DISTRIBUTION PATTERN OF DUMPSITES FOR THE MANAGEMEMT OF WASTE IN SOME PARTS OF ILARO TOWN USING GIS TOOLS

BY

KOLAWOLE A. OLAGUNJU*AND ADEWARA M. BABALOLA**

DEPARTMENT OF SURVEYING AND GEOINFORMATICS, FEDERAL POLYTECHNIC, ILARO, OGUN STATE.

Email: abitopus@gmail.com* & thawben@gmail.com**

+234-8037216095*, +234-803-0684742**

Paper Submitted for conference at

1ST National Conference, School of Environmental Studies, Federal Polytechnic, Offa,

Kwara State

Theme: Towards sustainable Built Environment in the 21st Century

Tuesday 7th - Thursday 9th February, 2017

DISTRIBUTION PATTERN OF DUMPSITES FOR THE MANAGEMEMT OF WASTE IN SOME PARTS OF ILARO TOWN

BY

KOLAWOLE A. OLAGUNJU*AND ADEWARA M. BABALOLA**

DEPARTMENT OF SURVEYING AND GEOINFORMATICS, FEDERAL POLYTECHNIC, ILARO, OGUN STATE.

Email: abitopus@gmail.com* & thawben@gmail.com**

+234-8037216095*, +234-803-0684742**

ABSTRACT

Increasing population has brought about massive volume of solid waste being generated every day in Ilaro town and unfortunately the management of these wastes is deteriorating day by day due to the limited resources in handling the increasing rate of generated waste. Solid wastes have opportunities as well as challenges it poses to the societies. In this paper, recent progress in the management of waste is reviewed and bringing the experience of waste management in Ilaro town on board, laying emphasis on the collection, transportation system, treatment system, disposal and the type of wastes disposed. Eight (8) waste locations were selected in the study area. Data on the composition of waste in each dumpsite was collected at a one (1) week interval for a period of two months monitoring. Social survey was also conducted by means of interview to evaluate the willingness of members of the community to pay N100 per week to waste managers to pick up their refuses at their door steps. To have an overview of the spatial location of the dumpsites, spatial distribution pattern of the dumpsites was carried out in ArcGIS. The study revealed that wastes are collected mostly at illegal fixed stations along roads, rivers, streams, drainage channels, and open spaces. Spatial analysis show that waste distribution pattern in the area is dispersed while non-spatial analysis show that paper and plastic are the most generated wastes which are biodegradable and non-biodegradable respectively while wood is the least generated. The social survey also revealed that community members are unwilling to pay for waste disposals. The study further suggests possible solutions for the management of wastes for a sustainable built environment. The information provided will be of immense usefulness when planning or implementing waste management system for the town and future research works.

Key words: Waste, Distribution pattern, Disposal, Sustainable, Treatment, Management, Environment

1.0 Introduction

Effective waste management has been greatly restricted by insufficient statistical data on the generation, processing and waste disposal (Helen M.H., Mohammad R.S., & Amir H.M, 2013). Developing countries experience exhaustive collection services, inadequately managed and uncontrolled dumpsites. These problems are fast becoming deteriorating and lack of statistical records about these waste related issues is making the matters seemed unsolvable. The ever increasing global concern on environmental health demands that wastes be properly managed and disposed of in the most friendly and acceptable way. This is to minimize, and where possible, eliminate its potential harm to humans, plants, animals and natural resources (Riyad A.S, Hassan A., Rahman A., Alam M., & Akid M., 2014).

The amount of waste generated in the prehistoric time is low as a result of less dense population and low exploitation of natural resources. Common waste produced during pre-modern times was mainly ashes and human biodegradable waste, and these were released back into the ground locally, with minimum environmental impact. Tools made out of wood or metal were generally reused or passed down through the generations. Although civilizations do vary across countries, states and regions than others in their waste output. However, in the study area, due to civilizations, populations increased as well as exploitation of the natural environment thereby causing increments in the leftovers of these used exploits.

Like any informal town in Ogun State, Ilaro lacks proper ways of waste disposal and there seemed not to be any plans towards having an effective waste management plan. As a result majority of its population dump solid waste illegally and haphazardly in the existing rivers, streams, road corridors and in any vacant space. This problem is acute with an increasing number of population; and as a result there is going to be significant negative environmental impacts. In this regard, this paper attempted to examine challenges facing waste management in Ilaro with a view to contribute to improving waste management initiatives within the town.

1.1   Aim and Objectives

The aim of the research is to assess the existing characteristics of waste disposal in the area and suggest possible solutions for the management of wastes for a sustainable environment. The aim is achieved through the collection of data sets from waste deposit observations in the study area, review of existing literatures and proffering possible solutions geared towards the management of wastes for a sustainable built environment.

2.1 Review of Literatures

One of the first critical steps in the process of developing a reliable waste management plan requires a comprehensive understanding of the qualities and characteristics of the wastes that need to be managed (Mohammed A.S., Lokman H., Satyajit R.D., Razak W., & Mohammed K.H., 2012) .Review of literatures provided an overview of reported waste management stakeholders and factors affecting waste management systems. Existing Literatures have identified the stakeholders that may have interest in the waste management issues. These are the National and Local Government, Municipal Authorities, Non-Governmental Organizations, Household, Private contractors, ministries of health, Environment, Economy and Finance, and recycling companies (Guerrero & Lilliana, 2012).

With the background knowledge of the qualities and characteristics of wastes, the wastes generated could be converted to economic resources and alternative energy generation using modern technologies. Some researchers have given opinions on factors influencing waste management systems. Generation of waste is influenced by family size, their educational level and monthly income. The volume of waste generated by one family is incomparable to waste generated by an entire community. The more the number of families increases in the community the more the waste to be generated increases.

In the same vein, as population increases the demand for household daily needs increase, hence preempt manufacturers to produce more daily needed materials to cater for the increasing population. Likewise, increase in manufacturing industries is equivalent to the industrial consumption of raw materials and waste generation as a by-product of manufacturing industries.

Again, local waste manufacturers are not professionally competent and confident in using economic instruments to address waste management issues. The administrators are also underfunded and funding politics has to some extent eroded the incentives to carry out the instructions of higher waste authorities (Chung & Lo, 2007).

2.1.1 Factors affecting the Management of Wastes

As the population increases, there is tendency for human activities to increase thereby bringing about increase in economic activities, and hence increase in waste generation. From the observations above, there appears to be no legally approved slot for waste disposal in the study area except one. Wastes are being deposited on open grounds. This means the people of the area are over exposed to the hazards of germs from the open wastes. The findings suggests that when

3

citizens receive information about the benefits of recycling, sorting waste and participating in designing of the program, they are more likely to participate in recycling campaigns. There already exists in the study area, the challenge of inaccessibility in some parts of the area as a result of housing patterns. Houses are built together without set-backs. This would make it difficult for waste collectors to access the areas. There were consultations with the local community to know whether they will appreciate that the refuse dumps around them be relocated to accessible areas for them and that they would pay monthly token to the waste managers. There is unwillingness in most of the local community members to pay a token N100 per week to waste managers to pick up their refuses at their door steps. Even some of the few manufacturing industries and firms around prefer to burn their wastes in their yards since they have large land mass to burn the refuse. They consider it to be more economical but the environmental impact of the incomplete combustion of carbon released into the atmosphere from the refuse burning poses threats to community health. Furthermore, information was gathered from field inspectors on measurement of volumes of disposal and the types of wastes. The following characteristics were noted in the field study as factors affecting waste management: collection and transportation system, treatment systems, composition of waste materials, volume of wastes and finance.

2.1.2   Summary of factors affecting performance of Waste Management Systems

Figures 1 and 2 summarize the factors reported in literatures and the findings of the present study affecting the performance of waste management systems. Some factors influence individual elements (Figure 1) while others affect the whole waste management system (Figure 2).
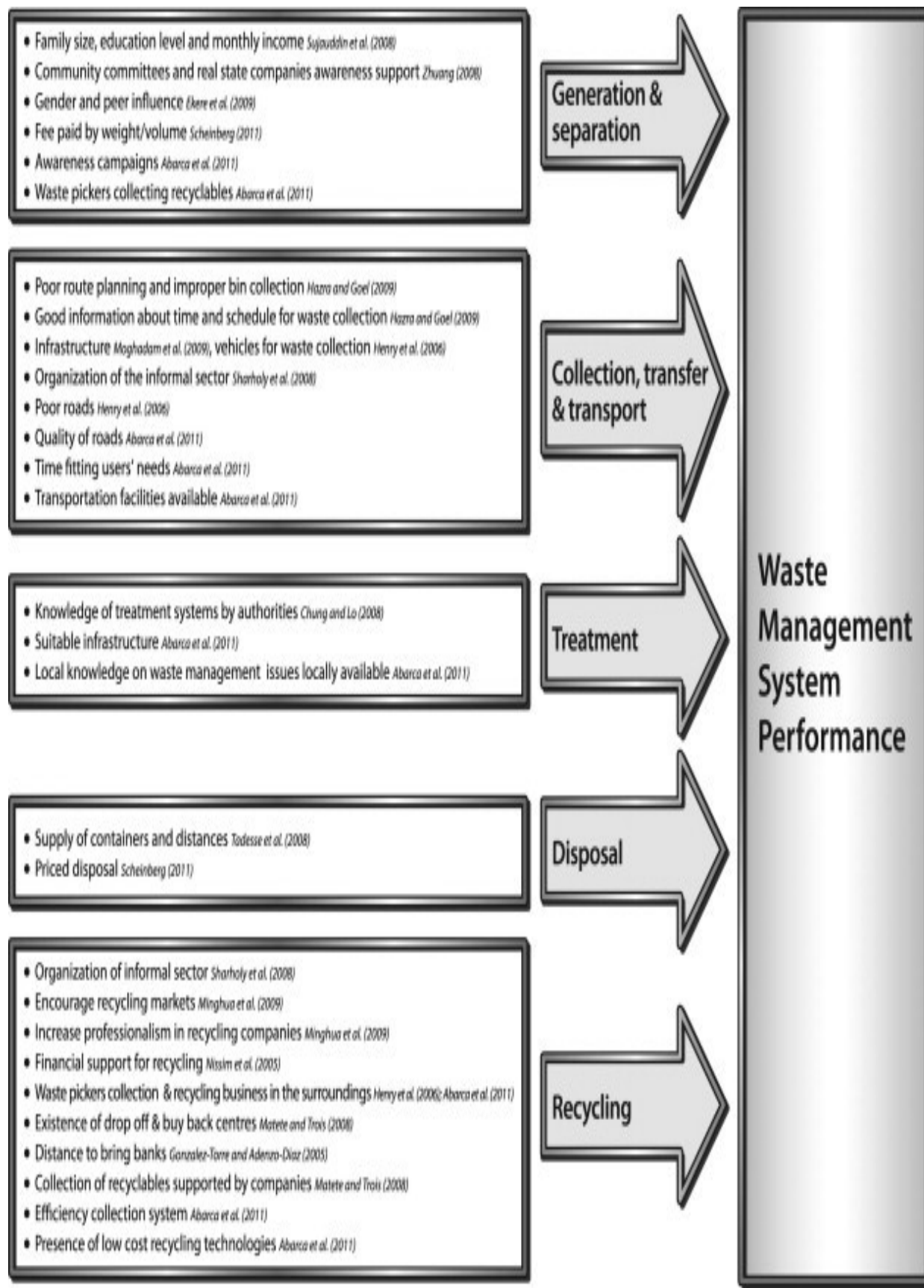
Figure 1: **Factors that influence the elements of waste management systems. (Guerrero et al. 2012)**
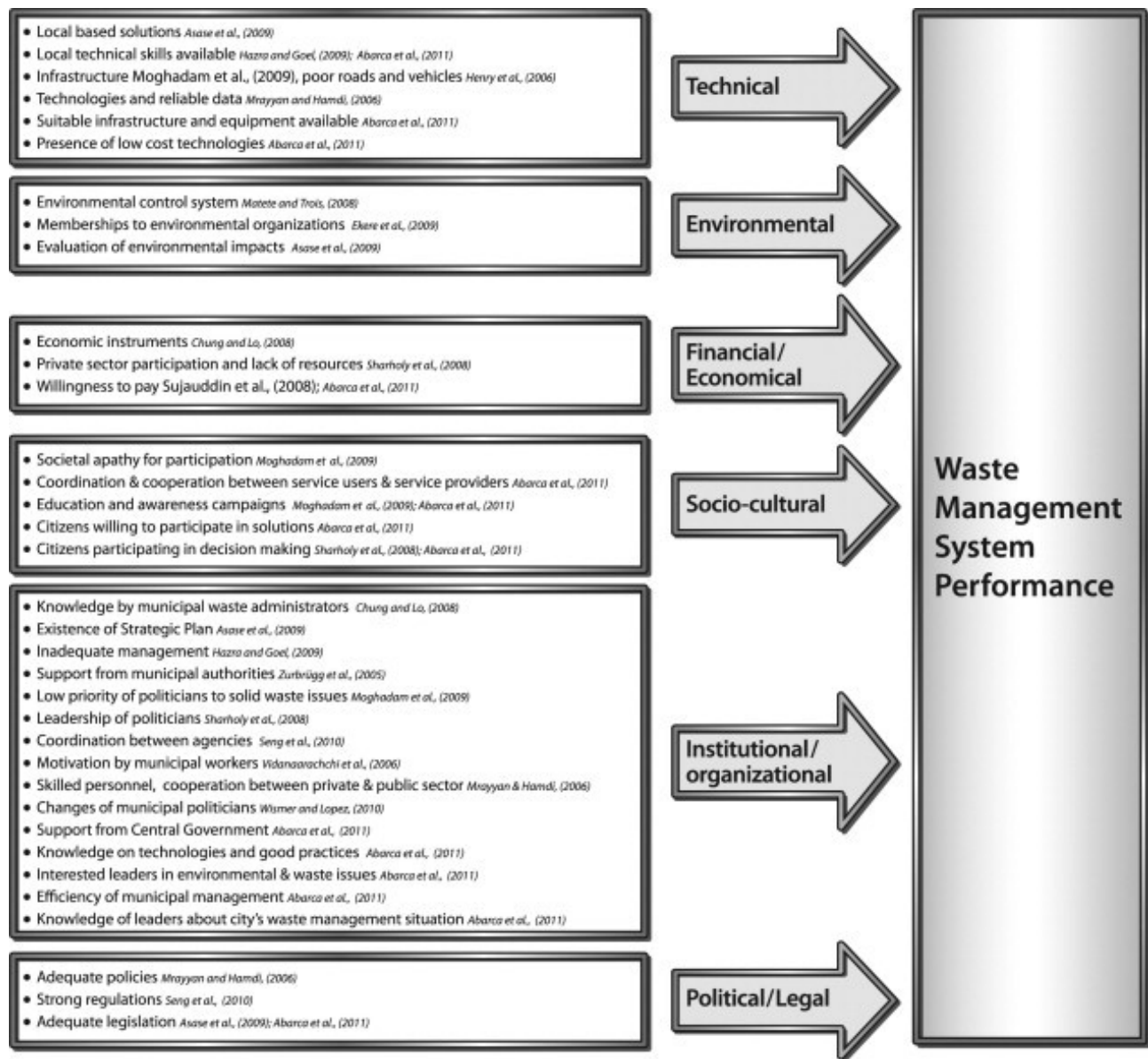
Figure 2: Factors that influence the aspects of waste management systems. (Guerrero et al. (2012)

3.1 Methodology

The adopted methods used to achieve the aim of this work are stated below:

- Collection of data and social survey about the dumpsites

- Review of some literatures on waste management

- Spatial distribution of dumpsites and analysis of waste composition at each dumpsite

- Suggesting possible solution for waste management for sustainable built environment based on the analysis of analysis of the wastes in the study area and from the review of literatures

3.1.1 Description of Study Area

Ilaro is situated on the rich cocoa belt of South Western Nigeria and with an above average rainfall. Geographically, Ilaro is bounded on the north by the Oyo Province on the South by Lagos and the east by the Egba Division and on the west by Dahomey (Republic of Benin). The boundary on the South is defined in the "Colony of Nigeria boundaries order in council 1913" (see page 311 of Vol. IV laws of Nigeria). It lies between 496505.830mE, 763173.51mN and 496435.980mE, 759321.670mN (Figures 3 & 4).
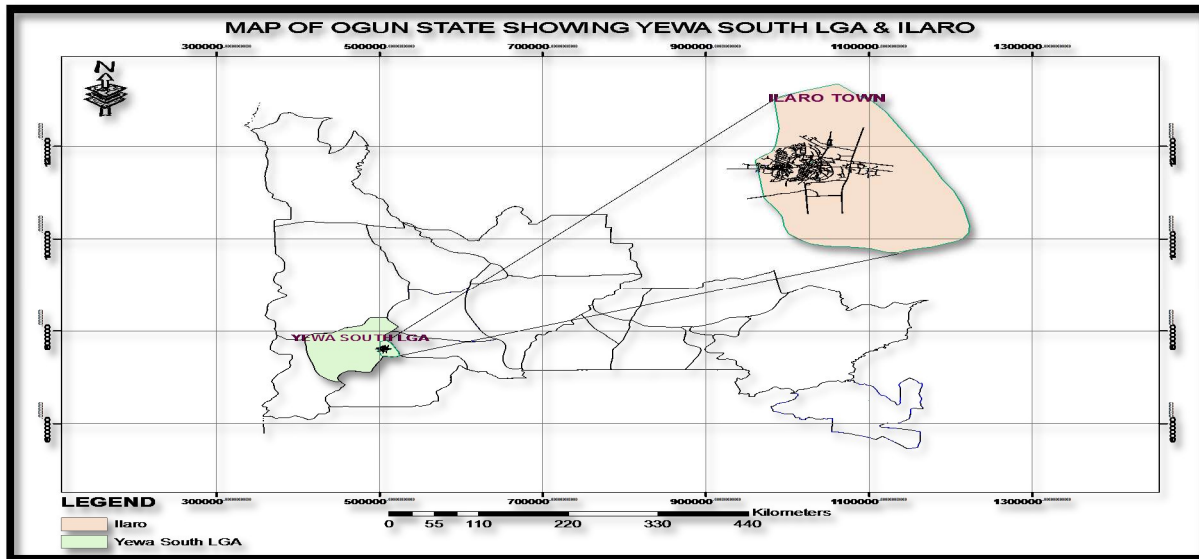

Figure 3: Map of Ogun state showing Yewa South LGA & Ilaro Town (Surveying & Geoinformatics department, Federal Polytechnic Ilaro)
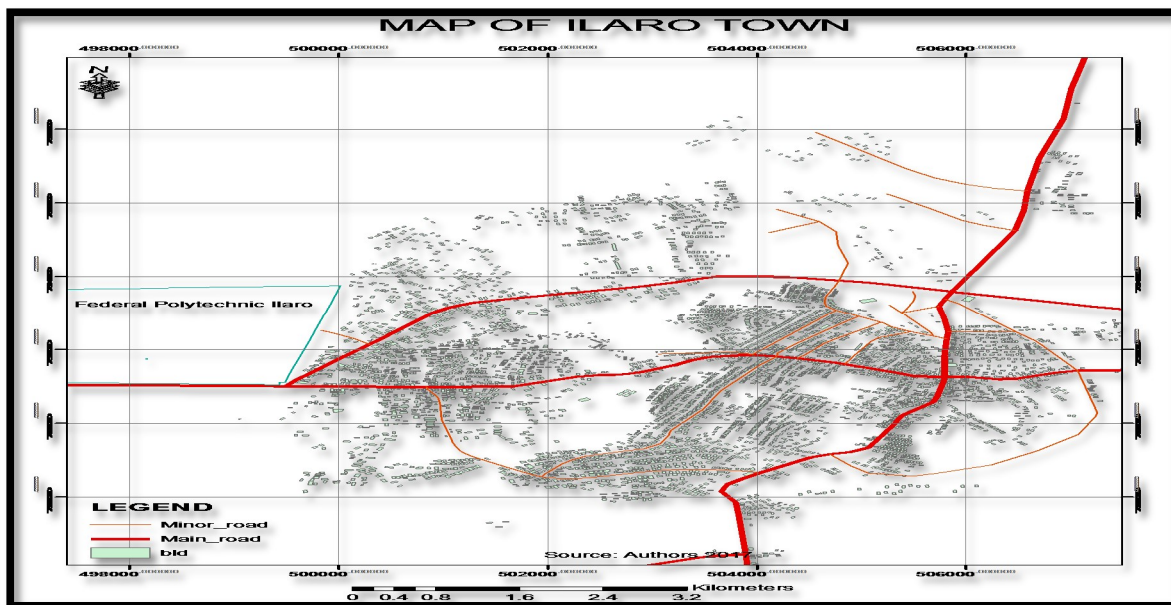

Figure 4: Map of Ilaro Town (Surveying & Geoinformatics department, Federal Polytechnic Ilaro)

3.1.2 Collection and Transfer of waste

The study showed that wastes are collected mostly at illegal fixed stations. Except for wastes from residential and commercial areas, institutions and industries do not have transfer stations for transporting wastes. They practice the open burning system. Residential and commercial areas and some schools do practice the open burning system or dispose of waste along road corridors, streams, and drainage channels or open areas where there are no commuters. Wastes collected at waste sites are classified into the following categories:

_ Paper = paper/book/printed materials

_ Pack = packaging materials

_ Can = can/jar/tin/metals

_ Plastic = plastic/polythene/rubber

_ Textile = textile/rags

_ Glass = glass/ceramic

_ Vegetable = vegetable/food waste

_ Wood = wood/grass/leaves

_ Miscellaneous

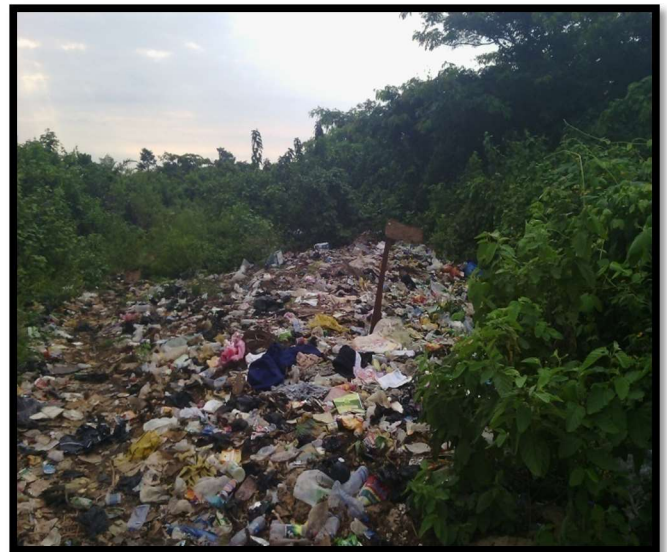**Figure 5: Illegal dump site along Ijado Road (Field study)**

Figure 6: Illegal disposal in an open ground (Field study)

3.2 Discussion of Findings

3.2.1 Waste composition of dumpsites in the study area

Below is an abstract of findings from field assessment of dumpsites in the study area. Table 1 below shows the category of wastes and the average volume of waste generated at the dumpsites on weekly basis for a period of two months.

Table 1: Average Waste Disposal in the Study area on weekly basis for a period of two months

| SN | LOCATION | EASTING | NORTHING | AVERAGE VOLUME (m³) | WASTE CATEGORY | | | | | | | |
| | | | | | COMPOSTABLE | | | | | NON COMPOSTABLE | | |
					PAPER	TEXTILE	FOLIAGE	WOOD	PACK	CAN	PLASTIC	GLASS
1	FPI	497859.99	762137.53	1.05	√	-	-	-	-	-	√	-
2	FPI EXPRESS	499056.95	761141.56	1.05	√	-	-	-	-	√	√	-
3	IJADO ROAD	499487.51	762085.59	130.90	√	√	√	-	v	√	√	√
4	IKOSI	499769.50	762826.98	0.52	√	√	√	-	-	√	√	√
5	EGBON	501096.08	764692.45	268.08	√	√	-	√	√	√	√	√
6	POWERLINE	502637.17	761949.63	78.54	√	√	√	-	√	√	√	√
7	UDOJI ROAD	502727.03	761295.42	102.62	√	√	√	-	√	√	√	√
8	ORITA	499722.23	761117.01	8.38	√	√	-	-	√	√	√	√

The findings reveal that paper and plastic are the most generated wastes which are biodegradable and non-biodegradable respectively while wood is the least generated. A common characteristic of the dumpsites is that all of them are situated along road corridors except Ikosi and Egbon road dumpsites (Figures 5 & 6). The dumpsites in the study area are more than the eight sites selected for this work but they have been reclaimed as a result development thus reducing the number. Out of these eight, Power line dumpsite remains the only government approved site but has since been neglected as a result of improper management. All its surroundings have been littered with refuse because it can no more accommodate the waste generated by the community.

Political instability is also a contributing factor. Waste management, in the study area is an ongoing challenge and many struggles due to weak institutions, chronic under-resourcing and rapid population increase.

There is no organized waste management system in the study area. Even the few corporate bodies and institutions in the area mainly practice the open burning system. All of these challenges along with the lack of understanding of different factors that contribute to the hierarchy of waste management will affect the treatment of waste in the study area.

3.2.2 Spatial distribution pattern of dumpsites

Spatial analysis show that waste distribution pattern in the area is dispersed (Figures 7 & 8). This implies that there is less than 1% likelihood (Figure 8) that this dispersed pattern could be the result of random chance. Non-spatial analysis show that paper and plastic are the most generated wastes which are biodegradable and non-biodegradable respectively while wood is the least generated.
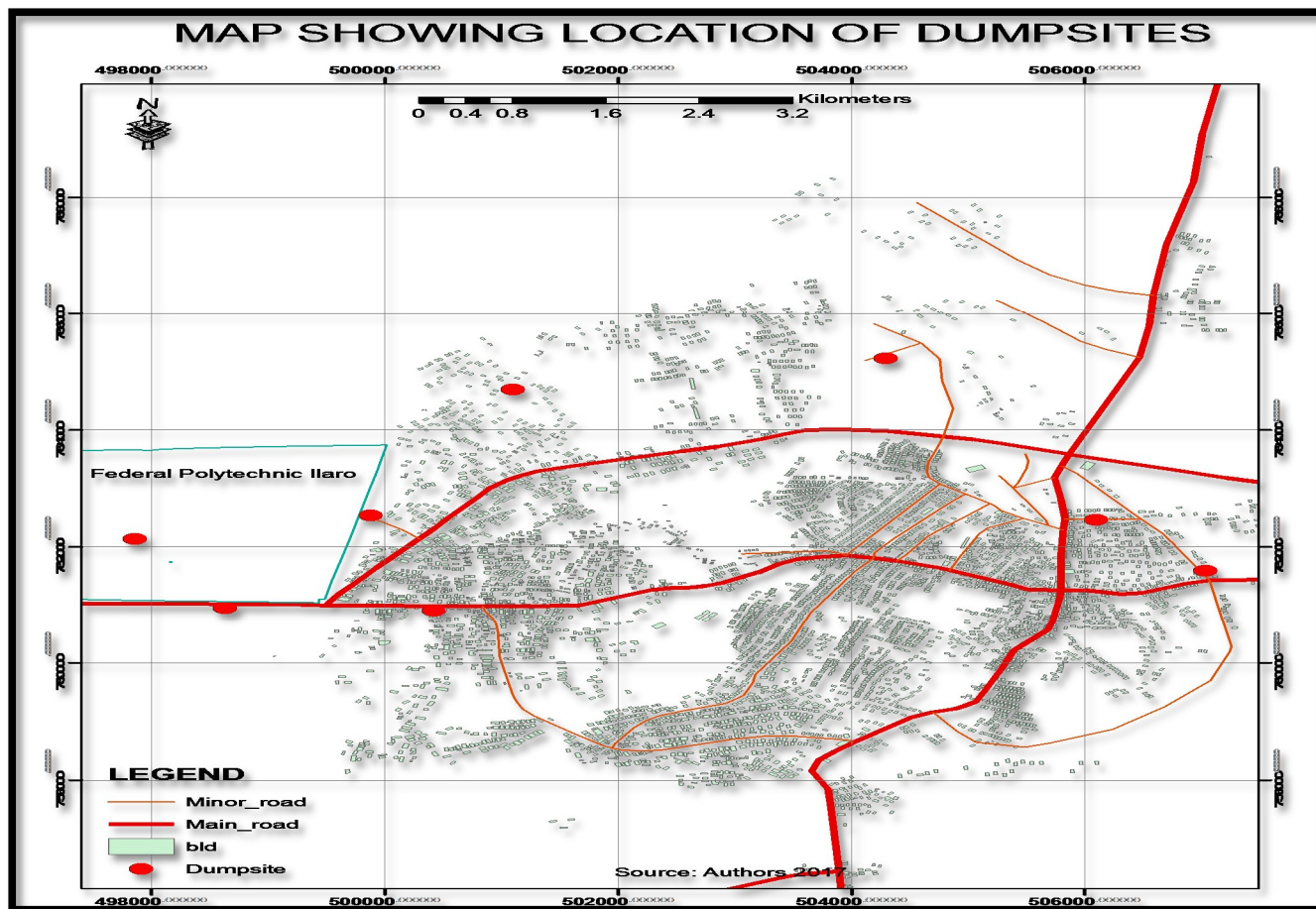

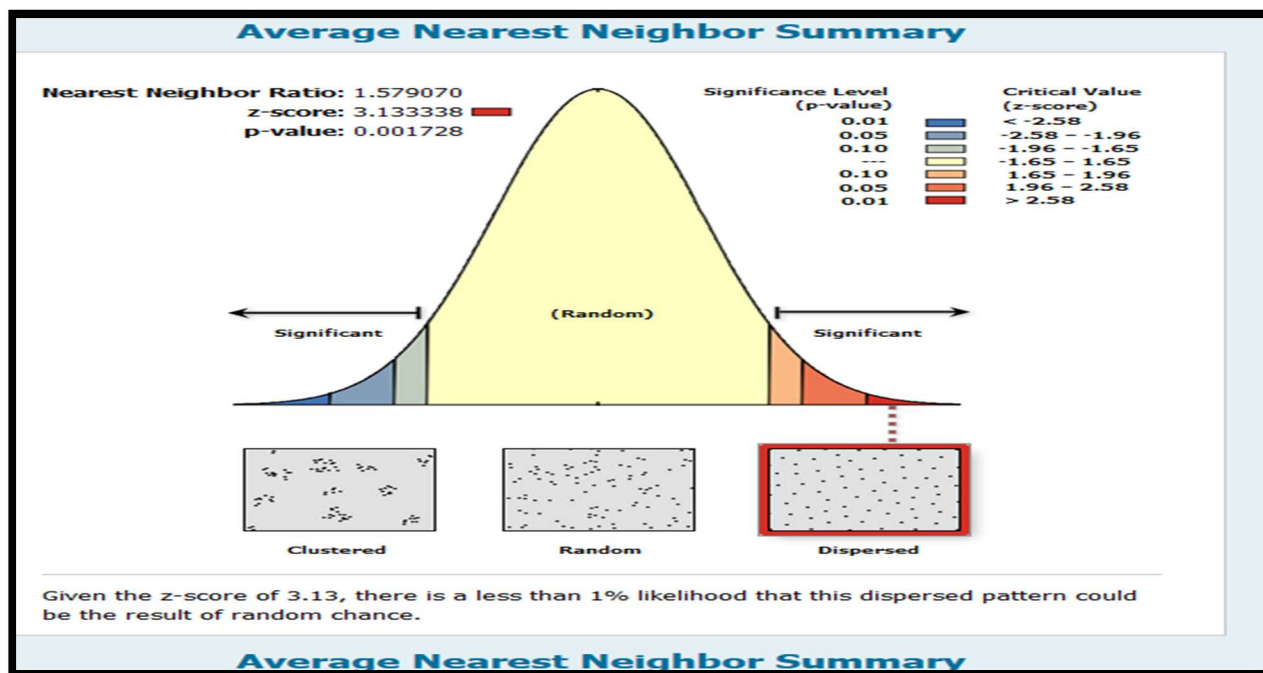**Figure 7: Spatial distribution of Dumpsites in the study area (Field study)**

Figure 8: Distribution pattern of dumpsites in the study area (Research Analysis)

3.2.3 Treatment

The study found out that very few private residential houses practice the local incineration of wastes while institutions and industries practice the open burning system

3.2.4 Final disposal

Most of the disposal sites in the study area are open dumps without leachate treatment. The town suffers from illegal disposal of waste into rivers, streams drainage channels, road sides and even beside some residential houses (Figure 9). Some of the waste disposal stations are being burnt while some are left increasing in volume for over long periods. If government or decision makers are interested in human health and waste management issues the wastes should be covered at disposal sites.
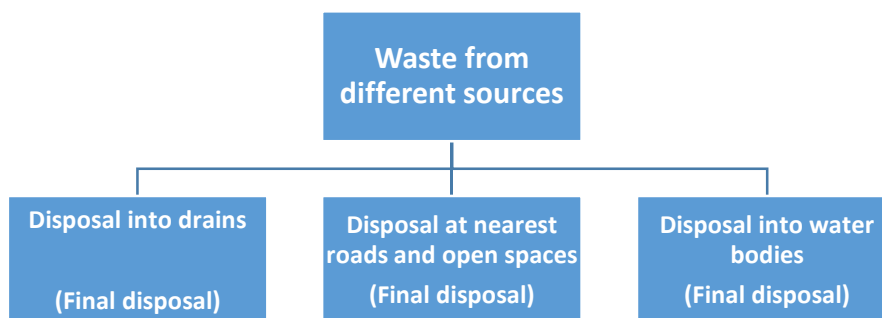

Figure 9:   Schematic diagram of existing manner of waste disposition in the study area (Field study)

3.3 Suggestions

3.3.1   Partnering and Awareness

There is need to initiate Participatory Hygiene and Sanitation Transformation program (PHAST) which should involve all residents, industries, institutions managements creating awareness about the risk involved in disposing wastes into water bodies, open grounds and road corridors etc.

3.3.2   Availability of Waste Containers

The absence of waste bins at different vantage locations within the community for throwing wastes is another challenge in waste, management. The distances of the residents to waste disposal stations is too far thus encouraging the residents to drop their refuse at any convenient locations. This occurs mostly at nights and especially during the rainy times. The refuse are washed down the drainage channels by the rain. The disappointment here is that what goes around comes around: the waste are only pushed to another parts of the community and this community suffers from the hazards posed by this waste.

3.3.3   Embracing Technology and the Reuse of waste

Technology has upgraded the conventional methods of waste disposal such as the modified composting barrel; chemical recycling and modern land fill methods. The modified composting barrel will reduce the volume of waste generated in the homes. It is eco-friendly, efficient and a sustainable solution to organic waste management alternative (Moqsud, 2010).

Embracement of technology in recycling of waste material will be a source of wealth creation to the economy. There is the need to encourage the recycling market that would employ more hands in the collection, separation and treatment of wastes for the recycling purpose, thus promoting employment opportunities for our teeming youths. Chemical recycling converts plastic materials into liquids or gases which are used in producing petrochemicals and plastics. The landfill system of disposal may not be source of revenue generation but a source of employment opportunity, although, it is mostly used today. It involved eliminating the odor and dangers in the waste before burying it underground. The recycled materials would be sold as raw materials or finished products for industries and firms at local prices thereby discouraging the importation of raw materials or finished products. This would also strengthen the nation's economic base. Technology has also shown that energy can be generated from waste in the form of heat or

electricity. This type of source of energy is renewable energy source as non-recyclable waste can be used over and over to generate energy. Plastics are used in a number of applications on a daily basis. Yet some plastic items end up in the waste stream after a single use only (single-life or cycle) or a short time after purchase, e.g. food packaging. Re-using plastic is preferable to recycling as it uses less energy and fewer resources (Al Salem et al, 2009)

3.3.4   Availability of Funds

Waste services provision is cost implicative as any other service provision. The adoption of the use of machinery for waste recycling requires huge capital investment. The participation of the government, private and public sectors to support with fund is essential for a sustainable waste management system. Aside from provision of waste containers, monthly charges on household, industries and organization should be brought to the minimum to encourage the users to pay and also serve as punishment for illegal disposal of refuse at unapproved locations should be implemented. This would serve as a deterrent for anyone who errs, thus compelling disposers to use approved disposal systems and paying the monthly disposal charges.

3.3.5   Adoption of New Waste Disposal Model

From the study of literatures reviewed and the existing waste disposal pattern (Figure 9), the model in figure 10 is envisaged for disposal system in the study area as against the existing direct disposal model (Figure 9).
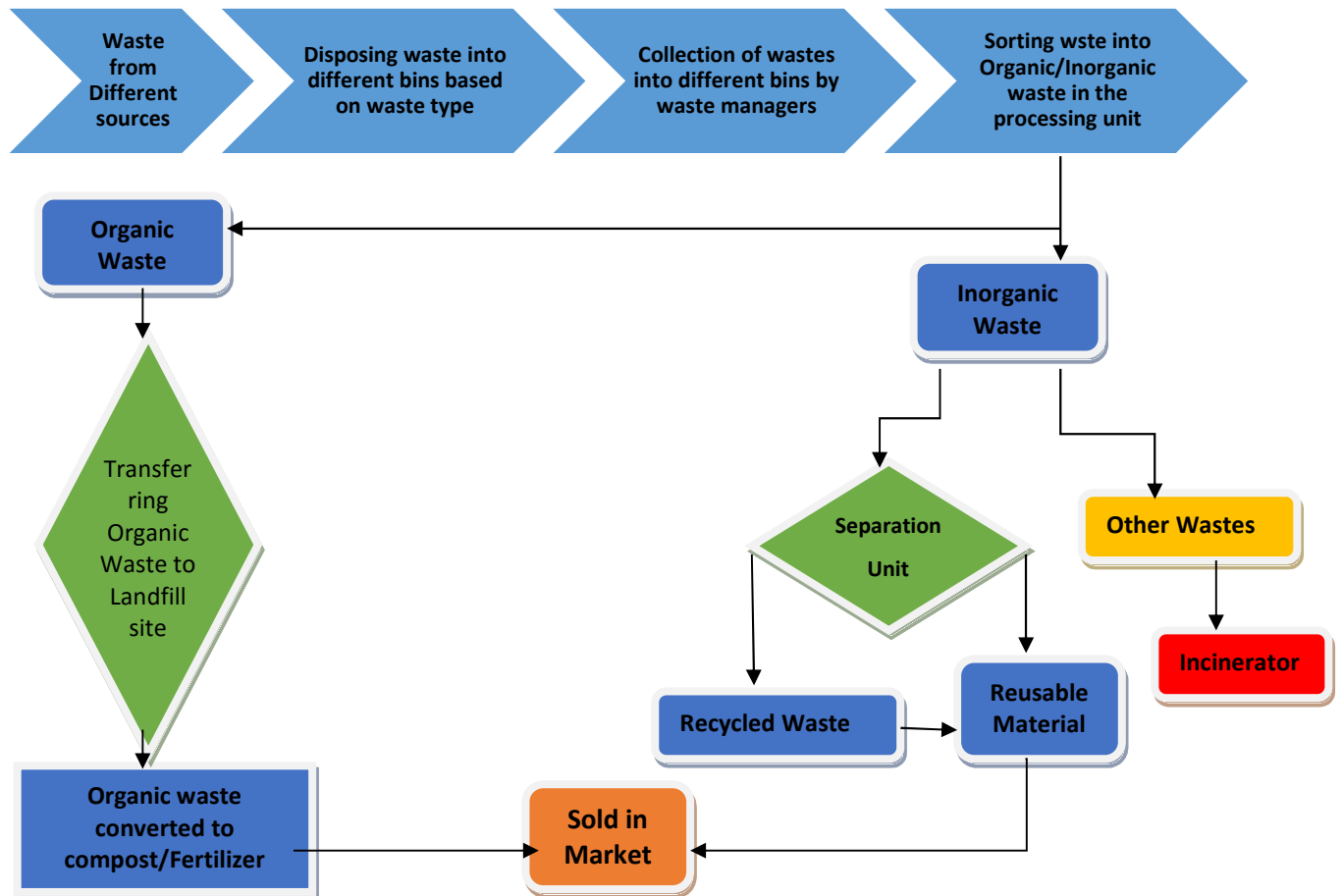

Figure 10: Schematic diagram of proposed waste disposal for the study area (Authors' Idea)

4   Conclusion and Recommendations

The characterization of household waste in the study area coupled with the reviews from literatures have provided detailed information on waste disposal, its composition and management in Ilaro town. In order to create wealth from waste generated in the study area through the use and re use of wastes, there is need for the understanding of the database (quantities and characteristics) of the wastes generated. This study also proposes to populate the database and use it as a feasibility study to establish whether the wastes generated should be reused or transferred to Landfill in the nearest future.

Works Cited

Al Salem S.M., Lettieri P., & Baeyens J. (2009). Recycling and recovery routes of plastic solid waste (PSW): A review. UK: Centre for CO2 Technology, Department of Chemical Engineering.

Chung S.S, & Lo C.W. (2007). Local waste management constraints and waste administrators in China. Waste Management, pp. 272-81.

Guerrero A., & Lilliana Abarca. (2012). Solid Waste Management Challenges For Cities In Developing Countries. Waste Management, pp. 220–232.

Helen M.H., Mohammad R.S., & Amir H.M. (2013). Municipal Solid Waste Characterization, Tehran-Iran. Pakistan Journal of Biological Sciences, 759-769.

Mohammed A.S., Lokman H., Satyajit R.D., Razak W., & Mohammed K.H. (2012). Generation and Assessing the Composition of Household Solid Waste In Commercial Capital City Of Bangladesh. International Journal of Environmental Science, Management and Engineering Research, 160-171.

Moqsud, M. A. (2010). Composting Barrel for Sustainable Organic Waste Management in Bangladesh. Japan: Institute of Lowland Technology, Saga University, Japan.

Riyad A.S, Hassan A., Rahman A., Alam M., & Akid M. (2014). Characteristics and management of commercial solid waste in Khulna city of Bangladesh. International Journal of Renewable Energy and Environmental Engineering, 7.