

**AN APPRAISAL OF PARTICIPATORY SOLID WASTE SORTING IN STAFF
RESIDENTIAL QUARTERS OF AHMADU BELLO UNIVERSITY, SAMARU
CAMPUS, NIGERIA**

BY

Zainab Dalhatu MUHAMMED

**DEPARTMENT OF GEOGRAPHY,
AHMADU BELLO UNIVERSITY,
ZARIA NIGERIA**

DECEMBER, 2015

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BY

**Zainab Dalhatu MUHAMMED
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**A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE, STUDIES,
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**DEPARMENT OF GEOGRAPHY,
FACULTY OF SCIENCE,
AHMADU BELLO UNIVERSITY,
ZARIA NIGERIA**

DECEMBER, 2015

DECLARATION

I declare that the work in this Dissertation entitled “Participatory Appraisal of Solid Waste Sorting in Staff Residential Quarters of Ahmadu Bello University, Samaru Campus, Nigeria” has been carried out by me in the Department of Geography, Faculty of Science, Ahmadu Bello University, Zaria. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this dissertation was previously presented for another degree or diploma at this or any other Institution.

Zainab Dalhatu MUHAMMED

Signature

Date

CERTIFICATION

This dissertation entitled “PARTICIPATORY APPRAISAL OF SOLID WASTE SORTING IN STAFF RESIDENTIAL QUARTERS OF AHMADU BELLO UNIVERSITY, SAMARU CAMPUS, NIGERIA” by Zainab Dalhatu MUHAMMED, meets the requirements governing the award of the degree of Master of Science Degree in Geography, Faculty of Science, Ahmadu Bello University, Zaria, Nigeria, and is approved for its contribution to knowledge and literary presentation.

Dr. R. O. Yusuf
Chairman, Supervisory Committee

Signature

Date

Prof. I.J. Musa
Member, Supervisory Committee

Signature

Date

Prof. I.J. Musa
(Head of Department)

Signature

Date

Prof. K. Bala
Dean, School of Postgraduate Studies

Signature

Date

DEDICATION

I dedicate this work to my parents, Prof. Dalhatu Muhammed and Khadija Uwa Muhammed.

ACKNOWLEDGEMENT

In the name of Allah, the Beneficant, the Merciful. All praise is to Allah the Lord of the world.

I like to start by expressing my unquantifiable gratitude and sincere appreciation to Dr. R. O. Yusuf chairman of my supervisory committee. In spite of his very tight schedules he was able to find time to go through even the minutest of detail in this work and for this, I have learnt a great deal. I also owe Prof. I. J. Musa, the member of the supervisory team, a debt of gratitude for his numerous contributions and criticisms, right from the conception of the topic, through the proposal and to the final report. The numerous relevant materials obtained from both supervisors cannot be forgotten.

I also appreciate the support and assistance rendered in a variety of ways by members of staff of Geography Department, Faculty of Science, Ahmadu Bello University, Zaria at various stages of completing this study.

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ABSTRACT

One of the indicators of sustainable waste management is re-use and re-cycle, but which can be cumbersome except when waste is sorted. This study is an appraisal of Participatory solid waste sorting in staff residential quarters of Ahmadu Bello University, Samaru Campus, Nigeria. The research objectives are to; assess the level of awareness and readiness, determine the population that sort waste, analyze the quantity of sorted waste material, identify motivational and hindering factors to solid waste sorting, and examine socio economic, environmental and health implications of solid waste sorting. Systematic sampling method was used by drawing a list of four areas selected when arranged alphabetically and well structured questionnaire was used to get information from respondents. It was revealed that a total of 140.5kg of vegetable waste was sorted from the other waste materials. It was also discovered that there is no waste sorting facilities on the campus. In terms of waste generating, Area 'A' had the highest (56kg) followed by Area 'BZ' (41kg). Findings also show that 38% of the respondents from Area 'A' and 29% from Area 'BZ' claimed that inadequate space for keeping separated recyclable items, lack of economics/incentive and absence of modern sorting equipments hinder waste sorting. More over, 28% of respondents agreed that the hindering factor was lack of awareness from the University authority. The conclusion is that waste sorting is being practiced but at a small scale. The recommendations are that, the government, non-governmental organization and international institutions can play vital roles such as building networks among partners, providing technical and logistical advices know-how and capacity building opportunities and providing developmental assistance mechanism in cooperation with other programme and development agencies.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

In many developing countries in Africa, getting control of various waste streams from households, congested market places and unplanned industries make their proper handling, treatment and disposal a serious problem (Cointreau, 2000). These wastes, which are often littered around in greater, unsorted quantities, eventually find their way in nearby streams and rivers, which subsequently become polluted (United Nation Environmental Programme, 2002).

Ahmadu Bello University, Zaria is one of the first generation universities in Nigeria. It operates both on and off campus residential systems for both staff and students. The waste management practice of off campus is similar with the town, but on the campus particularly in the staff residential quarters, waste management is an integral part of the Ahmadu Bello University (ABU) health and environmental management subsystem.

An assessment of waste sorting efforts is a research that is contributory to the large picture of efficient waste management and environmental management.

Department of Environmental Affairs and Tourism (DEAT) (2007) noted that in main cities like Cape Town, Durban, Johannesburg and Tshwane, efforts are clearly exerted and there are solid institutional frameworks in place to facilitate waste collection, transportation and management, including sorting, recycling and proper disposal. However, there are clear evidences of massive accumulation of waste especially in poorer settlements around city outskirts and in townships, where there is need for attention to support waste management

In the traditional approach to solid waste management, the local authorities are responsible for disposal of domestic solid waste. However, there is a growing tendency towards illegal disposal of waste by residents mainly due to the fact that local authorities are failing to execute their duty of waste collection (Manyanhaire, Sigauke and Munasirei, 2009).

On the other hand, 'sorting of waste' can be said to represent socially desirable behavior, and it has been regarded as a voluntary contribution to improving the welfare of any given society at large. However, since the socioeconomic situations in society are continuously changing; different perspectives develop on how to explain the various ways in which individuals choose to behave (Trehjørningen, 2010).

Waste sorting or selective sorting is simply a process used to separate waste on the basis of its composition. It is carried out by individuals and industries and then more precisely in specialized sorting centres. Waste reclamation is dependent on sorting. Among other things, it is used to separate recyclable waste from other waste (Lexicon Multimedia Glossary of Science and Technology (LMGST) 2010).

In developed and developing countries, alternative management options for waste are now recognized as important approach to solving waste problem such as; Waste avoidance, reduction, recycling, reuse and composting. Resource recovery from dumped consumer products is growing in significance, as waste is increasingly seen as a valuable resource. As human beings continuously realized that resources are finite, efficient use of resources and resources recovery from wastes are vital for global sustainability (Zaman and Lehmann, 2011).

As urban centers grow in socioeconomic characteristics, diversity of waste results in differences of waste generated which can be managed for various purposes including

sorting. This is rarely investigated at micro level. Hence this is the focus of this study in Ahmadu Bello University community, Samaru, Zaria.

1.2 STATEMENT OF RESEARCH PROBLEM

Global population is expanding and this puts a lot of pressure on our natural resources and environment (Shirley, 2006). Encouraging waste reduction across all levels of society, including at household level; through awareness and education campaigns play an important role in the success of any reduce, re-use and recycling initiative. Consequently, CSIR, (2011) opined that the socio-economic conditions prevailing in a specific municipality must be taken into consideration when establishing waste management programmes, as well as when deciding on the type of communication campaign to use.

Recycling is a realistic possibility for sustainable waste reduction. Residents (household) motivation to sort domestic waste (goods) before disposing of them, thus, lower the cost of business and perhaps make recycling a more lucrative and effective industry worthy of more local, state and federal support (Rwanda Solid Waste Collection and Biomass Recycling Project, 2010).

Thøgersen (2003) asserted that households under a pay-by-weight scheme sorted more of their waste for recycling, which is consistent with economic theory. However, when controlling the other variables, the author emphasised that the behaviour can be attributed only to the price effect, but also has to do with the fact that the price mechanism has enhanced norms as well as perceived self-efficacy which are factors affecting motivation. On the contrary, Geller, Winett and Everett (1982) had earlier observed that attempts at improving environmental behaviour by using monetary incentives and communicative strategies, only have been successful in a shorter time period. When

incentives were removed, behaviour returned to earlier levels. Thøgersen (1994), on the other hand was of the view that “behaviour that is reinforced by an incentive will become habitualized”. However, the fact that behaviour is based on personal norms and automacy; crowding out effect of moral behind sorting, could have been the case if the norm behind the act continuously was reconsidered and behaviour was undertaken only based on external incentives.

Muktar (2011) was of the view that, scavenging reduces the amount of solid waste to be disposed and also helps to save the natural resources that leads to sustainable development. It creates jobs and extra income for people especially the poor. Scavenging makes people to sort out materials from wastes in exchange for money and supplies raw materials for recycling enterprises.

Hardoy, Mitlin, and Satterthwaite(2001) estimate that between one third and one half of all solid waste generated in Third World cities remains uncollected and the collection rate could be as low as 10 – 20 percent in some cases. Depicting a similar picture of the problem, Cointreau (2001), has estimated that in some cases, up to 60 percent of solid waste generated within urban centers in poor countries remains uncollected and such refuse accumulates on waste lands and streets, sometimes to the point of blocking roads. Moreover, uncontrolled solid waste disposal can also cause environmental problems like traffic congestion on the streets and roads, municipal floods when dumped on waterways (Lawal, 2011).

According to Solomon (2009), it is estimated that an average Nigerian generates about 0.49kg of solid waste per day with households and commercial centers contributing almost 90% of total urban waste burden. Little information exists on industrial, agricultural and biomedical waste profiles. As with most developing countries, a greater percentage of solid

waste composed of organic matter, but recently there has been a marked increase in the amount of plastic wastes generated in Nigeria.

Pothimamaka (2008) researched on community learning process: a model of solid waste reduction and separation in Bang Sue District, Bangkok Metropolis, Thailand. The author combined both quantitative and qualitative research methods. The study notes that the best practice of solid waste management in developed countries is reduction of waste generated at the source. The study revealed that most people in advanced countries are taught how to deal with solid waste by separating it in their homes, schools and work places. This however, is not the case in many developing countries, such as Kolkata, India because for instance Chattopadhyaya, Duttadand Ray (2011) reported a complete absence of segregation of waste at source, limited house-to-house collection and the use of very old vehicles in waste collections. This is no doubt applicable to Nigeria as well.

Post (2007) conducted a study on investigation into waste reduction strategies in Jamaica. The author specifically focused on women participation in solid waste management in order to meet the waste reduction goals set forth by the Jamaican governments. Both qualitative (through in-depth interviews with national and regional institutions within the solid waste management system) and quantitative (through questionnaire survey on the household) research methods were employed. The findings revealed that the greatest potential for initiating waste reduction strategies exists at the household level through community-based programs. The diversion of food waste from the waste stream is currently achieved through the practice of domestic animal feeding.

Troschinetz (2005) also investigated recycling of municipal solid waste in developing countries. The author identified twelve factors influencing sustainable recycling in developing countries, while considering the three dimensions of sustainability –

environment, society, and economy. The factors were derived from quantitative and qualitative examination of twenty-three case studies of developing countries. The factors were then subjectively designated as either a barrier against or an incentive toward recycling, based on interpretation of statements made in the individual country-specific case studies. The twelve factors identified are: government policy, government finances, waste characterization, waste collection and segregation, household education, household economics, other variables are Municipal Solid Waste Management (MSWM) administration, MSWM personnel education, MSWM plan, local recycled-material market, technological and human resources, and land availability. Post (2007) suggests that recycling may not be the best option for Jamaica at the present time based on the presence of few existing incentives. Except composting, since about 50% of household waste is organic material.

In a Nigerian case study, Imoh and Emmanuel (2011) investigates the domestic waste management practices in Uyo, Nigeria, with a view to determining the types of waste generated, storage, sorting, transportation, disposal and impacts on environmental quality. Using a table of random numbers, four wards were selected in each zone for sampling. The authors' reported that in the three zones (i.e. high, medium and low income residential areas of Uyo) there was the absence of waste separation at source. They also indicated that neither government nor any organized private sector was involved in waste sorting. However, waste sorting at dump sites by scavengers is reported across the three zones. The highest total weights were generated in the middle income zone while the lowest values were reported in the low income zone where waste storage in polythene bags was also common. Daily collection of waste was confirmed in the high income zone where as waste

littering characterized by overfilled receptacles was common in the middle and the low income zones respectively.

Adekunle *et. al*, (2012) assessed population perception impact on value-added solid waste disposal in developing countries using Port Harcourt as a Nigeria case study. Qualitative research survey and structured questionnaire were employed. They revealed that no participant really sorted waste materials at source; rather, an overwhelming majority (81%) mixed or mingled their wastes together in a given waste bin and 19% practiced indiscriminate disposal. By this, they disposed of their waste materials at convenience, without discretion on environmental impact of such an action. This, cumulatively, gave a total of 100% of the study population involved in non-segregation of waste at source.

In another study, Ukoje (2011) analyzed the participation of stakeholders in solid waste management in Zaria, Nigeria. The study considers the framework for participation and character of relationships between stakeholders. The author utilizes the cluster and random method of sampling to select the neighborhoods, households and stakeholder groups for data collection. The study revealed that there is a lack of recognition and cooperation with non-public institution stakeholders in the solid waste management framework in Zaria. Also there is inadequate collection and disposal of solid waste by the stakeholders. As such other categories of waste like sorting of domestic waste were not discussed.

Quite a number of studies on waste management have been conducted. The advanced economies have developed a very rigorous waste management framework which ensures efficient waste collection, storage, transportation and disposal while minimizing the impacts of disposal on the environment. In addition, there is emphasis on waste sorting, re-

cycling and re-use including other practices which help to save waste management costs (Chattopadhyaya, Duttad, and Ray, 2011).

An observation of the residential areas of ABU reveals that a lot of waste lie unsorted and are packed together. Given the elitist characteristics of residents in the quarters, it is expected that environmental awareness and contemporary waste management especially waste sorting would be imbibed. The contrary picture has presently given a concern which deserves a research attention.

Provided with the immense socio-economic and environmental benefits of waste sorting, there is a need to exchange the skills and other attitudinal requirements between environmental management practitioners and the populace through a participatory framework. This can only be done if a systematic analysis is undertaken to ascertain the level of awareness of and readiness of people to adopt a behavioural change on waste sorting. Moreover, none the studies accessible (Pothimamka, 2008, Chattopadhyaya, Duttad and Ray, 2011; Post, 2007; Troschinetz, 2005; Imoh and Emmanuel, 2011; Ukoje, 2011 and Adekunle *et al*, 2012) paid any attention to participatory approach to solid waste for waste reduction particularly in Ahmadu Bello University, Zaria, Kaduna State Nigeria. This constitutes the subject of research discourse and a gap to be filled by the study. The research questions posed are as follows:

1. are people aware of and ready to adopt waste sorting in residential quarters of ABU.?
2. what is the proportion of the respondents that engage in sorting their solid waste ?
3. what is the quantity of waste materials being sorted and what are they used for?
4. are there motivations or hindrances to waste sorting over space?
5. do waste sorting have socioeconomic, environmental and health implications?

1.3 AIM AND OBJECTIVES

The aim of the study is to appraise solid waste sorting participation in Ahmadu Bello University (ABU), Zaria, Main Campus, Kaduna state, Nigeria. The specific objectives are to:

- i. asses the level of awareness and readiness to adopt solid waste sorting by residents of ABU.
- ii. determine the proportion of respondent engaged in sorting their solid waste and types of waste materials sorted.
- iii. analyze the quantity of sorted solid waste materials and their utilization in the study area.
- iv. identify the motivational and hindering factors to solid waste sorting across the staff quarters.
- v. examine the socioeconomic, environmental and health implications of solid waste sorting.

1.4 SCOPE AND LIMITATION OF THE STUDY

The purpose of this study is to appraise solid waste sorting for waste reduction in Ahmadu Bello University, Samaru, Quarters, Zaria, Kaduna state, Nigeria. The spatial scope of this work will cover four (4) residential areas on Samaru Campus areas of Ahmadu Bello University, Zaria. These include; Area 'A', Area 'C', Area 'E' and Area 'BZ'. These areas were chosen based on the availability of data on the residents' within the areas earlier mentioned. Samaru district where Ahmadu Bello University is captured by indication is part of the four (4) districts of Sabon- Gari Local Government Area in Zaria namely; Samaru district, Zaria city district, Tudun Wada district, and Sabon-Gari.

This study therefore examined solid waste sorting and recovery in residential quarters (areas) of the institution. The focus is limited to solid wastes which include: waste from consumable items and vegetables, household appliances and furniture; since they are the items that are common and can be easily sorted and recovered in the units. The study also addressed issues on personal sorting of waste from households, their perceptions on waste sorting, benefits derived from the activity, continuity with the exercise in terms of support, among others. Since waste generation and disposal is a daily affair, the temporal scope of the work is limited to six months including period of organization of the field work, actual survey and participatory analysis.

1.5 JUSTIFICATION FOR THE STUDY

Assessment of waste sorting is needed partly to change people's attitudes and behaviour towards ensuring a cleaner environment. While many current initiatives lead to visually cleaner areas, it does not encourage sustainable practices that reduce littering and illegal dumping in the long run. More thorough and rigorous investigation is required on level of awareness of sustainable waste management using the waste management hierarchy. As such, waste minimization and waste separation at source need to be encouraged to enhance re-use, recycling and composting activities (CSIR, 2011).

Also this study will provide informative evidence on the volume of waste materials sorted, participation in domestic waste recycling, reuse and composting, need for using an economic incentive to promote sorting of household waste.s

CHAPTER TWO

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

2.1 INTRODUCTION

This chapter focuses on the theoretical perspective on participatory appraisal of solid waste sorting. It presents definition of terms and concepts relating to solid waste sorting participation. This is followed by a detailed discussion on awareness and readiness to adopt solid waste sorting. The chapter also discusses various classification of solid waste and analyses them. In this chapter, analyses and the need for waste sorting utilization were discussed as well as solid waste reuse and recycling in Nigeria. The motivational factors leading to solid waste sorting where the internal and external motivational models were discussed with the analytical framework for explaining behaviour are also included. The socio-economic, environmental and health implications for waste sorting were also looked into with particular reference to staff in residential quarters. Finally, empirical studies on solid waste sorting were discussed.

2.2 CONCEPTUAL FRAMEWORK

2.2.1 Solid Waste

Solid waste according to UNEP (2002) is a substance or object which is disposed off or is intended to be disposed off or is required to be disposed off by the provisions of natural law. Therefore, waste are those materials that are either useless in essence, overused, unwanted or discarded in a particular time (Sangodoyin, 1979). Solid wastes are any solid materials which are no longer needed in a place. It is also described as the heterogenous mass thrown away from urban community as well as more homogenous accumulation of agriculture, industrial and mineral wastes.

Oluwande, (2007) argued that all kinds of waste including household, agricultural, industrial or mineral wastes share certain common features. Wastes generally refers to all unwanted and economically unusable or accidentally thrown into the environment (UNEP, 1994, Gerrams, 1994, Van Beukering *et al*, 1999). It could take the form of refuse (i.e. those results from floor sweeping, heating and cooking) garbage (i.e merely organic materials discarded or remaining as a result of storage, preparation and consumption of food), rubbish (all solid materials that vary from tiny pieces of papers, plastics, abandoned motor vehicles and packing materials) and dead animals (link to countries where domestic animals wonder about freely and they could be knocked down by moving objects (Oluwande, 2007).

Man is a social animal and his activities have great impact on the environment he lives. The environment also is significant to man and other living and non-living things (Arroyo, 2006). In most developing nations such as Nigeria, open dumping of solid wastes into wetland, water courses, drains and borrow pit is a prevalent form of disposal. This practice that often resulted in the littering of the surroundings creates eyesore and odour nuisance (Ihuoma, 2009). More so, according to Wilkinson (1990) poor refuse collection and disposal remain one of the major health and developmental problem in Nigeria. It is also a major cause of mortality especially in the country as it exposes people to diseases causing organisms and various pollutants.

Waste has in recent times become Nigerian's most serious environmental problem. This problem has become so aggravating that between 1977 and 1982, a total of nine conferences and meetings of local government commissioners were organized in various states across the country to discuss problems of refuse collection and disposal (FEPA, 1983).

According to the Global Waste Management Outlook (GWMO, 2015), the total waste generation is around 7 – 10 billion tones per year globally out of which Municipal Solid Waste account for 2 billion tones per annum. Per capita waste generation tends to increase by approximately 2010 until the year 2100 due to the population expansion, urbanization, economic and social development.

2.2.2. Waste Sorting

Sorting of waste is by no means a new phenomenon (Frey, 1997). Proper sorting of waste is one of the most fundamental elements for promoting effective recycling. If different types of waste are mixed, recyclability of the waste becomes degraded, while the quality of the obtained secondary materials becomes poor. Hence, the grade of waste to be recycled, which is defined by a mixture rate of different types of waste, seriously affects recyclability of waste and the quality of secondary materials (Jenkins *et al.*,2003).

Separating the different elements found in waste streams is essential for enabling the recovery of useful materials, minimizing the amount of materials sent to landfill and allowing recyclable materials to find a new incarnation (Mooris, 2008). Frey, (1997) noted that companies sort and recycle materials in order to extract value.

There is a clear link between social and economic development and sustainable waste management. Collection rate vary widely between countries and regions from 98% in high - income countries to around 30% or worse in low – income countries, (GWMO, 2015). An estimated amount of 2 billion people still lack access to solid waste collection services.

Effective recycling relies on effective sorting (Keseret *al*, 2012). With a wide range of sorting technologies on the market today, European citizens will not have failed to notice that, the sorting of waste, particularly at a household level, is becoming increasingly

important. While the various EU countries currently take different stances on how and which waste to separate, the trend will be; to separate as much useful waste as possible and deal with it in the most appropriate manner. Separating the different elements found in waste streams is essential for enabling the recovery of useful materials, minimizing the amount of material sent to landfill and allowing recyclable materials to find a new incarnation.

According to Keseret *al*, (2012) in June 2008, Members of European Parliaments voted to reshape the waste framework directive and the new rules are that; each country will have to set and adhere to its own targets on waste. In terms of recycling, the new legislation states that 50% of all household waste and 70% of all construction waste must be re-used or recycled by the year 2020, so the need to make sure sorting processes are as effective and economical as possible is of paramount importance.

2.2.3 Participatory Appraisal

Participation implies in learning to express and engage in self determined action and intervention. Participatory research is a research which involves participants in making inquiries, communicating perspectives, interactive processes where all sides need to be reflective and analytical in decision making (Jones, 2003)

The Oxford English Dictionary defines participation as “the action or fact of partaking having or forming a part of”. Oakley and Marsden (1984) agree that participation is a process and not just a solid project; however, they are quick to note that it is very difficult to establish a universal definition for participation. Schwarz, (1993) sees participation as getting involved in or taking part in an activity by individuals, groups at all levels. The author noted further that, participation in domestic solid waste disposal and recycling at household level is critical to assess and analyse.

Participatory appraisal is a family of approaches and methods which enable communities to share , develop and analyze their own knowledge of life and conditions (Chambers 1996). By empowering local people to conduct their own modes of investigation, communities can plan and act (Chambers 1996) on their own outcomes, developing more community based solutions. Participatory appraisal involves the researcher ‘handing over the stick’ to enable local people to control their own level of input and take ownership of the outcomes. The process involves starting from where people are, with a regard for them by outsiders (researchers) as main subjects and not objects for research (Inglis 1996). Principally, an interactive rather than extractive approach should be adopted by the researcher. There should be a respect for local perceptions and choices of both outcomes and involvement in the process. Individuals participating in the appraisal can give as much information as they feel comfortable with. More importantly, no one has to take part in the process, it is a question of choice and participants are actively involved in a voluntary basis (Alaszewski, 1996).

Chambers, (1996) traced the origins of participatory appraisal to late 1970s with the development of rapid rural appraisal as family of approaches. Chambers (1996) suggestion were among the paralleled moved in different parts of the world to learn about rural life and conditions. Tools used in participatory interviews or group meetings include brainstorming, mapping, ranking and diagramming. Essentially participatory appraisal in this research is employed for its adaptability and some of the non-traditional ways in exchanging Knowledge and practice about sorting between residents and the researcher.

Recycling provides a source of income, helps to conserve scarce resources and reduce the quantities of waste requiring disposal. Recycling rate depend on keeping material streams separate, clean and in high concentrates. (ISWA, 2014)

2.2.4 Motivational factors to Waste Sorting

Sorting of waste is by no means a new phenomenon and it is of interest to assessing the effect of an inclination of an economic incentive because it is doubtful that the desired behavior can solely be explained by economic motivation. Research has found that, introducing external motivating factors; like economic incentives, in contexts where internal motivation dominates, may lead to a crowding out of the internal motivation. A shift to a dependency on the external motivation may thus occur for maintaining the behavior based on internal motivation (Frey, 1997).

2.2.4.1 Intrinsic Motivation Model

Some researchers are of the view that individuals behave following motives coming from within: they are “induced by inner feelings” (Frey, 1997:13). Intrinsic motivation can be defined as motivation coming from within by the underlying desire or pleasure experienced by performing the action. The reward is the activity, which leads to the feeling of pleasure or desire (Frey, 1997). Theory on motivation suggests that intrinsic motivation can be both motivated, but also substituted by external incentives. For example, Frey (1997) has suggested that, in the psychological process, external incentives like economic incentives undermine intrinsic motivation due to what he calls the ‘the hidden cost of reward’, which has a function of crowding out the original motivation. Thøgersen (1994) finds that the inner feelings may be affected in different ways, and presumably by the outside interferences. He further holds that “a person’s own interest in the behavior becomes discounted when he or she is given an extrinsic reason for doing something he or she would have done anyway” (Thøgersen, 2003:198).

Motivation plays a significant role for explaining behaviour. The Figure 2.1 gives a clear overview of the different types of motivations. Internal motivation is constituted by

personal norms and social norms, and may if or when transformed into reutilized behavior, transform into habits. Habits are persistent behavior, which may be difficult to alter because the reasoning behind the behavior eventually is lost when reutilized. Expansion of the utility function is another theory that can also be a part of internal motivation. Through the achievement of good feelings and warm glow, increased self-image and so forth by acting, the individual is motivated in continuing the behaviour.

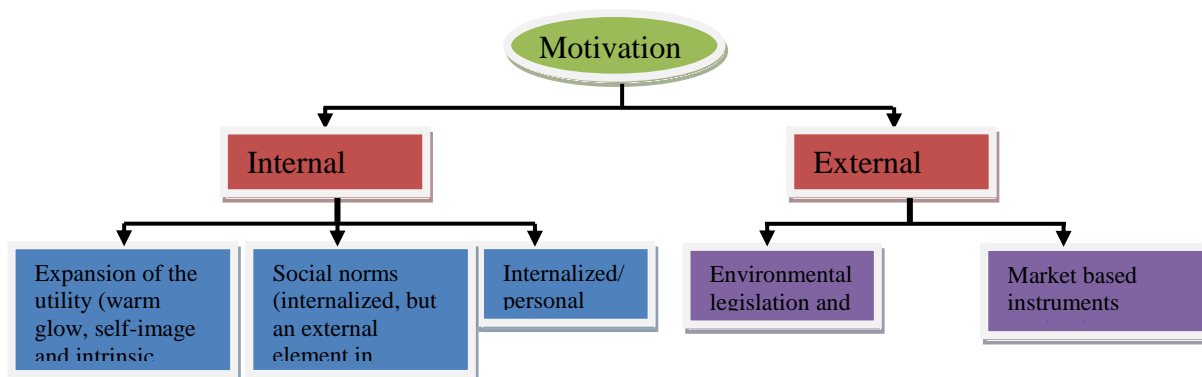


Figure 2.1 Different motivations

Source: Gutberlet (2013)

External motivation is motivation based on external incentives. This can be legal prohibitions or market based instruments like economic incentives, which intends to promote desired behavior by “changing the relative costs and benefits of environmentally beneficial behaviour in order to make it profitable for the individual to behave in accordance with the collective interest” (Thøgersen, 1994:409). Additionally, external motivation has the ability to create norms by influencing on individuals’ interpretation of the importance of the reason for implementing external incentives.

2.2.4.2 Analytical Framework for Explaining Behaviour

Many factors may play a role in shaping motivation behind socially desirable behaviour. Domestic waste sorting is based on economic incentives to promote socially desirable behaviour in making individual favourable to comply. Sorting can take place without external incentives that is through voluntary basis. Therefore, since sorting of waste

has not been enforced by formal law at any time, and perceived as a voluntary act, other explanations should be added. Vatn's (2005) and Ajzen (1991) postulated relevant theory explaining various factors influencing the choices made by individual's on behaviour as indicated in Figure 2.2.

Vatn's (2005) framework for analyzing issues regarding use of resources is mainly depending on attributes of the resource and available technology, agents and agent's choice, institutions and patterns of interaction. Ajzen's (1991) framework 'theory of planned behaviour' holds subjective norms, attitudes and perceived behaviour control to be important for the individual's intentional behaviour because intention and perceived control are factors explaining behaviour.

In the modified framework for this study, the upper left box represents attributes of the resource, which in this case will be equal to the perceived possibility of action based on the type of housing the respondent posses. The middle left box represents institutions like

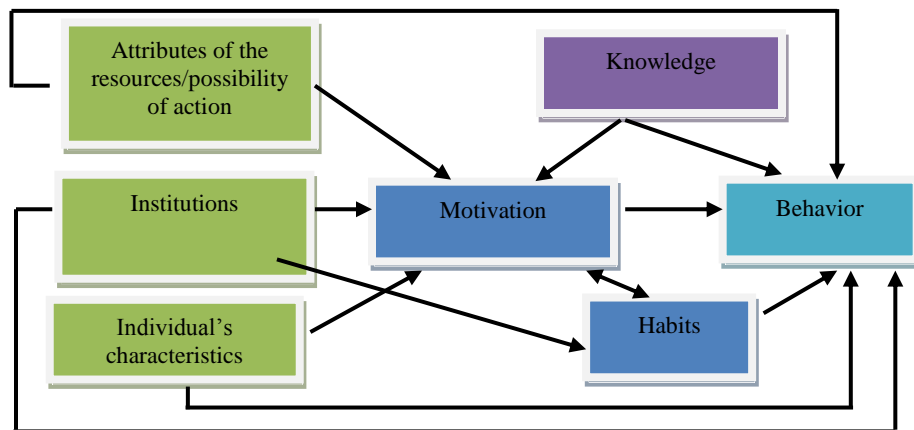


Figure 2.2: Framework for analyzing behaviour
 Source: Vatn (2005)

conventions, norms and legal rules. The lower left box represents characteristics of the individuals, including socioeconomic variables. According to Gutberlet (2013) attributes of the resource/perceived possibilities of action, institutions and individuals' characteristics all have the potential to influence an individual's motivation and behavior, as well as on habits.

2.3. LITERATURE REVIEW

2.3.1 Awareness and Readiness on Solid Waste Sorting

Usage of products and services is part of our everyday lives that causes huge amounts of waste. However some of these waste can be prevented (Egunjobi, 2006). Social consciousness, inner motivation and some other factors can have a strong effect on waste sorting efficiency (Jenkins *et al*, 2003). The decision not to sort is made due to a possibility to do so; it depends on infrastructure, knowledge and other physical factors such as time and other inconveniences (Evison and Read, 2001).

Willingness to sort can be substantiated in motivation, which can be divided into internal and external motivation. Internal motivation and behaviour are substantiated by person's opinion, awareness and self-respect. The external motivation is based on someone's influence. All forms of both internal and external motivations lead to sorting (Halversen, 2004).

The absence of a strong awareness campaign on indiscriminate waste dumping and household individual , as well as government commitment, stringent rules and regulations the general tendency in big cities is for people to dispose off their domestic wastes as quickly and conveniently as possible, often leaving large volumes of more complex residual wastes(Palmer, 1978).

Some people's sorting awareness habit is born out of introduction of new rules and demands can be confusing in the first run, but a longer perspective will increase a possibility to change society's mind; new rules can become a background for awareness. Henriksson, *et al*, (2010) pointed out factors behind awareness and readiness to sort to includes lack of information and knowledge on the need to sort waste before disposal, individual behaviour due to personal motivation, inconvenience, impracticality, age, or disability, insufficient amount of certain types of recycle waste, place of residence, lack of sorting tools, the size of residence plays an important role, skepticism which comes from local authorities, media, family and low profit stimulus.

One reason not to sort waste is that neighbours would know what products are used in ones household. The elderly people and persons who live in the outskirts of the city, low income earners, less privilege persons wants to sort the least (Jesson, 2009). There are some people who suggest integrating economical and social motivation to sort waste. According to them, authorities should economically stimulate waste sorting, but they should not constrain or punish those who do not sort, because this action has to come from their own consciousness by so doing , people will be aware and ready to sort their wastes (Gunter, 2007).

Arroyo (2001) explained that a well-planned city will abort the piles of solid wastes which are dumped in the outskirts. The approach as he further suggested is on providing information to the community on environmental issues. Oluwande (2001) suggested that these planned information and education activities should include: mass media training, group campaigns, video forums, pamphlets and house-to-house visits. Waste dumping on streets will be successful if the awareness materials focuses on: conveying short and clear messages, highlighting personal responsibilities and obligations of individual in

maintaining clean and healthy conditions, defining the role of the municipality as regards to its potentials and limitations, informing on the duties and responsibilities of the individuals and community in cooperating with the municipality and informing on the advantages of cleanliness in the promotion of health.

Arroyo, (2001) appraised women as key to influential awareness campaign strategy for maintaining a healthy and clean household. Arroyo's findings revealed that women show keen interest in improving sanitary conditions. Oluwande (2001) opined that women are more liberal and the best time to contact them are found to be between 10:00am and 2:00pm when children are at schools and men at work, thus, giving enough time for women to discuss on general and individual problems of waste management. In another similar study, Ahmad (2002) maintained that keeping a well appreciated environment is the responsibility of women and one directly affected by inadequate waste management at household and community level.

According to Wikipedia (2010), waste sorting is the process by which waste is separated into different elements. In every aspect of human life, several un-wanted materials (Newspapers, broken bottles, aluminum cans, flower trimmings etc) are generated. Sorting and recycling of waste have numerous benefits and is also environmentally friendly compared to the other methods of waste disposal (Ojo, 2001). Sorting and separation of municipal solid waste is gaining importance in various sectors. According to Henry *et al*, (2005) with the increasing cost of raw materials, recycling provides a cheaper source of raw materials for manufacturing industries. An accurate knowledge of the quantity and composition of the waste input is essential to the success of a resource recovery undertaken or knowledge of several other properties of solid waste

which are also required for proper planning, designing and operation of waste management programme (UNEP (2002)).

UNEP (2002) also noted that local residents' preferences for particular types of waste services, their willingness to pay for the services, their willingness to source separate recyclable materials and their capacity to move waste to communal collection points, all have an impact on the overall waste system. Incentive can therefore affect residents' preferences and behaviour.

2.3.2 Waste Sorting Practice

Waste sorting is the process by which waste is separated into different elements (CTMA, 2004). Waste sorting can occur manually at the household and collected through subscriber collection schemes, or automatically separated in materials recovery facilities or mechanical biological treatment systems. In every aspect of human life, several unwanted materials (newspapers, broken bottles, aluminum cans, flower trimmings, etc) are generated. These materials are discarded simply because they are considered waste to that effect. The total stream of waste generated within a community is often categorized into municipal waste, industrial waste, constructional and demolition waste (CTMA, 2004).

In June 2008 Members European Parliaments voted to reshape the waste framework directive and the new rules are that each country will have to set and adhere to its own targets on waste. In terms of recycling, the new legislation states that 50% of all household waste and 70% of all construction waste must be re-used or recycled by the year 2020, so the need to make sure sorting processes are as effective and economical as possible is of paramount importance.

2.3.3 Sorting Methods

Hand sorting is the first method used in the history of waste sorting (Gunter, 2007). Waste can be sorted in civic amenity (Cointreau and Sanra, 1998). More Waste Management World Articles, (2009) pointed out that waste disposal companies dealing with the sorting of materials commonly use one or more of the following five methods:

Trommel Separators/Drum Screens: These separate materials according to their particle size. Waste is fed into a large rotating drum which is perforated with holes of a certain size. Materials smaller than the diameter of the holes will be able to drop through, but larger particles will remain in the drum.

Eddy current Separator: This method is specifically for the separation of metals. An ‘eddy current’ occurs when a conductor is exposed to a changing magnetic field. Put simply, it is an electromagnetic way of dividing ferrous and non-ferrous metals. Induction Sorting Material is sent along a conveyor belt with a series of sensors underneath. These sensors locate different types of metal which are then separated by a system of fast air jets which are linked to the sensors.

Near Infrared Sensors (NIR): When materials are illuminated they mostly reflect light in the near infrared wavelength spectrum. The NIR sensor can distinguish between different materials based on the way they reflect light.

X-ray Technology: X-rays can be used to distinguish between different types of waste based on their density.

2.3.4 Benefits and Constraints of Solid Waste Sorting

UNEP (2005) proposed and identified the following benefits and constraints of solid waste sorting .Some of the benefits include:

1. Employment for individuals who engaged in recycling of especially aluminum cans and materials into cooking utensils.

2. Feeds for livestock from the organic waste particularly during the lean season.
3. Help door-to-door service providers to sell faster when sorted especially to waste scavengers, the metals and plastics and will make some saving
4. Selling of metals and plastics to waste scavengers, the quantity of waste for collection organizations and the cost of disposal will be reduced.

Constraints of solid waste sorting:

1. Consuming time of the waste sorters and thus discourages its practices
2. Have no direct use for households
3. Expensive because of the cost element in the purchasing of the different waste collection containers and sorting equipment.
4. Lack of space in households for the waste collection containers.

Benefits of Recycling also include but not limited to:

- Reduction in the amount of waste and resources lost in landfills or burnt;
- Prevention of pollution by reducing the need to collect new raw materials;
- Saving energy needed to make new products from raw material;
- Reduction of greenhouse gas emissions that contribute to global climate change;
- Helps in sustaining the environment for future generations;
- Helps in creating new well-paying jobs in the recycling and manufacturing industries (UNEP, 2005).

2.3.5 Classification of Solid Waste

Waste as the name implies is any unwanted materials, substances or object resulting from industrial, institutional, hospital and household activities which could be in the form

of rubber, plastic, metal, paste, oil, organic matter and other similar commodities. It is solid or liquid, renewable or non-renewable degradable or non-degradable. American Public Works Association described solid waste as useless unwanted or discarded materials with insufficient liquid content to be free flowing. Because of its 'stickly' nature, therefore, solid waste has the quality of accumulating and physically insulting the environment, if not well managed, it is this propensity that sets solid waste apart from other forms of waste.

Ojo (2008) explained that waste is whatever form nuisance that are found in residual from home, businesses and institutions when left unchecked and poses serious challenge to both community, the government and referred to it as fresh garbage, rubbish, refuse discarded and thrown away that enters a local collection system for disposal. Wilkinson (1990) classifies solid waste into three categories: Solid, Liquid and Gaseous wastes. On their parts Feacham *et al.*, (1976) explained that solid waste can be classified in different ways: the first is the division of solid wastes or refuses into two broad groups: domestic and industrial solid wastes, secondly, simple system that recognizes three categories of solid wastes namely animals, vegetable and minerals.

Adedibu (1998) revealed that solid wastes are non-gaseous and non-liquid wastes resulting from a range of community, industrial, commercial and agricultural activities. He further grouped solid waste into eight classes namely: domestic, municipal, industrial, agricultural, institutional, pesticide, residential and hazardous wastes. Sangunuga (2001) stated that the dominant types of waste includes: municipal waste, solid waste (Household refuses), hazardous waste and electronic waste. Waste must be sorted at source in order for it to be recycled. Some types of waste are collected at your homes but you can also dispose it at collection points and container parks. Companies maintain contacts with specialized

regional government institutions to manage their commercial and industrial waste (Fischer *and* Crowe,2000).

2.3.5.1Municipal Waste

Municipal wastes refers to “wastes from domestic, commercial, institutional, municipal and industrial sources but excluding excreta, except when it is mixed with solid waste”. It is worth to note that in many developing countries, it is difficult or impractical to put a line between excreta and solid wastes. Solid wastes mixes with excreta to the extent of being potentially hazardous to human health (Cointreau-Levine and Coad, 2000). However, in a more simpler form Oladipo (2012) stated that municipal wastes includes refuse from households, non-hazardous solid waste from industrial and commercial establishments and refuse from institutions (including non-pathogenic waste from hospitals) market waste, yard waste and street sweepings sometimes construction and demolition debris is also included.

Municipal solid wastes generally can be classified in terms of three major sources of generation as residential, commercial, and industrial. Sometimes, institutional sources are separated from commercial sources and, thus a fourth source is referred to as institutional. In the traditional scheme of classification, residential (domestic) solid waste consists of household garbage and rubbish, or refuse. The garbage fraction is mostly in the form of wastes derived from the preparation and consumption of food (e.g., meat and vegetable scraps). Traditionally, all wastes not classified as “garbage” are classified as “rubbish.” The major constituents of rubbish include glass, metal and plastic wastes, yard and garden debris, wastepaper and paper waste (Adewole, 2009).

2.3.5.2 Household Refuse (solid waste)

Oluwande, (2001) opined that household waste also known as garbage is not very different from municipal waste. The author also distinguished household refuses to vary according to the caliber of living, custom, climatic condition and other factors within a community since both the quality and the quantity of refuse vary with social status of the people in different parts of the community. In lower class where the majority of the refuse by the people are leaves used in wrapping food items. In middle class where the people are literate working class, the refuses contain about 30% leaves and 40% garbage while in government reservation areas the bulk of the refuse is garbage (Oluwande, 2001).

2.3.5.3 Hazardous Waste

A special class of waste known as hazardous waste, mostly discharged into the environment from industrial and related sources attracts special attention and management considerations because of their harmful nature to man and other components of the ecosystem. A waste classified as hazardous waste, by definition and convention usually has one or more of the following four characteristics: Ignitability, Corrosivity, Reactivity and Toxicity. This definition shows that a wide range of substances of different physical form; (liquid, gaseous, solid) fall into the class serious environmental and epidemiological disasters as a result of the lack of or inadequate handling and management of these wastes (Oladipo, 2012).

2.3.6 Need for Waste Utilization

Waste avoidance/reduction, recycling, reuse and composting as alternative management options for waste are now recognized as important approach to solving waste problem both in developed and developing world. Resource recovery from dumped consumer products is growing in significance, as waste is increasingly seen as a valuable resource. As human beings continuously realized that resources are finite, efficient use of resources and

Table 2.1: Categories of waste that can be sorted

S/N	Types	Description	Warning
	Glass	Empty bottles and jars without cap or lid. In most municipalities, clear glass and coloured glass must be separated. New glass containers are made from the recycled glass.	Ceramics, tempered glass, Pyrex or fireproof glass, mirrors, window panes and light bulbs must not be included in the glass waste, but disposed of with bulky waste at the container park.
	Paper and Cardboard	Newspapers, magazines, boxes and similar must be sufficiently clean to be recycled.	Paper tissues, kitchen roll, stickers, juice boxes, carbon paper and wallpaper, dirty or grease paper and cellophane paper are not recyclable as paper and should be kept separately and disposed of in the regulation bag for non-sorted waste.
S	Plastic or Metal and Drink Waste	Packaging made of Plastic or Metal and Drink cartons are used for recycling purposes to make new packaging, textile fibres, etc.	Butter wrappers, plastic pots (eg. yoghurt pots), packaging for hazardous and poisonous products, plastic bags and aluminium foil must not be included with the PMD waste. Put these in the regulation bag for non-sorted rubbish.
	GFT and organic waste	Greens (vegetables), Fruit and Tuinafval (garden waste), trimmings, grass and leaves are compostable. This waste can be collected at your home. It is also easy to compost it yourself or to take it to the container park.	Timber used for construction, charcoal and mussel shells are not suitable for composting.
	Small hazardous waste or small chemical waste	Syringes, fluorescent lamps, detergents, cosmetics, paint and varnish, used oil, pesticides and similar are harmful to the health and the environment.	They need to be collected separately. Batteries should be deposited in the many BEBAT collection boxes in supermarkets, petrol stations, etc.
	Building Waste	Car batteries, Asbestos cement	Waste containing asbestos is not accepted in the Brussels Capital Region container parks. You can call on the services of companies that specialize in handling asbestos.
	Reusable Textiles	Clothing, Shoes, bed linen and similar are picked up at your home or collected at the container park, in textile containers or kringloopcentra.	
	Discarded Electrical and Electronic Appliances	Refrigerators, televisions, computers, washing machines and similar can be handed in for free at the container park.	

Source: Fischer and Crowe (2000)

transformation of materials from one state to other. Therefore the idea of waste is a situation according to our intents and purpose, something unwanted or useful, is taken as waste.

The growing environmental awareness, the subject of waste management in a cost effective and eco-friendly perspective is gaining foot for protection of environment and derivation of value added wealth from waste (Sangodoyin, 1993). UNEP (2002) stated that many technological developments are now in process in different parts of the world for utilization of the by-product waste materials. The report summarized the immediate advantages of such re-cycling as: lower specific consumption of basic raw materials, lower production cost, higher product yield and less pollution and better environment.

Ojo, (2008) noted that solid wastes having wide-ranging impact on environment are divisible into three categories: waste which,s are hazardous and having little or no value added perspective, was which are not hazardous and recovery, recycling and reuse of valuables in it could be done economically and was which are hazardous and must be treated stably before throwing them as waste. In many cases, these solid wastes contain valuable materials, which can be recovered and recycled in the process. Recycling and utilization of these solid wastes through an integrated waste management approach have gained special significance due to several facts such as economic advantages, augmentation of primary resources, better and cleaner environment, conservation of energy and water through compliance with the law. (Ghosh and Sinha, 1990).

Various waste management concepts are used and they include the “3R’s” (Reduce, Reuse and Recycle). The United Nations Environmental Programme (UNEP) defined integrated waste management as “a framework of reference for designing and implementing new waste management systems and for analyzing and optimizing existing systems” (Solomon, 2009). The “3R’s” relates to strategies to minimize waste before land filling: reduction of waste generation, reuse of waste materials for different applications rather than disposing of it and recycling waste to extract materials of value for use in the

production of new products. Four basic interactive strategies have been identified by the United States Environmental Protection Agency to manage waste i.e source reduction, recycling (including compositing), waste-to-energy conversion and land filling (Solomon, 2009).

2.3.6.1 Solid Waste Reuse and Recycling in Nigeria

The knowledge of waste recycling and reuse is not a new one in the Nigeria context; it is the current sophistication involved that is rather new. Waste facilities in developing countries are substantial quantities and are diverted for recycling (Tajudeen, 2003).

There has been an emergence of biodegradable solid waste in the production of organic fertilizer and possible use in the production of biogas. Some researchers have studied the great potential in Nigeria's municipal solid wastes to produce enormous amount of methane gas (Yusuf and Oyewumi, 2008). Mixtures of manure and ashes from burning of urban solid wastes have been used for soil amelioration to boost agricultural productions in Jos (Pasquini and Alexander, 2003). Abeokuta alone generated 2.288m^3 of wood wastes per day from Saw Mills activities (Ania, 2006). If each state in Nigeria generate equal amount of wood wastes, then $82\,368\text{m}^3$ of wood wastes will be generated in the country per day and $30,064,320\text{m}^3$ annually.

2.3.7 Socio-Economic, Environmental and Health Implication of Poorly Sorted Solid Waste

Nigeria is among the third world nations that is witnessing an unprecedented growth of cities in recent times. This is very obvious from the estimated rate of urbanization or urban expansion which is put at 3.6% per annum through the higher growth figure of above 6% which have been recorded in cities such as Lagos, Kano, Ibadan, Kaduna, Abuja and Port-Harcourt.

The country's high population figure has series of implication on every aspect of people's socio-economic and cultural life style. With the pressure in urban population, existing facilities such as water, electricity, road, educational institutions, housing become inadequate and solid waste generation and disposal take unprecedented precarious dimension (WHO, 2006). The research further revealed that an estimated 20kg of solid waste is generated per capita per annum in Nigeria while Lagos alone generates over 10,000 tons of solid waste daily.

(Abumere, 1983; Adedibu 1998) opines that the nature and composition of solid waste generation is a product of the climatic and business activities of the urban centers. Abumere (1983) in study of soil waste generation in Ibadan examined the effects of socio-cultural factors on land use pattern such as housing density, eating habits. Omuta, (1988) explained that the increases in population, uncoordinated growth of development and expansion of commercial activities have impact on socio-economic setup of the city. The city Omuta, (1988) said has been plagued with virtually unmanageable rate of refuse littering the major streets in the city, this reflection on the poor refuse management techniques in the city.

Ojo (2008) stated that waste sites are source of contamination for children due to the incubation and proliferation of flies, mosquitoes and rodents, and they in turn are disease transmitters that affect people's health, which has its organic defenses in a formative and creative state. The author went on that the situation produces gastrointestinal, dermatologic, respiratory, genetic and several other kind of infectious diseases. Wastes that are not managed properly, especially solid wastes from households and community are a serious health hazard and lead to the spread of infectious diseases the report further stated that unattended wastes lying around attract flies, rats, and other creatures that in turn spread

diseases. Normally, it is the wet waste that decomposes and releases a bad odour. The bad odour affects the people settled around or next to them. The group is at risk from this unscientific disposal of solid waste includes the population in the areas where there is no proper waste disposal methods especially the pre-school children (UNEP, 2002).

Arroyo (2001) explained that exposure to hazardous waste in dump sites can affect human health, children being the most vulnerable to these pollutants. Direct exposures can lead to diseases through chemical exposure as the release of chemical waste into the environment leads to chemical waste poisoning. The study showed a connection between health and hazardous waste, that waste from agriculture and industries can also cause serious health risks and further noted that co-disposal of industrial waste with municipal waste can expose people to chemical and radioactive hazardous. Health care waste and other medical waste disposed in dump sites mixed with domestic waste, increases the risk of infection with Hepatitis B and HIV and other related diseases.

According to Achankeng (2003) a major environmental effect of dump sites is not directly transferred from land to people, except in the case of dust and direct contact with toxic material. Pollutants deposited on land usually enter the human body through the medium of contaminated crops, animals, food products or water. Henry *et al.*, (2005) highlighted that in a number of health survey a wide range of health problems, including respiratory systems, irritation of the skin, eyes and nose, gastrointestinal problems, psychological disorders and allergies, have been discovered. They noted that in dump sites closer to residential areas of feeding place for dogs and cats. These pets, together with rodents carry diseases with them to nearby homes.

2.3.8 Empirical Studies on Waste Management

Waste sorting is an important process in recycling and safe disposal of waste materials (Achankeng, 2003). In Nigeria reality recognizes that around 90% of municipal waste goes to landfills (Egunjobi, 2006), thus, resources are lost and pollution of soils and atmosphere and consequently cause harm to man and the environment (Egunjobi, 2006). According to sociologists, social, economical and environmental factors form society's opinion about waste sorting. Society's behaviour is formed not only by opinion, moral virtues but also by ethnic and cultural affiliation, age and place of residence (Bulkeley, 2005). According to UNEP (2005) sorting and recycling of waste have numerous benefits and is also environmental friendly compared to the other methods of waste disposal. Sorting and separation of municipal solid waste is gaining importance in various sectors. Henry (2005) maintained that with the increasing cost of raw materials, recycling provides a cheaper source of raw materials for manufacturing industries.

An accurate knowledge of the quality and composition of the waste input is essential to the success of a resource recovery undertaking or knowledge of several other properties of solid waste are required for proper planning, designing and operation of waste management programme (UNEP, 2005). In a another similar research conducted by Abagale *et al.*,(2012) in Ghana on knowledge of sorting waste materials at household level indicated an average percentage (85%) did not have knowledge on sorting materials, this is an indication that education on sorting of waste has not been undertaken there.

On readiness to sort, UNEP (2005) noted that, local residents' preferences for particular types of waste service, their willingness to source separate recycle materials, their willingness to pay for the service and their capacity to move waste to communal collection points, all have an impact on the overall waste system. Incentives can therefore affect resident's preferences and behaviour. In addition Abagale, *et al.*, (2012) investigate the

willingness of house wives to sort wastes. It was revealed that about 66% of the respondents were willing to sort their waste provided the necessary facilities were made available. The provision of especially different skip containers for residents area coupled with education on solid waste sorting was indicated to yield good result if implemented.

However, this was contrary to the finding of Henriksson *et al.*, (2010) where the result indicated that respondents would like to get more information about the effects of various types of waste onto the nature and environment and about the positive influence of sorting them. Achankeng, (2003) studied why people did not sort their waste and the result shows that respondents did not want theirneighbours to know what products are used in their homes. The researcher stated that elderly people and persons who live in the outskirts of the city, or in a smaller residence, or are less paid workers are likely to sort their waste.

A research covering Lithuanian population in general was carried out in summer of 2012 by Vilmorus, (2012). It was revealed that close 26% of the population sort always or almost, 32.2% sort sometimes and 41.% never sort very seldom. Looking at the social status, only 9% of the house-wives and women on maternity leave have indicated they are always or almost sorting. Willingness to contribute to waste recycling, saving of natural and energy resources were indicated as the main reason for sorting, the same as it was in Sweden. More educated population is more active in sorting. 33% respondents with higher education sort always or almost always (higher than average), while 33% never sort, or almost never (lower than average).

According to UNEP (2000) frequent public education and convenient collection services are a necessary requirement for successful household solid waste sorting programme. The educational campaign must be comprehensive and simple and must come out from the implementing municipality or group of municipalities. Illustration of the

process of sorting must be picture oriented and must continue even after the scheme in an advisory and supportive manner. McDougall (2001) revealed that the degree of waste sorting achieved in any integrated solid waste management scheme is a function of both ability and especially the motivation of households. In their own opinion, that participatory rate in new sorting programme are very difficult to measure, since what people claim they will do and what they actually do are not the same. However, a convenient sorting programme couple with reliable and frequent collection rates increases participatory rate and sorting efficiency.

Un-Habitat (2010) argued that motivation of household may come in the form of provision of free or subsidized collection bins. Waste sorting is likely to rise if households can be offered a cost reduction for having less non-recoverable waste in their waste bins. However, UNEP (2005) believed for the system to be cost effective, the collection cost associated with sorting programme should be less than the revenue obtained through the sale of the materials. It is difficult to reach a general and overwhelming conclusion on what stimulates waste sorting and recycling. Some researchers are of the opinion that sorting should be discussed from economic point of view: the best is to set fair prices and conditions for free competition and in this way the effective waste sorting level would be reached (Ackerman, 1997). Another group of researchers and activists believe that recycled materials, stock and products should be sold under much lower prices than primary resources and products, whereupon consumers would be obliged to sort the waste (Morris, 1996).

There are some suggestions for developing a model of general balance according to which consumers should motivate producers to use less packaging, make products of simpler design, thus facilitating their recycling (Fullerton, 1998). There are some people

who suggest integrating economical and social motivation to sort waste. According to them, authorities should economically stimulate waste sorting, but they should not constrain or punish those who do not sort, because this action has to come from their own consciousness (Gunter, 2007). Chaz (2002) explained that four pounds of trash a day are generated by each man and woman and child in cities of developing countries in Africa. These wastes Chaz (2002) further analyzed to include substantial amounts of paper and cardboard (40%) as well as yard waste (18%), metal (9%), plastics (8%) and other products. If sorted, they can provide several benefits to the people, economy and environment.

Ahmad (2002) opined that women are responsible for maintaining a healthy and clean household, one directly affected by inadequate waste management at household and community level. However Ahmad was quick to add that while this kind of informal meeting with women proved positive, ethnic and religious background must be taken into consideration. This finding revealed that women who are more severally restricted to their homes differ from those other part of the country who are more liberal in their tendency to waste sorting and sanitation at large.

Arroyo (2008) suggested that meeting of influential people in community must addresses matters pertaining to community welfare and area of cleaning, as well as the appropriate communication methods to enhance awareness in solid waste management among the community. The confidence of community member it is essential to also address community sensitive issues of welfare and health that is not directly related with solid waste management. The author further advocated the support of activities such as the monthly or weekly environmental sanitation vaccination campaign against the spread of hepatitis B and assisting flood victims during rainy seasons.

Ojo (2008) believes the best method of disseminating information and education campaign on waste sorting is through the religious leaders either through the mosque and churches. The author further suggesting initiating an essay competition with prizes in primary/secondary schools on how to keep an area clean is the best method to reach the children in the community.

Etzioni, (1988) observed that household were faced by number of challenges, in the case of pro environmental behaviour and sorting of waste, negative externalities will be equivalent to pollution caused on the society by the waste from a household not sorted. According to neoclassical economic theory, “members of a household will seek to maximize their total utility, which is just another way of saying that members of households try to make themselves as well of as they possibly can be in the circumstances in which they find themselves” (Lipsey and Steiner, 1975 quoted in Etzioni, 1988:24). Thus, if sorting of waste is perceived as costly, undertaking the activity is not rational and should therefore not take place in the individual’s household. The same individual, however, will seek to reap the gains from others’ sorting of waste, and hence would want others to sort. Having reviewed some accessible literature on waste sorting, from different backgrounds and perspective, there is a need to examine the situation in Ahmadu Bello University residential areas. This will bridge the gap existing in the study area particularly among a elitist community in Nigeria.

CHAPTER THREE

STUDY AREA AND RESEARCH METHODOLOGY

3.1 INTRODUCTION

This study is on participatory appraisal of solid waste sorting in staff residential quarters of Ahmadu Bello University, (ABU) Main Campus Samaru, Zaria. The chapter deals with the area of study, study design, source of data, sampling technique and sample size as well as data analysis techniques.

3.2 THE STUDY AREA

3.2.1 Location of the Study area

Ahmadu Bello University, (ABU) Zaria lies between latitudes $11^{\circ}07'N-11^{\circ} 09'N$ and longitudes $7^{\circ} 37'E-7^{\circ} 39'E$. It is about 85 km north of Kaduna. ABU is situated within Zaria and the physical and socio-economic characteristics are similar with that of Zaria. The area lies between 300-900 metres above sea level (Ogunleye, 2006). ABU is located in Zaria but the residential area being considered is on Samaru campus of A.B.U. Zaria is a nodal town for both road and rail transportation modes.

It is a confluence of the north-eastern and north-western axes of the country. Zaria urban area as used here provides the human and socio-economic materials that contribute to waste in ABU. Zaria is made up of two local government areas; Sabon Gari and Zaria. Zaria comprises several suburbs such as Samaru (where in is located Ahmadu Bello University), HayinDogo, Zango, Palladan, Hanwa, Chikaji, Muchia, Government Reserve Area (GRA), Sabon-Gari, Gyellesu, Tudun-Wada, Tudun-Jukun, Tukur-Tukur, Zaria city and Wusasa. These suburbs grew differently, but have almost merged together to become an urban centre known as Zaria.

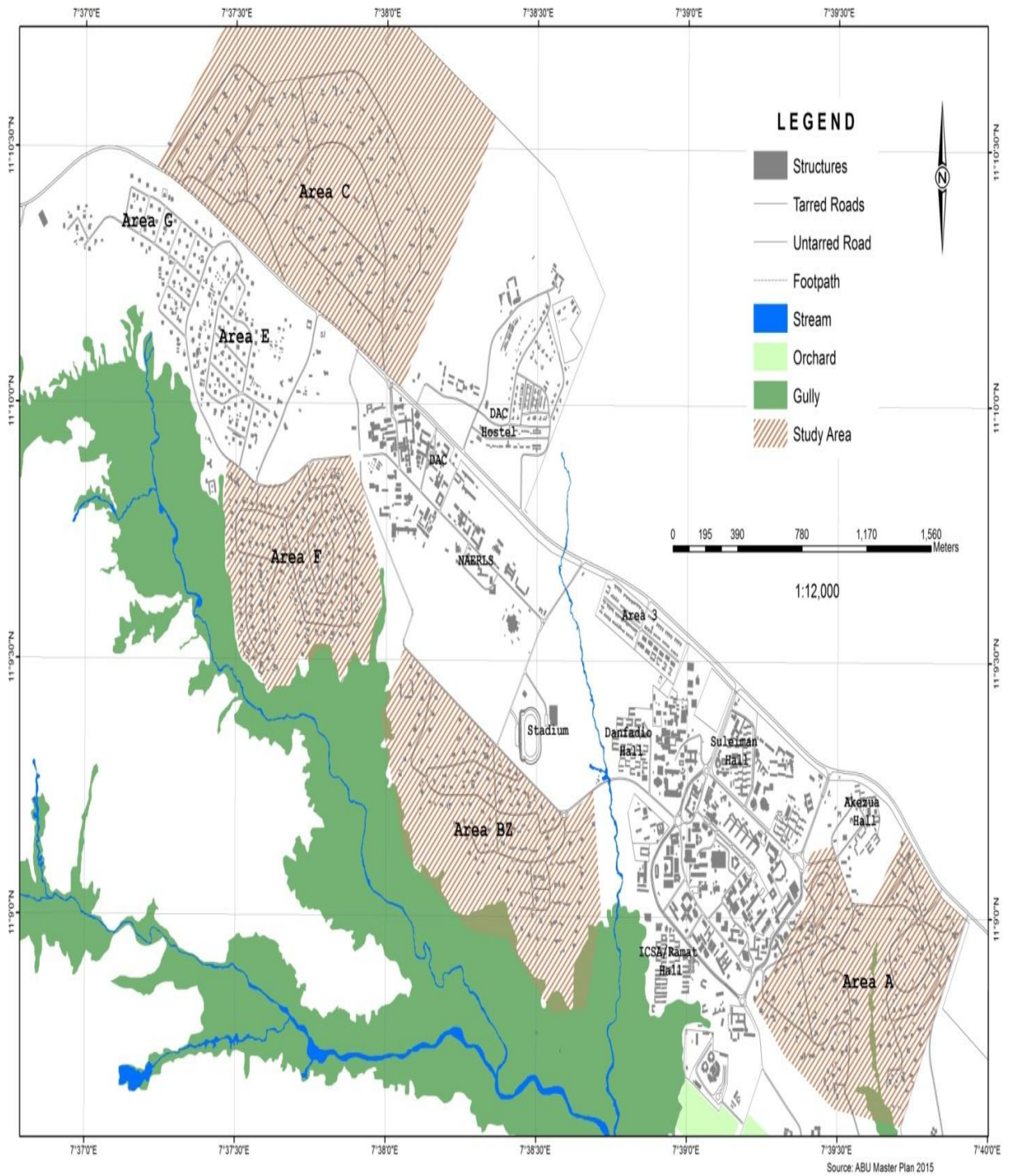


Fig. 3.1 A.B.U. showing the residential areas studied
Source: A.B.U. Master plan 2015

Most households lives in bungalow, duplex, storey buildings, professorial and flats (Accommodation Section Senate Building, Ahmadu Bello University, Zaria, 2014). Majority of the households are academic and non-academic staff of the institution and earn a relatively high level of income above Nigeria's minimum wage which is ₦18, 000 per month thus will encourage the consumption of all kinds of basic and luxury commodities alongside high generation of waste materials in the study area (Accommodation Section Senate Building, Ahmadu Bello University, Zaria, 2014).

The study areas comprises of Area 'A', 'BZ', 'C' and 'F' and a substantial volume of waste is generated on a daily basis, although there is an authorized waste disposal infrastructure in place in these areas. Figure 3.1.

3.2.2 Geography of the Study area

3.2.2.1 Climate

The climatic condition of ABU is not different from that of Samaru and in fact the whole Zaria which is the tropical continental. There are the dry windy season and rainy (wet) season. Rainfall is of high intensity, the average temperature is 27⁰C, relative humidity 70 - 90%. The wet season is usually from April to October every year with an average rainfall of about 1032mm. (Abaje, Sawa, Iguisi and Ibrahim, 2016)

3.2.2.2 Soil and Vegetation

The soil type of the study area is alluvial. Also the area constitutes dark vertisol referred to as "*Fadama*" soil (Hausa language) this soil is classified as hydromorphic soil. The fadama soil usually is found in the upstream and downstream of the stream system, while the alluvial soil is predominately at the middle of the stream. The soils are a mixture of quartz, mica wingdown particles from the harmattan.

The region generally falls within the Guinea Savannah vegetation. The vegetation of the area ought to be northern Guinea Savannah, but because nearly all vegetation within the stream system has been degraded due to man's activities such as intense cultivation and fuel wood falling, the real climax vegetation is almost absent. What is presently available are few scattered trees interspaced with tall grasses which is about 1 – 15m and 25m respectively. Trees found here includes Isorberlinadoka, grass type includes *Adropogonaeaspp*, *Schizachiriumsemiberebe* and *Moncynbiumcreresti* (Nyagba, 1986).

3.2.2.3 Geology

The area under study is underlain by rocks of a basement complex-igneous and a metamorphic of Precambrian age. The complex is composed of grandiorite, biotiteganite, granticsigneiss, and schist and quantize. The ground is sandy-clay-loam and permeable(Alagbe, 2002). The drainage system focuses on river Galma and Kubanni Rivers. River Galma is the major sources or attribute of River Kaduna and Kubanni on which Ahmadu Bello University Dam is situated. The main campus of ABU is situated along a valley west of Samaru village (Yusuf and Shuaib, 2012).

3.2.2.4 Population of the StudyArea

The study area is predominantly residential in nature. The population of study consists of household member directly involved in the disposal of waste products. They are mostly female housewives or maids employed to disposal and cleaning of the house. The chosen population of the study is 190 randomly selected from the four areas (Area A, BZ, C and F). Ahmadu Bello University (ABU) is the largest University in Nigeria and second largest in Africa, after Cairo University, Egypt. It was founded on October 4th 1962 as the University of Northern Nigeria, Ahmadu Bello University (ABU) operates two main campuses: Samaru and Kongo.

3.3 RESEARCH METHODOLOGY

This section discusses the various methods that will be employed in generating data for the study. The section focuses on the types of data needed, the sources of data, the sampling design, and the methods of data analysis. Reconnaissance survey has been conducted to provide adequate understanding of the study area.

3.3.1 Reconnaissance Survey

A reconnaissance survey was carried out. The purpose was to get the researcher acquainted with the study area. The residential houses were visited and households were also met for briefing and introduction.

3.3.2 Types of Data

- i. types of solid waste materials sorted and motivations to or not to sort
- ii. quantity of solid waste materials sorted and their end utilization
- iii. economic returns from sale of valuable waste materials sorted
- iv. various kinds of available solid waste receptacles

3.3.3 Sources of Data

3.3.3.1 Primary sources of data

The researcher employed the use of waste bin and assign four bins labeled 1 (cans/bottles), 2 (polythene/plastics), 3 (paper/cardboard) and 4 (vegetable materials) to sample residential unit in each of the areas which are closely monitored. Field observation and FGD in eliciting information for the research was carried out. These contain relevant and well structured questions aimed at eliciting responses that addresses the objective of the study.

3.3.3.2 *Secondary Source of Data*

The secondary information were obtained from related books, journals, published and unpublished texts, documents, magazines, conference articles, seminar papers, ministries of environment and related agencies. Other sources were from publications of the United Nations, World Bank, National Bureau of Statistics and related websites.

3.3.4 **Sampling Technique and Sample Size**

Ahmadu Bello University, Zaria is made up of majorly eight areas namely; Area A, Area BZ, Area 3, Area F, Area H, Area C, Area E and Area G housing units. Table 1 For this study, four (4) out of the eight (8) housing units of the institution were selected purposively for in-depth research. Based on available data gotten from the University, each area is made up of varying number of residential apartments and collectively has a total population of 484. This is presented on Table 3.1.

The residential apartments were arranged in alphabetical order. For the first housing unit which is Area A, the unit with the highest neighbourhoods is selected randomly, these are Bagauda, Bayajida, Catering Flat, Mai Bedde, Modibo and Sarkin Musulmi for the second unit which is Area BZ, the third, 4th and 7th neighbourhoods were selected randomly, these are Isa Kaita and Sardauna. For the third unit which is Area C, the 4th, 6th and 8th neighbourhoods were selected randomly, which are Harry Darling, Moh'd Lawal and Suleiman Barau while in the last unit which is Area F, the second, 4th and 7th neighbourhoods (Shehu Idris, Abdu Gusau and Savannah Flat) were selected. For the lowest neighbourhoods, 1st, 4th, 10th and 14th i.e. Bagauda, El-Kanemi, Plateau close and Yakubu L neighbourhoods in Area A were selected randomly, Area BZ; 1st, 5th and 9th (Abubakar Tafawa, Kudingi, and Tudun Sarki), Area C; 1st, 5th and 9th (Amadu Kumasi, LadanBaki and Sulu Gambari) while the last housing unit been Area F has the following;

Usman Nagogo, Kwamna Anon and Tagwai Sambo neighborhoods selected randomly (1st, 3rd and 5th).

For clarity of expression, population in this study is considered as household. It is expected that every household have a waste collection bin that were weighed after sorting for evaluation (because they probably have the same waste disposal behavior) hence it is a household analysis.

To determine the sample size, Krejcie and Morgan's (1970) Table was consulted and for a population of between 400 – 499, a sample size of 192 is appropriate. Since the population falls within that range which is 484, the sample size was 192. (See Tables 3.1 and 3.2)

To determine the number of residents to be sampled from each of the selected neighbourhoods the proportion of the population to the total population was obtained using the formula as follows:

$$NQ = n/N \times 192$$

Where, NQ is the number of residents per neighbourhood to be sampled

n is the population of the neighbourhood

N is the total population of the housing units under study.

A total of 192 respondents were selected using a well – structured questionnaire for a quantitative data. The houses were randomly selected to allow every house the equal opportunity of participation however only one hundred and ninety (190) copies of questionnaire were successfully retrieved. Two (2) copies were misplaced by the respondents.

Waste bin assigned to residents and interviews thus to be carried out, purposive sampling techniques were adopted at the neighbourhood level, which was used to select the

respondents from the neighbourhood. These involved all household members that participate in waste disposal. The collection and weighing of the waste were carried out weekly. The sorted waste was weighed using a weighing scale which helped in determining the volume of waste sorted within the study area in Kilogramme (Kg). The study was in two phases. The first phase is the questionnaire survey where information on awareness and perception of residents were obtained. The selected 192 households were administered a copy of questionnaire each. After this survey, the data were analyzed and the outcome was used as guidelines to direct the participatory action activities in the FGD which is the second phase.

The Focus Group Discussion (FGDs) was conducted in each of the selected neighbourhoods when the participatory processes of waste sorting were conducted. At least every household had a participant in the FGD session. Afterwards participants in this activity have had a group discussion on their perception of waste sorting, benefits derived from the activity, continuity with the exercise in terms of support among others. The FGDs provided insight on the extent to which waste sorting is adopted in the study area.

3.3.4 Method of Data Analysis

Analysis and presentation of information from the questionnaire were done by means of descriptive statistics. Here the analyzed data were summarized and presented in tables, graphs, charts, percentages etc. The statistical techniques adopted to analyze the responses generated during the study are achieved through the five (5) set objectives.

The use of descriptive method of analysis is hinged on the participatory nature of the study, since participatory research approaches are different from conventional research approaches which utilize inferential statistic in their analysis. Authors and researchers that have employed these methods include (Chambers, 1996), who traced the origins of

participatory appraisal to late 1970s with the development of rapid rural appraisal as a family of approaches.

Table 3.1: Selected neighbourhoods in ABU, Samaru Residential Quarters

S/N	Housing Units	Neighbourhoods	House Density	Selected Neighborhoods
1	AREA 'A'	Bagauda	Low	Bayajida
2	Area 'A'	Bayajida	High	Catering Flat
3	Area 'A'	Catering Flat	High	Mai Bedde
4	Area 'A'	El-Kanemi	Low	Modibo
5	Area 'A'	Etsu-Nupe	Low	SarkinMusulmi
6	Area 'A'	Ibrahim Dabo	Low	Bagauda
7	Area 'A'	Mai Bedde	High	El-Kanemi
8	Area 'A'	Modibo	High	Plateau close
9	Area 'A'	Nagwamatse	Low	Yakubu L
10	Area 'A'	Plateau close	Low	
11	Area 'A'	Salami	Low	
12	Area 'A'	SarkinMusulmi	High	
13	Area 'A'	UdoUdoma	Low	
14	Area 'A'	Yakubu L	Low	
15	Area 'A'	Tor Tiv	Low	
16	AREA 'BZ'	AbubakarTafawa	Low	Isa Kaita
17	Area 'BZ'	Biye	Low	Jama'a
18	Area 'BZ'	Isa Kaita	High	Sardauna
19	Area 'BZ'	Jama'a	High	Usman Dalla
20	Area 'BZ'	Kudingi	Low	AbubakarTafawa
21	Area 'BZ'	Mohammed Dikko	Low	Kudingi
22	Area 'BZ'	Sardauna	High	TudunSarki
23	Area 'BZ'	TudunMuntsir	Low	
24	Area 'BZ'	TudunSarki	Low	
25	Area 'BZ'	Tukurwa	Low	
26	Area 'BZ'	UngwanMagarabi	Low	
27	Area 'BZ'	Usman Dalla	High	
28	AREA 'C'	Amadu Kumasi	Low	Harry Darling
29	Area 'C'	Bomo	Low	Moh'dLawal
30	Area 'C'	BukarShaib	Low	Suleiman Barau
31	Area 'C'	Harry Darling	High	YahayaGusau
32	Area 'C'	LadanBaki	Low	Amadu Kumasi
33	Area 'C'	Moh'dLawal	High	LadanBaki
34	Area 'C'	Pam Bot	Low	Sulu Gambari
35	Area 'C'	Suleiman Barau	High	
36	Area 'C'	Sulu Gambari	Low	
37	Area 'C'	Swimming pool	Low	
38	Area 'C'	YahayaGusau	High	
39	AREA 'F'	Usman Nagogo	Low	ShehuIdris
40	Area 'F'	ShehuIdris	High	Abdu Gusau
41	Area 'F'	Kwamna Anon	Low	Savannah Flat
42	Area 'F'	Abdu Gusau	High	Usman Nagogo
43	Area 'F'	TagwaiSambo	Low	Kwamna Anon
44	Area 'F'	Nigeria III	Low	TagwaiSambo
45	Area 'F'	Savannah Flat	High	

Source: Author's adaptation of information from Accommodation Section of Ahmadu Bello University, Zaria, 2015

Table 3.2: Selected neighbourhoods and proportion of respondents

S/N	Selected Housing Units	Selected Neighbourhoods	Population of Neighbourhood	Number of Residents sampled	Number of Participatory waste Sorting
1.	AREA 'A'	Bayajida	16	7	6
		Catering Flat	39	15	
		Mai Bedde	29	12	
		Modibo	15	6	
		SarkinMusulmi	20	8	
		Bagauda	9	4	
		El-Kanemi	10	4	
		Plateau Close	8	3	
		Yakubu L	9	4	
2.	AREA 'BZ'	Isa Kaita	23	9	6
		Jama'a	18	7	
		Sardauna	26	10	
		Usman Dalla	15	6	
		AbubakarTafawa	10	4	
		Kudingi	8	3	
		TudunSarki	9	4	
3.	AREA 'C'	Harry Darling	36	14	6
		Moh'dLawal	20	8	
		Suleiman Barau	22	9	
		YahayaGusau	15	6	
		amadukumasi	9	4	
		ladanBaki	8	3	
		Sulu Gambari	9	4	
4.	AREA 'F'	Shehu Idris	41	16	6
		Abdu Gusau	16	6	
		Savannah Flat	17	7	
		Usman Nagogo	10	4	
		Kwamna Anon	8	3	
		TagwaiSambo	8	3	
	Total		484	192	24

Source: Author's Survey, 2015

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 INTRODUCTION

The aim of this study is to appraise solid waste sorting in Ahmadu Bello University, (ABU) main campus Samaru, Zaria, Kaduna State. The results of the survey that are analyzed statistically are organized and discussed under the following headings: Section A: Socio-economic/Demographic status of respondents, B; Awareness and readiness to adopt waste sorting, Section C: Waste sorting practices and quality of waste sorted, Section D: Motivational and hindering factors of waste sorting and Section E: Socio-economic, environmental and health implication.

4.2 SOCIOECONOMIC CHARACTERISTICS OF THE RESPONDENTS

Socioeconomic characteristics of respondents include gender, age, education attainment, income and nature of housing among others. These attributes are not only pointers to the nature, types and volume of waste they or can generate, but also their propensity to waste sorting. Figure 4.1 present the gender, Marital Status is depicted in Figure 4.2 while Table 4.1 focuses on age of respondents. Educational attainment and income of respondents are presented in Table 4.2 and 4.3 respectively.

Figure 4.1 presents the gender distribution of respondents. From the figure, the female were the overwhelming majority from the residential areas sampled. Area 'A' 86%, Area 'BZ' 92%, Area 'C' 82% and Area 'F' 95% compared to the male counterparts Area 'A' 15%, Area 'BZ' 8%, Area 'C' 18% and Area 'F' 5%. The finding shows a clear under representation of the male members of the households.

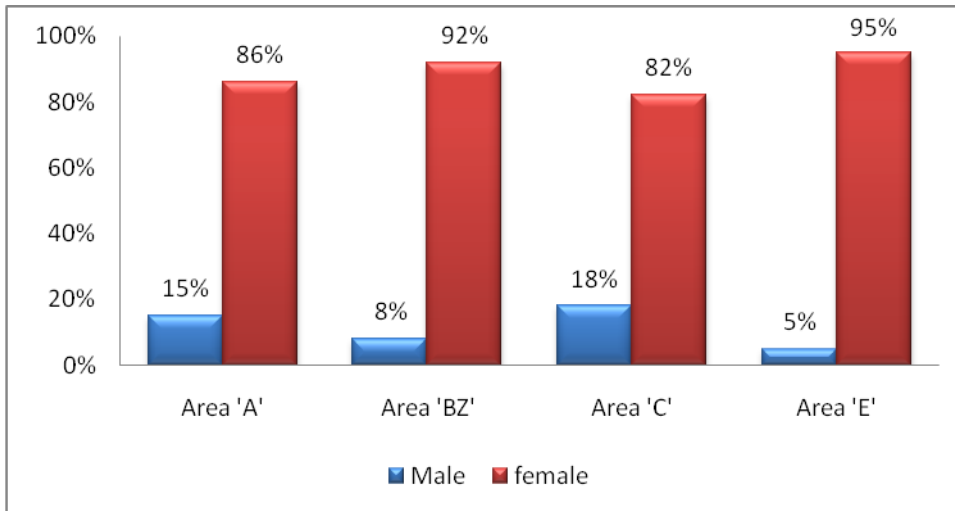


Figure 4.1.: Gender Distribution of Respondents
Source: Author's Analysis, 2015

This is because the respondents are mostly the females who are responsible for the removal and disposal of waste, while the male are often responsible for financial responsibilities in the homes.

Meanwhile the finding is in line with that of Garshol, (2010), where in Weinstein the female outnumbered the male population in waste sorting. Ahmad (2002) noted that women are responsible for maintaining healthy and clean environment and directly affected by inadequate waste management.

4.2.2 Marital Status of the Respondents.

Living in a community means individual assumes some responsibilities including marriage. For the residents of ABU Samaru quarters included in this study, Figure 4.2 presents the marital status.

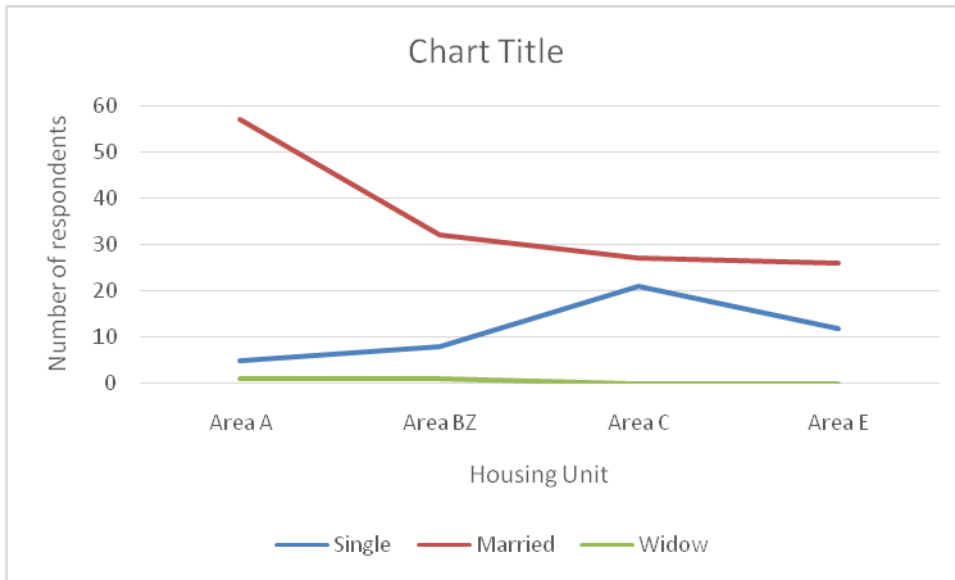


Fig. 4.2: Marital Status of respondents
Source: Author’s Analysis, 2015

The Figure 4.2 indicates the respondents who were single, married and widowed. Area A has 90% of the respondents who were married which is the highest while the lowest proportion of married respondents were discovered in Area C and F with 30% respectively. Area C has the highest respondents that were single, while Area A was the lowest. From the study area, none of the respondents are widowed. This could be because residential quarters are mostly allocated to matured staff with families.

Table 4.1: Age of Respondents

Age Group	Frequency	Percentage
16-20	43	23
21-30	39	20
31-40	78	41
41 years and above	30	16
Total	190	100

Source: Author’s Analysis, 2015.

The Table 4.1 presents the age range of respondents. The highest which is 44% of the respondents are within the age range of 31-40 years while the lowest is 16% which are within the age range of 41 and above. This could be because of the age differences between male and female respondents, where mostly male are older than the female and are willing to participate actively in waste management.

Table 4.2: Distribution of respondents by highest educational attainment

Educational Attainment	Frequency	Percentage
Quranic	2	1
Primary	3	2
Secondary	3	2
Tertiary	160	84
Others	22	11
Total	190	100

Source: Author's Analysis, 2015

The Table 4.2 presents the highest educational attainment of respondents. The survey generally revealed that out of 190 respondents sampled from the four residential areas, tertiary education recorded the highest with 84%, while 2% accounts for the lowest which is Qur'anic education. In an oral interview conducted with the Director of Estate Management, it was revealed that staff allocated to Area 'A', Area 'BZ', Area 'C' and Area 'F' are senior staff of the residential quarters, hence the variation in their educational attainment..

The analysis clearly present most of the respondents are highly educated in reflection of the university environment where in they work. Another pointer is that most of

the respondents were women who were equally educated as well, hence their knowledge of environmental aesthetic will be fairly higher than average.

Table 4.3: Monthly Income of Respondents

Income Level	Frequency	Percentage
Less than N18000	8	4
N18000-N30000	16	8
N30000-N60000	41	22
N60000-N90000	40	21
N90000 and above	83	44
None of the above	2	1
Total	190	100

Source: Author’s Analysis, 2015

The Table 4.3 reveals the income status of respondents in the study area. Area A has 44% of the respondents having the highest income level of above N90,000 per month while the lowest income earners among respondents was in Area C with a monthly income of less than N18,000. This is because some respondents were actually living in the “boys’ quarters” of the houses sampled. On the average, the incomes of respondents were high, at least compared to the minimum wage in the Nigeria Public Sector. The variation is based on the fact that not all the respondents were working in the University but were married to men who were staff of ABU. Even at that, some were academic staff while others were non academic and technical staff. Hence the slight variation observed in income categories of respondents.

4.3 AWARENESS AND READINESS TO ADOPT TO WASTE SORTING

Municipal solid waste management is considered to be one of the most immediate and serious problems confronting institutions, urban centers and government in most developing and transitional economies (Zurbrugg, and Schertenleib, (1998). With the increasing population of Ahmadu Bello University, issue of solid waste management is of major concern. The increase in institutional waste generation is said to be rapid as this has a direct relation with urbanization and population growth. Urbanization is much associated with influence and also diversity in consumption of assorted food product consumption. The collection and safe disposal of waste material is therefore very importance if a clean and human friendly environment is to be kept.

A first in point waste management at domestic level is use of waste receptacle for collecting of waste. The use of waste receptacle in the study area is presented in Table 4.4. Table 4.4 presents the use of waste receptacles in their homes. It was established that almost all the respondents used at least one waste receptacle in their homes. In Area ‘A’ and Area ‘BZ’ all the respondents’ use receptacle, 95% of the total respondents from Area A to F

Table 4.4: Use of Receptacles by respondent

Residential Areas	Yes	%	No	%
Area A	48	26	-	-
AREA BZ	47	26	-	-
AREA C	49	27	5	71
AREA F	39	21	2	29
Total	183	100	7	100

Source: Author’s Analysis, 2015s

used receptacles, while 5% said they do not use receptacles. This implies that receptacles are widely accepted instrument for waste collection in the study area. With the use of waste bin, it will be easier to sort waste which led to the need to ascertain the awareness of and readiness to sort waste.

According to UNEP (2005), an accurate knowledge and readiness of sorting waste is essential to the success of a resource recovery undertaking. To gather information about the level of awareness and readiness to sort waste, the respondents were asked to state if they are aware and ready to sort their wastes. Figure 4.4 shows how the respondents answered regarding awareness of and readiness to sort waste.

Respondents' response on waste sorting implies that 90% of the residents do not sort waste in Area A which is the highest while 40% is the lowest in Area F. It is clear that most of the residents do not sort their waste. This may be due to lack of enlightened awareness on its benefit. This emphasizes the assertion of UNEP (2002) that an accurate knowledge of the quantity and composition of waste input is essential to the success of resource recovery, which are also required for proper planning, designing and operation of waste management.

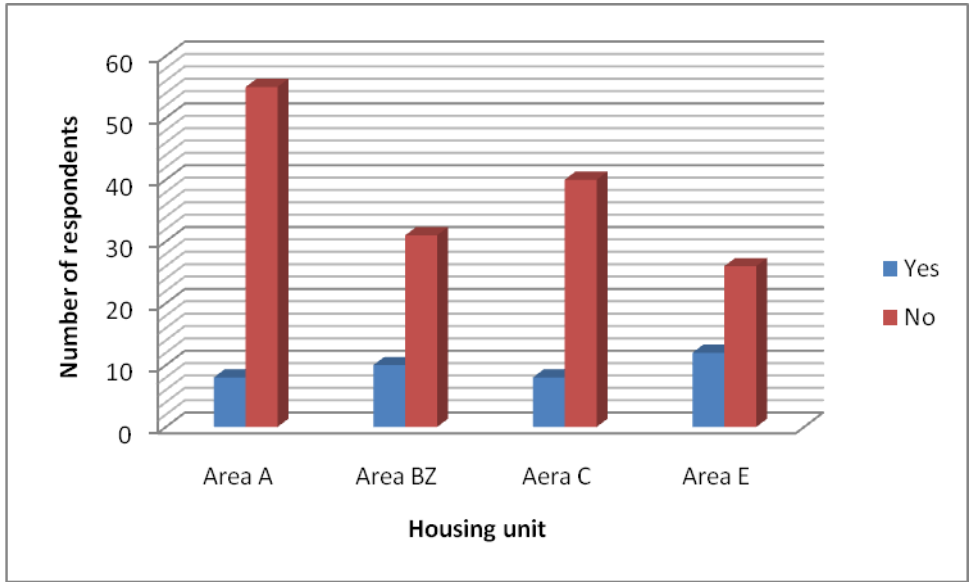


Fig. 4.3: Waste sorting by respondents
Source; Author’s Analysis, 2015

Having established the use of waste receptacles in the various housing unit, respondents on their waste sorting attitudes and the response is presented in Figure 4.4.

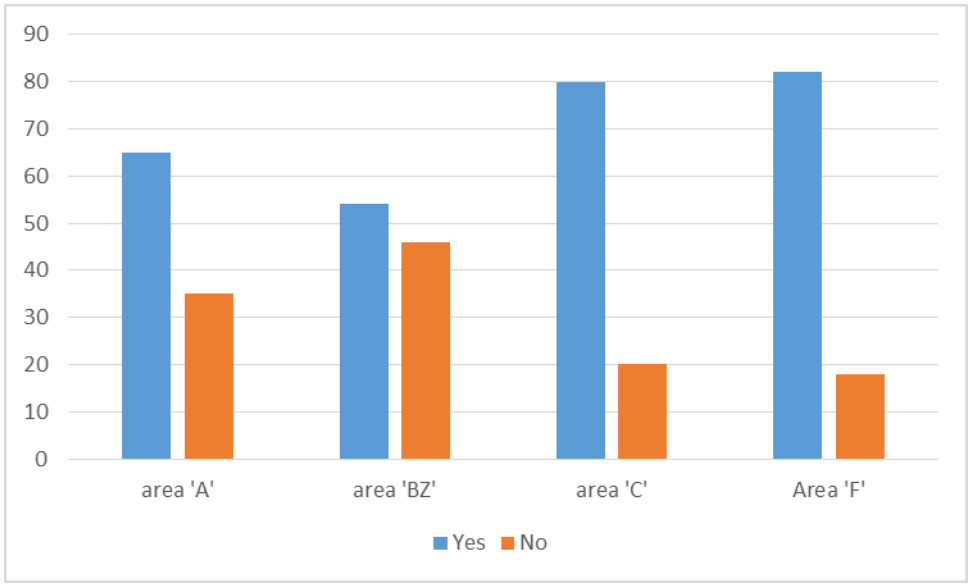


Fig. 4.4. Level of awareness and readiness to sort waste
Source: Author’s Analysis, 2015

Area 'A' and Area 'BZ' respondents were slightly different. Close to 65% of the respondents from Area 'A' were aware and ready to sort their wastes while 35% were ready to sort wastes. From Area 'BZ', 54% of the respondents were aware and ready to sort their wastes while the remaining 46% claimed the contrary (Figure 4.4). In Area 'C' and "F" 80% of residents were aware and ready to sort their wastes while 20% and 18% respectively, are not. The finding of the study revealed that the high level of formal education of the respondents in the study area (Table 4.2) does not have to do with knowledge and readiness to sort their wastes.

According to UNEP (2002) frequent public education and convenient collection services are a necessary requirement for successful household solid waste sorting programme. The educational campaign must be comprehensive and simple and must come out from the implementing municipality or group of municipalities. Illustration of the process of sorting must be picture oriented and must continue even after the scheme in an advisory and supportive manner.

Meanwhile, from the Focus Group Discussion with University Health Services the only University Organisation assigned with the task of management. As clearly spelt out by a discussant;

‘The Ahmadu Bello University authority has not provided sorting equipment in the staff quarters or for the university as a whole. Neither is there provision of waste sorting machines in the staff quarters or for the environmental sanitation section of University Health Service’

Dr. Mrs. N. Madugu

This is in line with the finding of Nwuse *et al.*, (2011) and Bogoro and Babanyara (2011) that equipment grossly affects sorting, collection and disposal of municipal solid waste.

Table 4.5: Perception of residents on waste sorting

Perception	Frequency	Percentage
Objects/materials disposed or wished to be disposed	118	62
Valuable resources which can be recycled	42	22
Contaminants which threaten environment and people's health	18	10
Other	12	6
Total	190	100

Source: Authors Analysis, 2015.

Table 4.5 presents perception of the residents of A.B.U residential quarters depends on several factors. One of them is the society's attitude towards awareness about the generated municipal waste and its effect on the environment. Majority of the respondents which is 62% are of the opinion that waste are to be disposed, while 10% of respondents are of the opinion that waste contaminant threaten the environment and people's health. In general waste need to be disposed recycled and could be a threat to the environment and people's health.

4.4. WASTE SORTING PRACTICE AND QUANTITY OF WASTE SORTED

4.4.1. Efforts at Encouraging Waste Sorting

Respondents were asked if there is any advocacy/law encouraging sorting of waste at source before disposal..

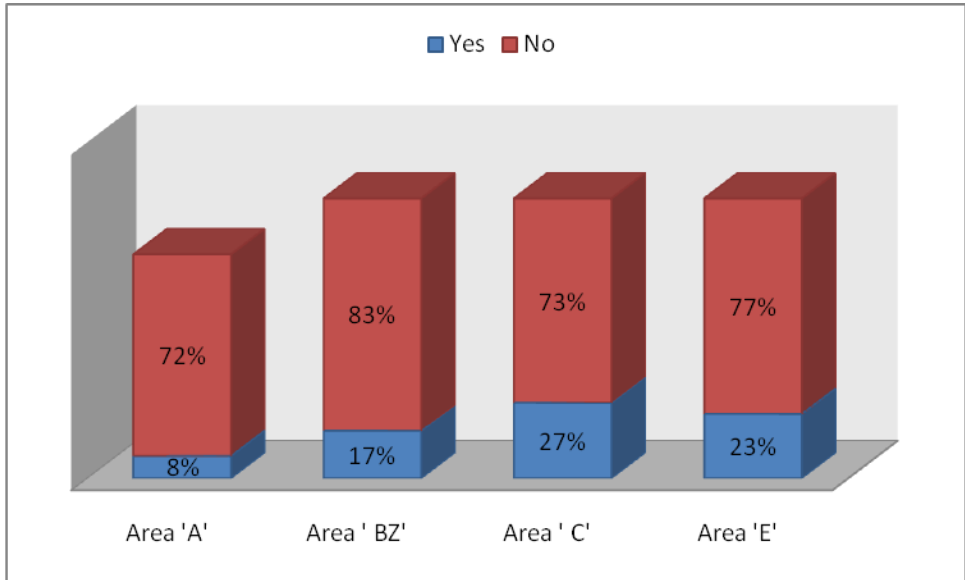


Fig. 4.5: Existence of effort to encourage waste sorting practice at home among respondents

Source: Author's Analysis, 2015

An overwhelming majority of the respondents in Figure 4.5 were of the view that there was no law of that nature in the study area. The breakdown revealed that 83%, 77%, 73% and 72% of respondents from Area 'BZ', Area 'F', Area 'C' and Area 'A' respectively said there was no law/encouragement on sorting waste by the institution. In a contrary expression 27%, 23%, 17% and 8% representing Area 'C', Area 'F', Area 'BZ' and Area 'A' said they were aware of some fragmentary effort through advocacy to encourage waste sorting but not as law. It has been observed from the analysis that if there was a law / policy on waste sorting practices, there could be a significant encouragement. Also advocating for waste sorting will open opportunity in waste to wealth through waste recycling and re-use.

Effective recycling relies on effective sorting. With a wide range of sorting technologies on the market today European citizens will not have failed to notice that the sorting of waste, particularly at a household level, is becoming increasingly important.

While the various EU countries currently take different stances on how and which waste to separate, the trend will be to separate as much useful waste as possible and deal with it in the most appropriate manner. Separating the different elements found in waste streams is essential for enabling the recovery of useful materials, minimizing the amount of material sent to landfill and allowing recyclable materials to find a new incarnation (Kreiger *et al.*, 2013).

4.4.2 Housing Characteristics as a facilitator of Waste Sorting

Ease of waste sorting depends on kind of housing the members of a household dwell in. On the ABU campus, duplex are larger than bungalows and professorial flats, (Catering flats) and Boys Quarters (BQ), hence, people living in duplex and bungalows often have more space in the (Kitchen or elsewhere) to practice waste sorting which simplifies the sorting of household waste. Figure 4.6 presents the distribution of housing nature of respondents.

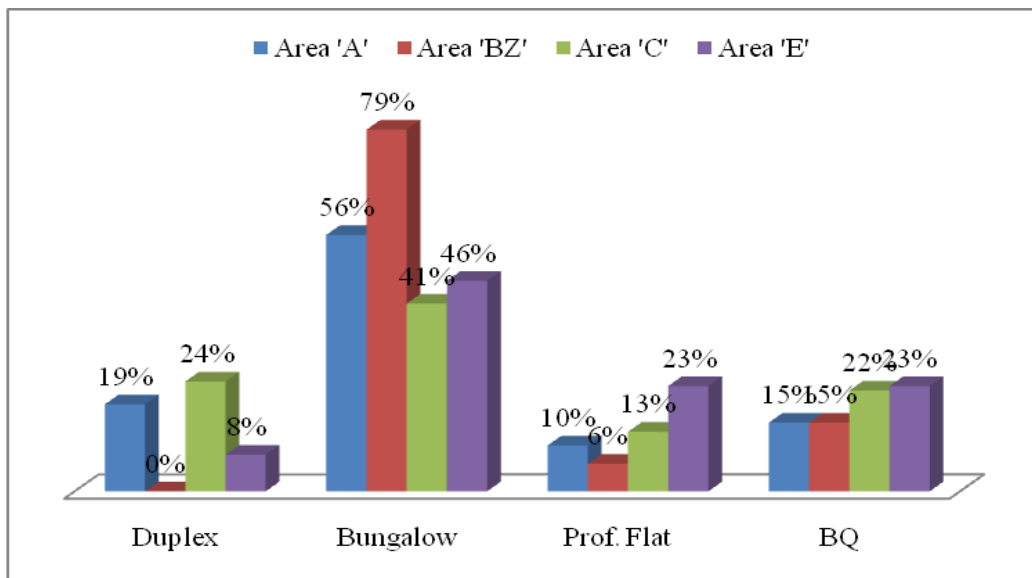


Fig. 4.6: Housing type of Respondent
Source: Author's Analysis, 2015

Majority of the respondents from the selected residential areas lives in bungalows .As a breakdown Area ‘A’ (56%), Area ‘BZ’ (79%), Area ‘C’ (41%) and Area ‘F’ (46%) were the observations. The highest percentage (56%) of respondents from Area ‘A’ lives in bungalow houses, 19% lives in duplex while 15% and 10% lives in boys quarters and professional flats respectively. Area ‘BZ’ respondents recorded overwhelming majority of 79% in bungalow houses and boys quarters and professional flats shared the reaming percentages 15% and 6% respectively. The respondent lives duplex houses in Area ‘BZ’. Respondents from Area ‘C’ were slightly different from the Area ‘A’ and Area ‘BZ’. The highest population lives in bungalow houses, 24% lives in duplex, 22% lives in boys quarters (BQ) while 13% lives in the professional flats (Catering flats). As for respondents in Area ‘F’ 46% lives in Bungalow houses, 23% lives in Professional flats and Boys Quarters, while the remaining 8% lives Duplex. This study proved that the residential areas were meant for senior staff of the university with high income.

4.4.3 Composition of Waste Sorted in Participatory Appraisal

A major focus of this study is a demonstration to residents’ processes of waste sorting. The items of waste sorted is presented in Table 4.6. The participation process is to educate and exchange ideas between the people and practitioners.

Table 4.6 presents the composition of the wastes sorted in the staff residential quarters in the institution. It reveals that higher amount of waste sorted from Area ‘A’ were vegetable with 56kg, can and bottles 23kg, polythene/plastics 27%, paper/cardboard 18.2kg. From area ‘BZ’ the highest waste sorted weighed were vegetable 41kg, 22kg can/bottles, 18kg for polythene/plastics while paper/cardboard were 13kg. In Area ‘C’ the

Table 4.6: Participation of waste sorting exercise

S/No	Items	Area				Total
		Area 'A'	Area 'BZ'	Area 'C'	Area 'F'	
	Vegetable	56kg	41kg	26.5kg	17kg	140.5kg
	Cans/Bottles	23kg	22kg	9.5kg	9.3kg	63.8kg
	Polythene/Plastics	27kg	18kg	7.6kg	8.8kg	61.1kg
	Paper/Cardboard	18.2kg	13kg	6.3kg	6.5kg	44kg
	Total	124.2kg	94kg	49.9kg	41.6kg	319.7kg

Source: Author's Analysis 2015

The highest sorted waste is the one generated from vegetable and cans/bottles, these are 56kg and 23kg respectively which surpasses those generated from cans/bottles and paper/cardboard weighing 27kg and 18.2kg respectively. Some of these are shown on plate 1, 2 and 3.



Plate 1: Baskets of sorted waste in a participatory demonstration of waste sorting in Area F
Source; Author's Survey, 2015

Plate 1 shows baskets sorted with waste in the study area. To gather information about level of waste sorted from the participatory exercise, the participants sorted wastes were weighed using the weighing scale. Plate 2 also shows the weighing of sorted waste in the study area while Plate 3 shows the variation in the volume of sorted waste.



Plate 2: Weighing of sorted waste in a participatory demonstration in Area A

Source; Author's Survey 2015



Plate 3 : Variation in Quantity of sorted wastes in Area BZ

Source; Author's Survey, 2015

From the waste sorting exercise, it is observed that majority of the sorted waste are still reusable and recyclable. Some of these are small unit waste like vegetable, plastic and glass bottles and papers. However vegetable waste dominates the waste stream which came from food consumed. This is in line with the study of Amori, (2013) who stated that out of the average waste generated in residential areas, food waste exhibited the highest percentage followed by plastic related materials.

4.5 MOTIVATIONAL AND HINDERING FACTORS OF WASTE SORTING

One of the main objectives of this study is to find out the motivating and hindering factors of waste sorting. Motivation for waste is based on different reasons. In order to clearly establish the linkage between factors that motivate or hinder waste sorting, reasons for sorting waste (which is the proxy for motivational factor in this study) are presented in Table 4.7. Similarly factors that hinder waste sorting is presented in Table 4.8.

Waste sorting are done for different reasons and purposes so as to minimize the challenges of waste collection and recycling

Table 4.7: Reason for waste sorting

Reason	Frequency	Percentage
For Money	16	8
Aesthetic	24	13
Free from Diseases vector	123	65
Reduce environmental challenges	20	10
Others	7	4
Total	190	100

Source: Author's Analysis, 2015

In the study area, the highest which is 65% of respondents said that the reasons for waste sorting is to enable the environment be free from disease vectors while 4% of respondents is the lowest which said that they sort waste for other reasons. This infers that

most of the respondents feel that waste sorting has to do with health and disease control. This finding is sported by Henry, *et al.*, (2005) highlighted that in a number of health survey, a wide range of health problem including respiratory system, irritation of skin, eyes, nose and allergies have been discovered due to not sorting of waste.

Materials within the environment are used for different purposes which are sorted based on preference and for different reasons. This is also the same in the residential areas. In this study, wastes are sorted for; money, aesthetic, free from disease vector, reduce environmental challenges and other reason which account for the most response given by the respondents.

Table 4.8 Factors that hinder waste sorting

S/No.	Factors that hinder waste sorting	Frequency	%
1.	Lack of waste facilities	12	6
2.	Laziness	28	15
3.	Lack of awareness	58	30
4.	Lack of support from A.B.U. Management	15	8
5.	All of the above	39	21
6.	Choose not to sort	15	8
7.	Others	23	12
	Total	190	100

Source; Author's Analysis, 2015

Discovering the hindering factors behind successful waste sorting is very important. Table 4.8 established that the highest responses recorded were on lack of awareness 30% while lack of waste facilities account for 6% in the study area. Lack of enlightenment could be the reason why respondents in the study area do not sort waste.

According to UNEP 2002, frequent public education and continent collection services are a necessary requirement for successful house hold solid waste sorting programme.

The preceding sections have convincingly pointed out that many residents do not sort their waste. Nonetheless it needs to be verified the multiple benefits of waste sorting at least based on the opinion of the respondents. The analysis is presented in Table 4.9

4.6 SOCIOECONOMIC, ENVIRONMENTAL AND HEALTH IMPLICATIONS OF WASTE SORTING

Researchers advocated the need to carry out waste sorting on socio-economic, environmental and health implications within the urban space.

Table 4.9 Waste Sorting Implications

Socio-Economic implication	Frequency	Percentage
Serves as raw materials for recycling and composting plants	31	16
Source of income for scavengers	56	29
Enable university authority to plan future waste management	33	18
All of the above	70	37
Total	190	100
Environmental Implication		
Decrease in level of solid waste to landfills	56	29
Saving energy	86	45
Reduces indiscriminate waste dumping	29	16
No idea	19	10
Total	190	100
Health Implications		
Leads to separation of organic from inorganic wastes	52	27
Convenient and hygienic free	72	39
Reduces airborne diseases	50	26
No idea	16	8
Total	190	100

Source: Author's Analysis, 2015

Table 4.9 present the socioeconomic implication of waste sorting; Out of the entire respondents sampled, 37% agreed on all the above factors which constitute the highest

while 16% recorded the lowest which implies that it serves as a source of raw material. This is in line with the study of Jesson and Stone (2009) who conducted a research in Sweden on why people sort waste. Their finding revealed that people sort waste for economic reason as 75% of the respondents agreed to sort wastes for monetary returns.

The implication of environmental aspect of waste sorting is very crucial to understand. The level of understanding of respondents on the environmental implication was relatively different. The highest implication which is 45% accounts for energy saving, on the other hand 10% of the respondents said no idea.

A major health implication to waste sorting in the study area is likely to come from the convenient nature and hygienic free of waste sorting from the respondents. In the study area 39% of the respondents were on the view that waste sorting is convenient and hygienic free ,while 8% said no idea. UNEP (2002) stated that waste that are not managed properly, especially, solid waste from house hold and community are a serious health hazard and lead to the spread of infectious diseases attracting flies, rat and other creatures that in turn spread diseases.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter summaries and conclude the research work on participatory appraisal of solid waste sorting in staff residential quarters of Ahmadu Bello University, Main Campus, Samaru, Zaria. Recommendations were to the university authority for implementation.

5.2 SUMMARY OF FINDINGS

Individual's characteristics may be of importance for both motivation and behaviour. The result of the analysis shows that 83% of the respondents were female. Tertiary education accounts for 84% which seems to be the highest qualification in the study area. The result of the analysis shows that from the four areas sampled 44% of the respondents are within the age range of 31-40 years .The majority (44%) of the respondents with an average income of ₦91, 000 and above . About 79% average of the respondents lived in bungalow houses.

The result of this study also shows the level of awareness and readiness to sort waste. An average of 70% was knowledgeable of waste sorting and ready to participate in waste sorting. Almost all the respondents had receptacle at the household. An average of 61% calls for advocacy/law encouraging sorting of waste at source before disposal to increase the level of awareness by the institution which is currently only being enforced at the student hostels level.

Effective recycling relies on effective sorting. The study revealed that waste sorting practice and quality of waste sorted will increase if the university introduce modern sorting machines at the staff residential quarters , over 61% of the respondents disclosed this which

the director of University Health Services (Sick Bay) agreed that plans are in place to introduce modern sorting machines. It was revealed that 140.5kg quality of vegetable waste was sorted in participatory exercise being the highest waste sorted. Area 'A' had the highest (56kg) followed by Area 'BZ' (41kg).

5.3 CONCLUSION

An analysis has been made in this research to appraise the participatory appraisal of solid waste sorting in staff residential quarters of Ahmadu Bello University, Main Campus, Samaru, Zaria. This research made analysis of data mostly in the form of questionnaire administered to some selected staff resident in ABU residential staff quarters.

Awareness and readiness to adopt waste sorting implies that receptacles are widely accepted instrument for waste collection in the study area, Waste sorting practice and quantity of waste sorted in the area revealed that there was no law of that nature. Motivational and hindering factors of waste sorting were on lack of enlightenment to the respondents.

The implication of environmental aspect of waste sorting is very crucial to understand. The level of understanding of respondents on the environmental implication was relatively different. The highest response on the implication is that on energy saving .

From the findings, the major conclusion is that domestic solid waste sorting is not being practiced in staff residential quarters of Ahmadu Bello University, Main Campus, Samaru , Zaria. The knowledge level is low but there is an increasing prospect of adoption of waste sorting.

5.4 RECOMMENDATIONS

Based on the findings of this study, the following recommendations are suggested to help in creating awareness on the need for waste sorting in staff residential quarters of Ahmadu Bello University, Main Campus, Samaru, Zaria.

Appraising public participation of waste sorting in the staff residential quarters of Ahmadu Bello University, main campus Zaria is just beginning, though it has not appeared in the university law and regulations only a few practice it. Most of them lack the knowledge and awareness on waste sorting. It is recommended that the university authority should create an enabling environment for sensitization of its residents on needs and benefits of sorting waste before disposal.

Households are the main source of the municipal waste, sorting must begin from home. Nigeria is a developing country and shortage of natural resources. In the study area, people throw away the reusable materials. To encourage the household waste sorting, it is hereby recommended to the university authority to distribute bags/containers and modern sorting machines to residents staff quarters for waste sorting. This will take care of the inadequate spacing in the residential housing units.

The Sick Bay (University Health Services) is responsible for solid waste management and disposal. Enforcement team should be established for mobilizing the participation of university communities in waste sorting through environmental laws. The use of mechanism of fees, penalties and fines to encourage observances of the law. Multiple coloured bins for different waste materials should be given to residents, so that waste sorting be encourage at that level.

Finally, it can be concluded that a strong will, clear strategies and commitment of staff resident in the quarters are essential for the success of the university solid waste

sorting system. The University Health Services waste management can be provided with legal framework, technical support and rewarding system for residents. NGOs or any other Civil Society organization should play significant role in initiating awareness building programmes, technical and methodological advice, and assisting in creating market mechanism. Also since knowledge is important, enlightenment campaign should be embarked on. It should be done using bill boards, posters and other public awareness creation opportunities.

Based on available and accessible literatures, there seems to be a dearth of empirical works of waste sorting at commercial level. Therefore, future researches can examine participatory waste sorting in towns and cities rather than institutions which has almost homogenous characteristics.

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APPENDIX I
QUESTIONNAIRE

DEPARTMENT OF GEOGRAPHY, AHMADU BELLO UNIVERSITY, ZARIA

Dear respondent,

The purpose of this questionnaire is to obtain information on participatory appraisal of solid waste sorting in staff residential quarters of Ahmadu Bello University, Main Campus Samaru, Zaria, Kaduna State, Nigeria. Your answers will be confidential and strictly for academic use. I sincerely request your cooperation in completing this questionnaire.

Please tick (✓) the appropriate option.

Thank you.

SECTION A: DEMOGRAPHIC AND SOCIOECONOMIC INFORMATION

1. Sex (a) Male [] (b) Female []

2. Age of respondent:

16 – 20 years []

21 – 30 years []

31 – 40 years []

41 years and above []

3. Educational Qualification:

Non-formal []

First School Leaving Certificate []

Secondary School Certificate []

Tertiary []

4. Income level

< ~~₦~~18, 000 []

₦18, 000 – ~~₦~~30, 000 []

₦30, 000 – ~~₦~~60, 0000 []

₦60, 000 – ~~₦~~90, 000 []

~~₦~~90, 000 – and above []

5. Nature of House

a. Duplex []

b. Bungalow []

c. Professional Flat (Catering flat) []

d. Boys Quarters (BQ) []

SECTION B: AWARENESS AND READINESS TO ADOPT TO WASTE SORTING.

1. Use of receptacles at home

Yes []

No []

2. Level of awareness on waste sorting

Yes []

No []

3. Provision of waste sorting equipment by University authority

Yes []

No []

4. Perception of waste

Object/materials disposed or wished to be disposed []

Valuable resources which can be recycled []

Contaminant which threaten environment and people's health []

Others _____

SECTION C: WASTE SORTING PRACTICE AND QUANTITY OF WASTE SORTED

1. Advocate/encourage waste sorting among resident

Yes []

No []

2. Method of waste sorting practiced

Manual sorting []

Mobile sorting []

Compact sorting []

3. Quantity of waste weighed

Vegetable materials []

Cans/bottles []

Polythene/plastic []

Paper/cardboard []

SECTION D: MOTIVATIONAL AND HINDERING FACTORS OF WASTE SORTING

1. What are factors that motivate you to sort?

Personal norms []

Economic incentive []

Social norms []

Encouragement from institution []

2. What are your reasons for sorting waste

Influence of the people []

For financial benefits []

Saving of natural resources and energy []

Personal habit and awareness []

Government/institution regulation []

3. Why are you not sorting waste?

No space to keep separated recyclable []

Believes that sorted waste still goes landfill []

I don't want my neighbour to know my purchases []

No economic incentive equipment from the institution []

No sufficient information on sorted waste []

Reduction of the impact to environment/health/socio-economic []

4. Motivation for starting increasing waste sorting exercise

Impose penalties for those who don't sort waste []

More information about the importance of waste sorting []

Incentive from government institution for sorting []

Provide sorting equipment in the quarter []

Others _____

5. Factors hindering waste sorting

Lack of facilities []

Laziness []

Lack of awareness []

Lack of support []

No idea []

**SECTION E: SOCIOECONOMIC, ENVIRONMENT AND HEALTH
IMPLICATION OF WASTE SORTING**

1. What are the socio-economic implications

Serves as raw materials for recycling and composting plants []

Source of income for scammers []

Enable university authority to plan future waste management []

All of the above []

2. What are the environmental Implications

Decrease in level of solid waste to landfills []

Saving energy []

Reduces indiscriminate waste dumping []

No idea []

3. What are the health implications

Leads to separation of organic from inorganic wastes []

Convenient and hygienic free []

Reduces airborne diseases []

No idea []