 million and, apart from its sheer population size, the

city is playing significant economic, social and cultural roles both at the national and international levels. Accordingly, the City has significant contribution to the national GDP growing to the concentration of various urban-based service orientated and manufacturing activities. The city, which is the Federal Capital, accounts for almost a quarter of the national urban population that is a mosaic of Ethiopia's multi ethnic and multicultural identities. On the other hand, being the home of the African Union, the Economic Commission for Africa, several specialized UN agencies and other international organizations and more than one hundred diplomatic missions, it is among the few most culturally and ethnically diverse cities in the world.

The city's rapid population and economic growth, coupled with discernible changes in lifestyles and consumption patterns of its residents and visitors that are associated with globalization and improved information and communication technology, contribute to dynamic changes in both the quantity and composition of solid waste to be generated in the city. In particular, the rapid growth of spring water industry, trade and services has accelerated the generation of plastic bottles. Yet, the city does not have a comprehensive, integrated and sustainable solid waste management plan to effectively respond to the complexities associated with such dynamics.

The recycled plastic wastes can be reused alone or regenerated by mixing with fresh raw material in suitable ratio. Products made with simple regenerated plastics alone belong to low-grade products, acceptable only in developing countries while the latter can be accepted by advanced countries. Some of the products made from simple regenerated plastics alone include disposable products, such as, dish, knife and fork, and plastic bags. Hence, a study has been conducted to assess the quantifications and collections and prevailing management practice of

recyclable plastic bottles and paper waste in Addis Ababa.

The raw materials required by the local plastic products manufacturing sub sector i.e. plastic resins are entirely imported. During the period 2009 - 2011, the local plastic manufacturing sub sector has imported on average 67,235 tons of various type plastic polymers of which the largest share (40.58%) is accounted by polyethylene and related polymers followed by polypropylene and related polymers (19.48%) and polyvinyl chloride and related polymers (see Table 3.1).

Table 3.1 import of plastic resins (tons)

Type/ Year	2009	2010	2011	Average	% share
Polyethylene and related	27,006.1	27,006.1	27,839.1	27,283.8	40.58
Polypropylene and related	9,270.3	13,071.0	16,955.7	13,099.0	19.48
Polyvinyl chloride and related	14,836.3	9,251.2	8,928.2	11,005.2	16.37
Ethylene-vinyl acetate and related	5,484.7	5,647.7	7,990.2	6,374.2	9.48
Other polyether's	3,042.2	2,454.9	2,447.8	2,648.3	3.94
POLY(ETHYLENE TEREPHTHALATE)	1,215.0	1,971.3	4,081.5	2,422.6	3.60
polyesters	828.7	1,152.7	1,143.9	1,041.7	1.55
Polymers of halogenated olefins	935.3	491.4	944.6	790.4	1.18
Alkyd resins	446.1	555.5	1,154.5	718.7	1.07
Polystyrene and related polymers	29.0	1,152.7	349.2	510.3	0.76
Acrylic	1,011.7	156.8	292.6	487.1	0.72
Polyamides	167.0	980.4	130.3	425.9	0.63
Epoxide resins	343.2	12.6	887.5	414.4	0.62
Polycarbonates	5.5	0.3	16.7	7.5	0.01
POLY(METHYL METHACRYLATE)	0.6	5.9	10.7	5.8	0.01
Total	64,622	63,911	73,172	67,235	100

Source: - Ethiopian Revenues & Customs Authority.

Global plastic consumption is accelerating in an exponential manner and it indicates how the role of plastic in everyday life of society could be significantly important .In this connection, the graph below indicates how consumption increased significantly between 1050- 2013.As the world around us

changes, our lives will be affected both directly and indirectly. Plastics will not just be a tool to respond to the major challenges facing the global community; they will also be an intrinsic part of our everyday lives. The key driver of change here will be the acceleration of technology: the combination of technology and

plastics will change the way we live work and relax (Ray Hamond, 2007)

2. METHODOLOGY

2.1. Description of the study Area

The study area; Addis Ababa was established in 1886 and with four million populations; Addis Ababa is one of the oldest and largest cities in Africa. At an average altitude of 2400 meters, it is also one of the highest. Being the capital of a non-colonized country in Africa, it has been playing a historic role in hosting the regional organizations such as the Organisation of African Unity African Union, and the Economic Commission for Africa, which contributed to the decolonization of African countries, and later bringing Africa together.

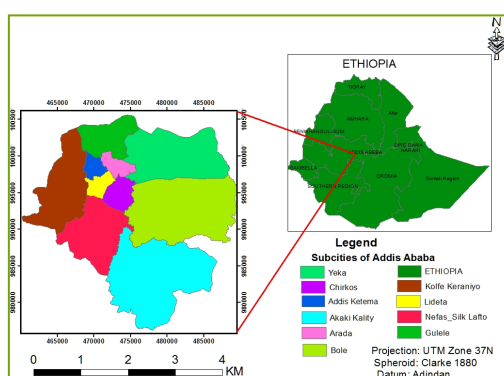


Figure 1. Map of Addis Ababa
Source of Location Map (From ARC GIS 10.2, 2016)

2.2 Location

The study area, Addis Ababa lies at an elevation of 2,300 meters (7,500 ft) and is a grassland biome, located at 9°1'48"N 38°44'24"E Coordinates: 9°1'48"N 38°44'24". The city lies at the foot of Mount

Entoto and forms part of the watershed for the Awash. From its lowest point, around Bole International Airport, at 2,326 meters (7,631 ft) above sea level in the southern periphery, the city rises to over 3,000 meters (9,800 ft) in the Entoto Mountains to the north. The city is divided into 10 sub-cities.

2.3. Climate

The city has a complex mix of highland climate zones, with temperature differences of up to 10 °C (18 °F), depending on elevation and prevailing wind patterns. The high elevation moderates temperatures year-round, and the city's position near the equator means that temperatures are very constant from month to month

2.4. Demographics

Based on the 2007 census conducted by the Ethiopian national statistics authorities the population of Addis Ababa is 3,384,569 million; all of the population are urban inhabitants. For the capital city, 662,728 households were counted living in 628,984 housing units, which results in an average of 5.3 persons to a household.

2.5. Economy

The economic activities in Addis Ababa are diverse. According to official statistics from the federal government, some 119,197 people in the city are engaged in trade and commerce; 113,977 in manufacturing and industry; 80,391 homemakers of different variety; 71,186 in civil administration; 50,538 in transport and

communication; 42,514 in education, health and social services; 32,685 in hotel and catering services; and 16,602 in agriculture.

The city has recently been in a construction boom with tall buildings rising in many places. Its geographic location is in the center of Ethiopia that has combined with a lack of development policies in other urban centers have given the capital the majority of social and economic infrastructure in the country. As a result, it has been a melting pot to hundreds of thousands of people, coming from all corners of the country in search of better employment opportunities and services. This high rate of rural-urban migration accounts for about 40 percent of the growth. Coupled with rapid natural population growth, Addis Ababa one of the fast growing cities in Africa, posing critical challenges, including a high rate of unemployment, housing shortage, and environmental deterioration.

2.6. Research Approach

This study was conducted on the assessing the generation and collection of plastics and paper waste. Therefore, it intended to look the quantity of plastics and paper generated and collected and income generation by the quantitative research approach. Thus, both qualitative and quantitative research approaches were employed to collect, analyze and interpret the collected data.

2.6.1. Research Type

In this study, descriptive research

type was employed because it is more appropriate to describe what actually exists or current condition which means the generation and collection of plastics and paper waste at Addis Ababa.

2.6.2. Time Dimension

The researcher conducted the research only once and the data was gathered from the selected sample size at one point in time from September -March/2018. Thus, cross-sectional time dimension was used to undertake the research.

2.7. Research Techniques

Following topic selection and its approval, a literature review was compiled. Appropriate and relevant literature were selected and reviewed. Following the preparation of research proposal and identification of data sources, the researcher prepared the appropriate instrument for data collection was developed. Each instrument was tested at pilot scale before it was employed to full data collection campaign. The data collection task has been undertaken. Primary data was collected using observation and interview. Secondary information was then compiled from internets, government, reports and research articles. The collected primary and secondary data were fed into SPSS. Then, the result was summarized using SPSS and presented in tables, figures and chart.

2.8. Methods of Data collection

Different data gathering tools were used to collect data during the study. Interview and direct non participant observation and document review

were used to collect primary and secondary data.

2.9. Sampling Design

According to Kothari (2004), sample design is a definite plan for obtaining a sample from a given population. Accordingly, the first population of the study, sampling frame, sampling unit and sampling techniques to be described as followed.

2.9.1. Population of the study

Population refers to the total items about which information is desired (Kothari, 2004). In this study, the population of the study which the sampling frame was taken is 856 employees working in government and private organization who are engage at collection and recycling have been responsible for solid waste recycling and reusing activities.

2.9.2. Sampling Frame

The sampling frame is the list from which the sample was drawn. Thus, the sample frames was from 74 Share enterprise 617 members, 7 private recycling companies, 116 worda cleansing expert, 10 subcity cleansing managers and 10 subcity expert.

2.9.3. Sampling Unit and Unit of Analysis

Unit of analysis is a population to be studied or individual member of the sample that are identified for analysis. The unit of analysis for this study was governmental and private organization found in Addis Ababa and who are engaged in plastics and paper waste collection and recycling activities.

2.9.4. Sampling Technique

Random sampling techniques were used to select an individual respondent from each strata. The collector and recycler were first identified then the target samples were calculated according to its number of total population.. A purposive method of sampling was applied to select samples from organization which their total population was very small and their ratio of sample proportion was less than one

2.9.5. Sample Size Determination

According to Singh and Masuku (2013), there are many approaches to determine the sample size of the study. These include using a census for a small population, limiting a sample size of similar studies, using published tables, and also applying formulas to calculate a sample size. The sample size in this study was determined by using scientific formula; a method which was explained by Yemane (1967).

The total number of the population was 8456. Yemane scientific formula was used to determine the sample size of this study. The representative number of samples that was determined by Yamane scientific formula considering 90% margin of error.

$$n = \frac{N}{1+N(e^2)} \quad \text{Equation 1}$$

Where,

n= the required sample size

N=the total number of population

$$e = \text{allowable error (90\% = 0.1)}$$

$$\text{Hence, } n = \frac{856}{1 + 856(0.1)^2} = 90$$

Accordingly, 90 governmental and non-governmental organizations were selected. However, some organizations which have lower sample ration. The original number of their population was taken as a sample. Hence, a total number of 90 samples were selected and contacted.

2.10. Sources of Data

Both primary and secondary data were collected from different sources.

2.10.1. The primary Data Source

To obtain Primary information about to assess the generation and collection of plastics and paper waste in Addis Ababa, interview and direct observation were used. Then, the questionnaire was tested and reviewed before it was fully implemented for data collected. This was done to avoid ambiguity, and redundancy of words, in turn, to improve clarity and understanding.

2.10.2. Secondary Data Source

Secondary data were gathered from relevant documents like books, previous works, the annual report

of the organization, and other published and unpublished material were used.

2.11. Method of Data Analysis

The collected data were organized according to the variables. Simple quantitative statistical tools including frequency, percentage, chart and tables were used. SPSS (Statically package for Social Science), and Excel program were employed to analyze the data.

2.12. Data presentation

Data obtained by using different data collection method were analyzed and presented differently. The analyzed and interpreted data were presented in the form of tables, figures, chart, plates and narration and included in the report.

3. RESULT AND DISCUSSION

3.2. Response Rate

As it is described in the methodology part, primary data are used for this study were gathered from the organization that are responsible for generation, collection and recycling of Addis Ababa solid waste. The following table summarized the respondent's total response rate along with the returned.

Table 1. Response rate of the interview

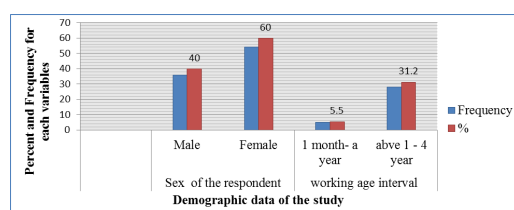
Respondent	interviewer	Response for interview	Response rate %
94	94	94	100

Source: Field survey (2018)

The above Table 3.1 summarised that from the total 90 respondents, 100% of respondent were found during the interview period, this indicates that the interviews are sufficient enough to carry out the analysis

3.2. Demographic Data

Knowing sex and duration of the respondent that how long they are engaged at this work and age help to set their composition and flexibility and their inclination to change. As it was shown in Figure 4.3, 60% of the respondents were females & 40 % were males. Regarding the age intervals of the respondents staying at this work were 5.5% of the respondent were engaged on this work for less than a year, 31.2% were between 1-4 year and 63.3% of the respondent was above 4 years.



Source, *Field survey, (2018)*

Figure 2. Sex and working age interval characteristics of the respondent (n=90)

3.3. Result of the Study

In this section, the analysis of the primary and secondary data which were gathered during the fieldwork is presented based on the objectives of the study.

3.3.1. Quantification of plastic bottles and paper waste generation in Addis Ababa

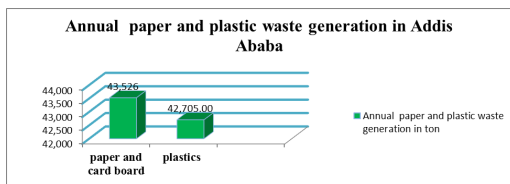
Solid waste is generated from different activities such as anthropogenic sources of activities (industrial, household, commercials, street and soon) secondly from natural activities such as deciduous tree /falling of tree by

wind and volcanic eruption, flooding and soon. Therefore from there are two type of solid waste are generated in Addis Ababa city biodegradable and non-bio degradable and hazardous and nonhazardous solid waste.

To observe the waste composition in Addis Ababa, two research data are not added, one from a research from Nor consult in 1982 and the second from the IGNIS project between 2008 and 2014 which surveyed only households. However, IGNIS project neither is more preferable than nor consult.

According to (IGNIS project study, 2013), waste composition of Addis Ababa is 64% organic, 5.3 paper and card board, 5.2 % plastic and other waste has generated respectively. Therefore from the data that we can understood that paper and plastics waste are the highest generation followed by organic wastes.

Thus, this study would like to quantify the amount of plastic bottles and paper and card board waste regarding the data organized and extracted from IGNIS Project study. Based on the secondary data , the estimated population of Addis Ababa is 5 million where these people has intended to generate 0.45 kg /cap/household waste from this 5.3% is paper and card board where 43,526.25 ton of paper are generated annually and 5.2% of waste is plastics where 42,705 ton of plastic waste is generated annually.



Source, field survey, 2018
Figure3. Annual paper and plastic waste generation in Addis Ababa

As it seen in figure 1.3., the generation amount of plastic and paper is very high and this materials are very useful to recycle and it can protect natural resource by converting these solid waste materials as a raw material and also the figure show that paper and card board waste is generate higher than plastic bottles.

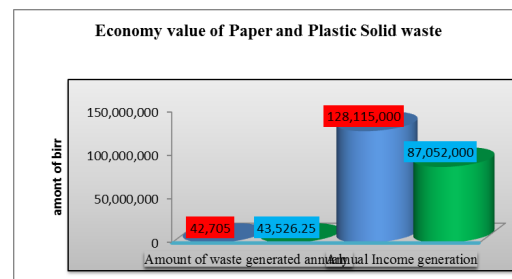
3.3.1.1. The economic value of plastic and paper and card board waste to Addis Ababa city

Solid waste management has a far-reaching impact on the urban development and overall economy. As urban economy grows so do industries of different sizes and other business grow. Increase in volume and types of waste (including toxic and other hazardous waste) demands fast removal, treatment and safe disposition. This costs a lot. However, failure to deliver the service would adversely affect citizens' health, which leads to an increase in the health service expense as well as a decrease in the people's productivity. High solid waste management cost, in the other side, is again a burden on the economy (Cointreau, 2004:3).

Waste is resources that can substitute the raw material and it can

help to conserve and preserve the natural resource of the city by enhancing recycling and reusing activities. In Addis Ababa, there are places where waste is recovered. The key role in the informal waste recycling process is played by a market place named Minalesh Tera. Minalesh Tera is located in Merkato in Addis Ababa; one of the biggest open markets in Africa. In Merkato, the same kinds of materials are sold on the same block called 'tera' in Amharic; which translates to queue in English. Thus, people would go to the block of the material they are looking for and find different types of that material.

Therefore, the annual paper and plastic waste generation has major role to create an income also created foreign currency to the country. According to SWRDPO, in 2009 about 36 million birr were found from the recyclable waste.



Source, field survey, 2018
Figure 4. Economy value of paper and plastic waste

As depicted in figure1.4., paper and plastic waste have high amount of economic value which means if the cleansing association collect the generated paper and plastic waste annually they can earn about

128,115,000 birr from plastic and 87,052,000 birr from paper and card board and these also have an opportunities to recycling company who sold these waste to abroad and the country would have get millions dollars foreign currency. Therefore, paper and plastic waste is not waste it is possibly resources.

3.3.2. Quantifications of paper and plastics waste collection in Addis Ababa

Collection and transportation of solid waste contains the process of gathering of waste from place of generation, taking it to nearby public solid waste containers or transfer stations and lastly dumping it to disposal site (UNEP, 1996). As to Tchobanoglous et al., (1993) the term collection includes not only the gathering or picking up of solid wastes from the various sources, but also the hauling of these wastes to the location where the contents of the collection vehicles are emptied. According to the author, this location may be a material processing facility, a transfer station or landfill disposal sites. In many developing countries waste can be collected from, either by door to door or by using communal containers. Communal containers are placed in a place where the residents of the area are required to bring their refuse and dump into it. According to (Meaza cheru,2016) In each Kebele, containers are placed at common place near the main roads. The distance to these containers may be different for different households.

For some it may be next door and for others a kilometre or more away. On the basis of schedules from the Kebele, employees carry bags of waste to the containers with a trolley. This is the primary stage of collection. Those who can't afford to pay the waste collection fees and those who live far away from the containers have to then carry their waste to the common place by themselves. The containers are yellow and have sizes of 8 m 3 . There are only 512 containers for the whole city of Addis Ababa; most of these containers are in a very bad condition. Push-carts used to collect waste from households in Addis Ababa and the formal waste management process respectively.

Inorder to know the amount of plastic and paper waste collection in Addis Ababa, both an interview and annual report were used. Thereby, there are 60 interviewer were randomly selected from the population to respond the amount of paper and plastic waste which collected per day by themselves.

There are about 617 cleansing association but recently they are merging to union and become 74 union who are engaging on collection, transportation, sorting and selling of solid waste. (SWRDPO, 2019)

As shown in below figure1.4. , 50 respondent respond that average amount of plastic waste collected per day were 75 kilogram and 10 of the respondent respond that 65 kilogram plastic waste were collected.

Therefore, as mentioned on the above there about 617 cleansing association who are daily working in collection of solid waste from household? So, multiplying the average amount of collected waste with whole number of association or union or union 46.27 ton of plastic were daily collected and annually 16,888.55 ton of waste plastic were collected.

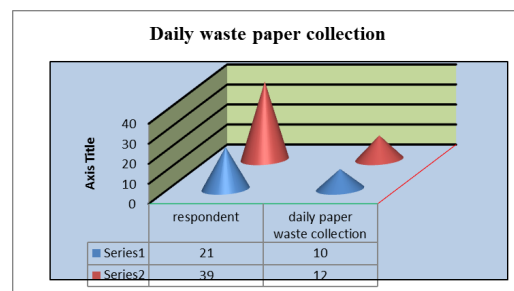


Source, field survey, 2018

Figure 1.4. Daily waste plastic collection

As shown in the below figure 1.5, 21 respondent were respond that 10 kilogram of paper waste were collected and 39 of the respondent respond that 12 kilogram of paper waste were collected per day, this indicated that most of the respondent are collected high amount of paper waste from other and this also show that 617 cleansing association could collect 7.4 ton of paper waste per day and 2,701 ton paper per year.

As result, a lot of paper and card boards are dump and disposed into open dump site and other open spaces.



Source, field survey, 2018.

Figure 1.5. Daily waste paper and card board collection

3.3.3. Performances of plastic and paper waste recycling company

Municipal solid waste management concerns individuals, community groups, government and NGOs government organizations and institutions as service users, service providers, intermediaries, regulators and partners. Accordingly, the group of service users includes households, small and big business organizations (e.g. hotels, restaurants, and supermarkets), industries and other service providers (e.g. hospitals and schools). Local governments are classified as service providers while the national government is the body that embraces institutions and organizations responsible for formulating institutional and legal framework of municipal solid waste management services. It is also responsible for the provision of assistance in case of cross-jurisdictional problems. Both formal and informal private sector actors are also considered as actual or potential service suppliers.

The NGOs governmental organizations are described as bodies that are operating between the private and the governmental realms. External supporting agencies are bilateral and multilateral international agencies involved in solid waste management issues as part of urban management or related programmers (Sch?beler and et al, 1996).

Plastic recycling is the process of recovering scrap of waste plastic and reprocessing the material into useful products. Since the vast majority of plastic is non-biodegradable, recycling is a part of global efforts to reduce plastic in the waste stream, especially the approximately 8 million tons of waste plastic that enter the earth's ocean every year. (Jambeck et al . 2015). This helps to reduce the high rates of plastic pollution.

According to SWRDPO report , there are about seven recycling companies participate on paper and waste plastic collection from the cleansing association and returning those materials for recycling purpose and sold it to foreign market.

In order to examine the performances of waste paper and plastic recycler companies, direct observation and interview were used. Therefore,

3.3.3.1. Performances of waste plastic collection of the recycling companies

Six companies are participating on waste plastic collection and converting the collected materials

for the stage of recycling purpose and three of them are exporting the materials and the rest are sold it to other companies.

According to the data obtained from the organizations expert, the capacity of the machine daily demand of waste plastic to be recycled were more than a million. However, only 2, 983 ton of waste plastic have collected and recycled in 2010 E.C half year report. (SWRDPO, 2010). Those organizations have a major impact on solid waste management of the city basically they have a capacity to reduce the recyclable waste not to dispose at landfill.

3.3.3.2. Job Creation and Foreign Currency

According to the data obtained from interview, waste plastics and papers recycling companies have created income for those who had not any work. Thus, there are 452 worker were employed in recycling companies and regarding foreign currency, three recycling companies were exported crushed plastic material for outside market. Thereby, the companies have found 1,064,389.8million dollar million dollars (SWRDPO report ,2018).

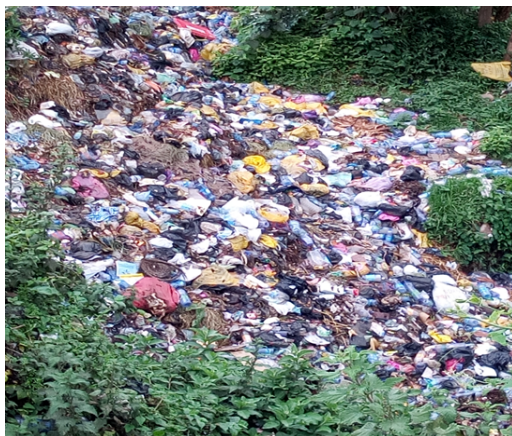
3.3.4. Identification of challenges on waste paper and plastic collection and recycling

In order to identify the major challenges on waste collection for reusing and recycling activities on this study an interview were used. Thus ,there are 90 respondent were randomly selected to respond about

the major challenges for collection, reusing and recycling solid waste in Addis Ababa. Thereby the challenges were identified as followed. major challenge for reusing and recycling activities

3.3.4.1. Sorting of waste plastic and paper

Sorting is major activities that have to be done during disposing of solid waste at household level. In Addis Ababa it is usual to see mixed waste from the source which does not sorted in different collection bags. As shown in the below figure, most of the study respondent were responding that sorting is one of the challenges that discourage the collection of recyclable waste basically plastic bottles and paper and card board. Because of these, high amount of waste plastic and paper and cardboard are disposed to the river and other open spaces and impact on environment media and human health.



Source, field survey, 2018 Figure 1.6. , challenge of improper sorting of plastic and paper waste for collection of recyclable waste

3.3.4.2. Work place

The respondent for this study were cleansing association, recycler companies, and worda expert and sub city manager. Therefore during the interview, majority of the respondent responding that insufficient work place become a major challenge for collection of recycling and reusing activities. Whereas the rest of respondent respond that inadequate infrastructure such as water and electric power) were respectively challenges for collection of recyclable materials such as plastics and paper and card board.

As shown in the figure below, from the interview, work places for those who are engaged at collection and recycling activities was very significant issue that need to be addressed by concerned body to improve the city solid waste management especially recycling activities.



Source, field survey, 2018. Figure 1.7. Insufficient work place for collection of recyclable materials.

3. CONCLUSION AND RECOMMENDATION

4.1. Conclusion

Due to the flooding population's

growth, expansion of the urban area and increasing of economic activities in Addis Ababa, the amount of waste plastic and paper have increased drastically. Based on that in Addis Ababa, 42,705 ton plastic is generated annually and 43,526 ton paper was generated. Regardless, this study has also quantified the amount of waste plastic and paper and card board collection in Addis Ababa. Thus, the cleansing association replied that an average of 16,888.55 ton of plastic and 2,701 ton of paper were collected per annum. Therefore, the generation and collection rate of waste plastics and papers have quietly varied which mean high amount of the generated solid waste did not collected which simply disposed to open dump site and disposed to other open space.

In Addis Ababa solid waste become a source of income and foreign currency. There are about seven companies were participated on solid waste reusing and recycling business. These companies have undertaken their business starting from collection of the recyclable waste and converting into the recyclable stage like crushing the plastic bottles and shredding the paper and card board. Thus, 452 employee have got an opportunities to work in solid waste recycling activities which means even though job creation activity from this sector become less, few inhabitants could get job and has increased their income.

Related with income, three companies have exported their

material to abroad and could have got 1,064,389.8million dollar foreign currency for the country. However, if the companies working very well, more than 10 million dollar will get from recycling waste plastic.

Regarding challenges on collection, reusing and recycling activities, work place for accumulation of recyclable waste and sorting of waste plastic and paper at household level were mentioned as major obstacle amongst other. Sorting solid waste at house hold level is very critical activities which can highly support the improvement of solid waste management in Addis Ababa. Therefore most of the respondent such as cleaning association, worda and sub city expert and recycler companies assured that sorting solid waste was very challenging activities which cannot be easily avoided with single participation of the government.

Secondly, working please determined the effectiveness of reusing and recycling activities. Solid waste were collected and transfer to temporary transfer station but depend on the composition of the collected waste temporary transfer station is vital for reusing and recycling purpose

Finally, plastic and paper waste can be seen easily in different part places of in Addis Ababa, the generation rate elevate than collection rate and also millions of birr are dumping to landfill due to inadequate recycling and reusing

activities because of the existing of low attention to this field without providing appropriate work places for those recycling companies.

4.2. Recommendation

While conducting this research, various gaps were identified in the generation and collection of waste plastic and paper and their economic value in Addis Ababa. Thus, the following recommendation forwarded with respect to the objectives of the research for further improvement of the collection, recycling of waste plastic and paper and cardboard by different actors who are responsible for these issues. As mentioned earlier, there are efficient studies regarding solid waste characterization and composition of Addis Ababa city. Therefore, solid waste characterization and composition study should be undertaken. Sorting of solid waste is a vital activity for waste plastic and paper collection and recycling purpose. Therefore the concerned

body should formulate different laws and regulation regarding sorting activity, collecting the recyclable material and recycling waste plastic and paper activities has a major function for environment, social and economic growth. Therefore, city administration shall encourage the recycling companies with providing efficient work place or should establish one recycling center to those who are participated in recycling activities. Incentives for those who are good enough on collection, sorting and recycling activity shall be introduced. Evaluation and monitoring system should be improved and strengthened.

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