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ASSESSMENT OF FARM WASTE UTILISATION AMONG RURAL DWELLERS IN OSUN STATE, NIGERIA

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ASSESSMENT OF FARM WASTE UTILISATION AMONG RURAL DWELLERS IN OSUN STATE, NIGERIA

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B. Agric., M.Phil. (AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY), (Ife)

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CERTIFICATION

This research project, written by YUSUF Olayinka Jelili, has been read, approved and adjudged to meet part of the requirements for the award of Ph.D. Degree in Agricultural Extension and Rural Sociology of the Department of Agricultural Extension and Rural Development, Obafemi Awolowo University, Ile Ife, Osun State, and was supervised by me.

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30/09/2014
(Chief Examiner)

DEDICATION

This work is dedicated to the memory of my late father, Alhaji Musiliu Ajibike YUSUF, whose sweat cooled me throughout my educational sojourn in his life time.

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ABSTRACT

The study identified farm wastes among rural dwellers in Osun State, Nigeria, it examined rural dwellers' perception about farm wastes' economic potentials, determined the knowledge level of identified farm wastes' economic potentials and the level of utilisation of farm wastes by rural dwellers as well as identified factors associated with farm waste utilisation with a view to empowering the rural dwellers economically through judicious utilisation of identified farm waste items.

Multi-stage sampling procedure was used to select respondents for the study. At the first stage, 20 per cent of the total number of Local Government Area (LGA) in each Agricultural Development Project (ADP) zone was sampled giving a total of 6 rural LGAs. At the second stage, proportionate sampling method was used to select five per cent of the total number of communities in each LGA giving a total of 28 communities. Finally, 13 respondents involved in farm waste utilisation were purposively selected from each of the communities, giving an overall sample size of 364 respondents. Interview schedule was used for quantitative data collection while Focus Group Discussion (FGD) and Key Informant Interview (KII) were used to elicit qualitative data. Frequency counts, percentages and weighted mean scores were used to describe data collected while chi-square, correlation and stepwise regression analyses were used to make deductions. Also, factor analysis was used to identify factors associated with farm waste utilisation among rural dwellers in the study area.

Results showed that cassava and yam peels, maize stalks and cobs, cowpea husk, palm kernel shell, empty palm fruit bunch, cocoa pods, poultry droppings, and sheep and goat faeces were prominent waste items identified in the study area. Results further revealed high extent of utilisation of cassava peels for livestock feeding with weighted mean score ($\overline{X}_{w}$) of 2.45 $\pm$ 1.11, yam peels for making yam flour ($\overline{X}_{w}$ = 2.24 $\pm$ 1.06), maize cobs ($\overline{X}_{w}$ = 2.22 $\pm$ 1.07) and palm kernel shell ($\overline{X}_{w}$ = 2.43 $\pm$ 0.99) as household fuel for cooking and palm fronds for broom production ($\overline{X}_{w}$ = 2.23 $\pm$ 0.91). Also, results of Chi-square analysis

established significant association between farm waste utilisation and gender (χ^2 = 10.38), farm land acquisition (χ^2 = 51.00), ethnicity (χ^2 = 19.67) and nativity (χ^2 = 10.40) at $p \leq 0.05$. Result of regression analysis further showed that income (t = 2.401), perception about farm waste items (t = 4.458), perceived behavioural control (t = 2.534) and attitude towards farm waste utilisation (t = 2.732) positively and significantly contributed to extent of farm waste utilisation at $p \leq 0.01$.

The study concluded that there were varieties of farm waste items with good economic potentials which if well utilised could be harnessed to empower rural dwellers economically thereby enhancing their livelihoods.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

The rural environment is replete with abundant resources, utilisation of which is not only significant to rural development, but overall national development. Some of these resources with huge potentials for wealth generation are often left unused with their potentials 'wasting' away. These waste materials are generated within the rural environment, particularly during rural dwellers' livelihood pursuit, but are often discarded without regards for their wealth generating potentials. In conventional farming practices, the residues are generally treated in an uncontrolled manner and either burned in open-air fires or thrown away to decay. This burning or decomposition, apart from amounting to a colossal waste of resources, contributes to environmental degradation and pollution which is hazardous to both human and ecology. Furthermore, with increased density and distribution of cottage industries located in the rural areas, the presence of large expanse of land used as dumping sites for various wastes is not uncommon in most rural environments. As a result, more land resources are locked up and chances of environmental pollution intensify, thereby contributing to unhealthy and unconducive living in the rural environment (Jekayinfa and Omisakin, 2005; Oyeleke and Jibrin, 2009; Ajayi, 2010, Oladeji, 2011).

Agricultural activities are generally known to generate waste materials during crop growth and harvest. Similarly, livestock farming experiences a large volume of by-products in terms of urines and faeces. Wastes may also be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products and the consumption of final products. Various scientists, according to Afolayan *et al.* (2012), estimated waste generation in Nigeria at 0.58 kg/person/day with little or no consideration for the rural dwellers that constitute more than 53% of over 160 million population of the country. A further breakdown of waste generation in Nigeria by some of these scientists has

been quantified as follows: municipal solid waste – 4,075 million tons, fuel wood - 38.1 million tons, agro waste- 11.24 million tons with sawdust at 1.8 million tons.

Waste constitutes environmental threats to human's existence. They are often disposed through use of landfills or dumping sites where they are accumulated to decompose. Bulkeley and Askins (2009) argued that landfill is unsustainable solution to waste disposal, because it both locks up potentially valuable resources – land, and contributes to environmental pollution, through the decomposition of biodegradable fraction of the waste into acidic solution that leaches heavy metals from other wastes, thus contributing to water pollution. The decomposition process, according to these authors, also leads to creation of methane, a greenhouse gas that contributes to climate change. Knowles (2005), in his own contribution, concurred to the unsuitability of landfills, noting that many lack protective barriers and are sometimes located close to waterways thereby causing water as well as soil contamination, which poses threat to both human health and the local environment.

The concept of waste as a material "which has no use" is changing to that of "a resource" by converting into useful materials with necessary modifications (Kumar and Grover, 2007). The idea that waste is actually a misplaced resource is slowly gaining recognition. It is becoming increasingly recognised that waste materials can be a valuable resource, whilst there is debate as to how this value is best realized. Venkateswaran (1994) noted that there are various forms of resource recovery from waste that can take place and are currently being practiced to varying degrees. Kumar and Grover (2007) noted further that the utilisation of waste is necessary for ecological sustainability, environmental safety, economic stability and well being of human society.

Agricultural extension is not only concerned with agriculture or relating to land use alone, but more broadly interested in rural resource management and general rural transformation. In fact, several authors have independently concurred that every aspect of rural life, ranging from economic to environment should be of interest to extension

(Obibiakwu, 1983; Adams 1982; Jones and Garforth, 1997; Ajayi, 2010). Since rural environment where agriculture takes place is subject to environmental degradation, which arises from waste generated in the course of livelihoods activities of the rural dwellers, then the focus of extension agents and agencies should include, as well, issues pertaining to rural environmental management.

The thrust of this study was to assess the utilisation of farm waste among rural dwellers in Osun state, Nigeria, with a view to engendering attainment of sustainable rural livelihoods through utilisation of farm waste items available within the rural environment, and also delineating definitive roles extension would have to play in the process.

1.2 Statement of research problem

Many rural farm families make a living from a variety of livelihood choices ranging from cultivation of arable and tree crops and rearing of livestock to trading and agro-processing amongst others. Making a living by exploration of these livelihood activities often generates wastes with enormous potential for wealth generation. Despite the invaluable potentials, abundance and availability of these waste items, many rural dwellers have, conventionally, made their livelihood choices without considering a full utilisation of these waste items. They often focus more on major produce/product of their cultivation/processing.

Most of the materials usually regarded as wastes could constitute part of natural asset base within the rural environment that are convertible to important local resources by the rural inhabitants. They should at best be regarded as by-products which exploitation could enhance sustainable livelihood diversification and facilitate economic empowerment of the rural populace. However, they are often discarded with their vast potentials left untapped or underutilised. For instance, biomass briquettes, mostly made of green waste and other organic materials, such as rice husk, ground nut shells, could be used for electricity generation, heat and cooking fuel in the rural areas. On the contrary, rural dwellers massively cut down big

trees protecting the ecosystem in order to make coal to meet their energy needs, thereby contributing to environmental degradation. This dependence on traditional charcoal and firewood contributes to the prevailing deforestation and soil degradation, the effects of which have manifested in irregular rainfall, floods and violent storms (Sabiiti, 2011).

Another instance is cited from the cassava industry. Due to efforts to transform Nigeria's agriculture, cassava production have risen to more than 50 million tons per annum, with several factories now processing cassava to products such as flour, gari, glucose, and ethanol, which in turn is churning out cassava residues including cassava peels en masse to the environment (IITA report, 2013). Also, under the cassava transformation plan of Nigeria's agricultural transformation program, it is estimated that over 2 million tonnes of additional cassava by-products would be produced each year (IITA report, 2013). This will undoubtedly increase the availability of cassava peels which can be converted to important resources by the rural inhabitant who would be engaged to produce the cassava. However, how much of the enormous cassava peels already being produced in the rural environment even before the anticipated increase in production have been efficiently converted to useful local resource is an important question to ask.

International concerns on the need to exploit potentials of waste materials for wealth generation is increasingly emerging. From developed economy in the United States to the developing ones in Africa, like Egypt, Uganda, Tanzania, South Africa and Nigeria, the focus on 'waste to wealth generation' have been on the increase in recent times. However, much attention has been paid to the urban cities only, due to colossal amount of wastes generated that are already posing environmental threats to the urban populace. As Taboada-González *et al.* (2010) rightly noted, there is inadequate knowledge about waste generation and composition in rural areas globally because these types of studies have been conducted mainly in big cities. Moreover, many scholarly writings on waste materials emphasize mainly the environmental and hardware-technological aspects of wastes, with less attention to the

socio-cultural dimension (Jekayinfa and Omisakin, 2005; Oyeleke and Jibrin, 2009; Oladeji, 2011). Hence, there is dearth of empirical research pertaining to the socio-cultural aspects of wastes, especially in agricultural sector of rural economies. Similarly, there is dearth of evidence from literature of the holistic documentation of varieties of farm waste items in rural environments and their potential for utilisation as important local resources.

Given the foregoing, the study attempted to fill the identified gap through documentation of farm waste items generated in rural areas of Osun State with their potentials for utilisation, identification of socio-cultural and other factors associated with farm waste utilisation and delineating roles of extension in farm waste utilisation towards the attainment of sustainable rural economy. The study was guided by the following research questions:

- what are the farm waste items available in Osun State of Nigeria, and what are their potentials for wealth generation?
- how do the rural dwellers perceive these waste items?
- are the rural dwellers aware of, and have knowledge about utilisation potentials of these farm wastes?
- what are the socio-cultural and other factors inhibiting the accessibility to and utilisation the farm wastes?
- Do extension agents and agencies specifically play any role in championing farm waste utilisation amongst rural inhabitants in the study area?

1.3 Objectives of the study

The main objective of the study was to assess farm wastes' utilisation among rural dwellers in Osun State, Nigeria.

The specific objectives were to

a. identify farm wastes available among rural dwellers in Osun State;

b. examine the rural dwellers' perception about farm wastes' economic potentials;
c. determine the rural dwellers' knowledge level of the identified farm wastes' economic potentials;
d. determine the level of utilisation of farm wastes by the rural dwellers; and
e. identify factors associated with farm wastes' utilisation among rural dwellers in the study area.

1.4 Hypotheses

Four sets of hypotheses were formulated for the study. The hypotheses and background leading to them are as follows:

1.4.1 Respondents' personal characteristics and farm waste utilisation

Several studies (Babayemi and Daudu, 2009; Adedayo, 2012; Agwu, 2012) have sought to establish relationship between respondents' personal and socioeconomic characteristics, (such as age, gender, marital status, income level, farm size, educational level, amongst others) and waste management practices and utilisation behaviour. However, diverse results were obtained from findings these studies. As such, hypothesis one was set in null form:

Hypothesis one: There is no significant relationship between rural dwellers' personal and socioeconomic characteristics and their level of utilisation of farm wastes.

1.4.2 Respondents' knowledge about utilisation of farm waste

Knowledge is a fundamental precursor of performance. While someone may want to do something, lack of knowledge about how to do it may inhibit them. This then suggests a possible relationship between knowledge about how to utilise farm wastes and their actual utilisation. But for lack of adequate empirical evidence from literature, hypothesis two was set in null form.

Hypothesis two: There is no significant relationship between rural dwellers' knowledge of utilisation potentials of farm wastes and their level of utilisation of farm wastes.

1.4.3 Respondents' perception about farm wastes' utilisation

Perception is an important stage in attitudinal formation. The predisposition of an individual to act or behave towards a particular thing is largely shaped by their perception of that thing. Furedy and Pitot (2012) suggest that religious beliefs and long standing social taboos, amongst others, may influence personal and community attitudes towards wastes. As such, the tendency to utilise farm waste may be dependent on how rural households perceive these farm wastes. However, due to dearth of empirical evidence from literature suggesting a direct causal relationship between peoples' perception and farm waste utilisation, hypothesis three was set in null form.

Hypothesis three: There is no significant relationship between rural dwellers' perception of farm wastes' utilisation and their level of utilisation of farm wastes.

1.4.4 Relationship between key variables of theory of planned behaviour (TPB) and farm wastes' utilisation

The key variables of the theory of planned behaviour, one of the theories used to provide theoretical underpinnings for the study, are perceived behavioural control, subjective norm and attitudes towards farm waste utilisation. Several studies (Ho, 2002; Tonglet *et al.*, 2004; Kasfikis, 2005; Zhou 2010; Niaura, 2013) on waste management and recycling behaviour of respondents have used the TPB to investigate waste recycling behaviour amongst different categories of respondents. However, those studies differed from the current one in that they focussed on non-farm waste and conducted within urban setting with the subjects being urban dwellers or college students. For these differences, hypothesis four was also formulated in null form.

Hypothesis four: Perceived behavioural control, subjective norm and attitudes of respondents towards farm waste utilisation may not influence level of farm waste utilisation among rural dwellers in the study area.

1.5 Significance of the study

Globally, sustainability has become a prominent issue central to development. The effects of what is being done today on the future generations to come is increasingly being recognised and discussed in development arenas. Careless disposal and burning of farm wastes within the rural areas, as is mostly the conventional practice, is not only dangerous to the rural environment but tantamount to wanton disposal of useful resources that could have been put to judicious use on one hand, and polluting the global environment on the other. The outcome of the study is very beneficial to the grassroots, and by extension, national development because the study identified examples of specific enterprises that available farm waste items within the rural environment can be channelled to as important local resource by the rural dwellers. This could facilitate sustainable livelihood's diversification and employment creation within the rural sector.

Also, the documentation of various farm wastes with their potentials in the study area could serve as a compendium for governmental, non-governmental and developmental agencies in designing of appropriate development intervention efforts for economic empowerment and poverty reduction amongst the rural populace of the study area. Again, the conventional role of extension has been dissemination of innovations among rural clientele within its coverage. Beyond this usual role, the outcome of the study explicated specific roles of extension organisations and professionals in pioneering farm wastes utilisation among rural dwellers.

1.6 Basic assumptions of the study

The study was premised on the following assumptions:

i. Farm waste items which have potentials for use as important local resource are available within the rural environment

ii. Inappropriate disposal of these farm waste items poses environmental threat to the rural dwellers.

iii. Through judicious utilisation of these farm wastes, rural dwellers may be economically empowered thereby alleviating poverty pervasive in the rural environment.

iv. Utilisation of these waste items can ensure attainment of sustainable livelihoods among the rural dwellers through livelihoods diversification.

1.7 Operational definition of terms

Waste: Waste generally refers to any item that results from human activities which an individual regard as unwanted and economically unusable and therefore discards purposefully or accidentally into the environment, but other individuals may take advantage of and benefit from its utilisation. Although, there are various types of wastes generated from human activities, this study focused on farm wastes.

Farm waste: Farm waste is used to refer to any item gotten from a crop or livestock animal (or parts of it) that is cultivated/processed or reared but not the primary focus of cultivation/processing or rearing. They include by-products which arise during processing of farm produce. By being termed waste does not mean the item lacks potential for utilisation or necessarily discarded, rather, what is meant is that the producers or processors do not pay attention to it after obtaining the core produce or product for which they primarily engaged in the production or processing. As such, a producer or processor may still use some of these

items, but ultimately, not to the fullest, as some of them are left unused or abandoned to 'waste' away.

It also includes certain plant that may not necessarily be cultivated but found growing on the farmers' farm and has potentials for utilisation, which rural dwellers have not fully harnessed their utilisation potentials. The term agricultural waste or agro-waste is used interchangeably in this study to imply farm waste.

Farm waste utilisation: refers to various ways farm wastes items were utilised by respondents in the study area including those that are offered for sale

Dumping: This refers to uncontrolled methods of waste disposal common in developing countries.

Subjective Norm: It is used to describe how certain individuals, such as parents, friends and relatives may influence (i.e. would encourage or discourage) the decision of an individual to engage in farm waste utilisation.

Perceived Behavioral Control: It is a measure of rural dwellers' confidence in their ability to engage in farm waste utilisation, and there perception of how easy or difficult it is to do this.

Perception about farm waste items: It measured how favourable or otherwise rural dwellers view the economic importance of farm waste items

Attitude towards farm waste utilisation: It expresses the predisposition of a rural dweller to utilise farm waste items or ways of disposing them, based on his evaluation of how favourable or otherwise the act is.

Rural dwellers: These are subject of focus (primary respondents) for the study. They were selected through a multistage sampling procedure. The term rural dwellers and rural inhabitants were used interchangeably in the study to refer to the respondents.

Rural areas: This refers to the locality where respondents reside. A rural area is defined in the study as an area whose primary or major occupation of the inhabitants is farming.

1.8 List of abbreviations

CDA – Community Development Associations

CTCS – Cooperative, Thrift and Credit Society

EFB – Empty Fruit Bunch

FEPA – Federal Environmental Protection Agency

FGD – Focus Group Discussion

FYM – Farm Yard Manure

FWU – Farm Waste Utilisation

KI – Key Informant

NIMBY – Not In My Backyard

NIABY – Not In Anybody's Backyard

PBC – Perceived Behavioural Control

PKS - Palm Kernel Shell

LGA – Local Government Area

OPT – Oil Palm Trunk

OSSADEP – Osun State Agricultural Development Programmes

SWM – Solid Waste Management

SN - Subjective Norm

TPB – Theory of Planned Behaviour

UNEP – United Nation Environmental Programme

WSSD – World Summit on Sustainable Development

CHAPTER TWO

LITERATURE REVIEW

This chapter dealt with review of relevant literature on the present status of scientific knowledge in the field of study. Relevant concepts and theories which provided theoretical underpinnings for the study were discussed. Hypothetical model derived from the understanding of these concepts and theories was also presented.

The chapter was divided into following sections for ease and clarity of discussion:

1. Waste: Contextual definition and socio-cultural implication.
2. Waste management and the 'sociology of waste'.
3. Farm Waste Management and the environment: Role of extension.
4. Potentials of farm wastes for utilisation.
5. Concepts of Entrepreneur and Entrepreneurship.
6. An empirical review of past studies on farm wastes utilisation.
7. Conceptual and Theoretical frameworks for the study.
8. Model for the study.
9. Operation of the model.

2.1 Waste: Contextual definition and socio-cultural implication

There is no universally accepted definition of what constitutes a waste. As such several definitions abound in literature. An account of some definitions is hereby provided. According to 7th edition of the Oxford Advanced Learner's Dictionary (2006), waste is defined as 'materials that are no longer needed and are thrown way. Similarly, the United Nation Environment Programme (UNEP) defined waste as all unwanted and economically unusable materials that result from human activities, discarded purposefully or accidentally into the environment (UNEP, 1994). Waste is also defined as "any substance or object which the holder discards or intends to discard" (Waste Framework Directive 75/442/EEC, 1975,

Article 1 (a)). Although defined by different people at different point in time, key thing that cuts each definition above (and several others) is the idea that waste are materials meant to be thrown away. The UNEP definition however added the environment – the 'final destination' of the discarded material. However, it is important to note that discarding them do not mean they lack further utilisation potential, rather, the one throwing them away has no further need for them.

The New Encyclopaedia Britannica defines 'waste' as "*material that is discarded because it has served its purpose or is no longer useful*" (p.392). Two things come into view from this definition. Firstly, an object becomes waste simply because it was destined so by design (it is discarded once *it has served its purpose*). Secondly, an object becomes waste when it *is no longer useful* – maybe it has reached the end of its useful life (wear and tear), or maybe it is its user that finds no further use for it and, thus, it is no longer of value (Kasfikis, 2005).

In their own contribution, Oelofse and Godfrey (2008) noted that defining waste has its origins in the management of unwanted and discarded material, where waste historically was disposed without consideration for the resultant environmental consequences or the re-use or recycling potential. However, due to increasing understanding of the implication of the environmental consequences, the management of waste, both locally and internationally, has been incorporated into environmental legislation to protect both the environment and human health from any adverse effects of waste disposal.

While there are certainly some cases where it is clear that material is waste and re-use should not be considered - for example, medical waste - resource recovery at landfill sites and waste dumps is clear indications of the existing re-use potential of waste being disposed of. There is also a vast number of 'difficult' or 'border-line' residues and by-products (mostly industrial waste) that are not being disposed of, but are consistently and profitably re-used,

both locally and internationally. Defining something as waste therefore involves treading a very thin line between 'resource' and 'waste' (Oelofse and Godfrey, 2008).

The socio-cultural implications of waste definition

What a society defines as 'waste' is intensely implicated with how that society makes sense of the creation and destruction of value. Thompson (1979) exemplified this by considering the difference in the way between the terms 'second-hand' and 'antique' are construed. While the latter describes an object that perhaps embodies ancient and/or special aesthetic properties, the former describes an object from the (not so distant) past that still embodies utility, but in some ways carrying a 'miasma' because it has already had an owner. However, they have something in common: both are socially constructed. Indeed, people in different cultures (or even in different 'tribes' within the same culture) may value different things, or they may value the same things differently, but there is certainly a universal distinction between the valued and the valueless, also marking the distinction between non-waste and waste (Thompson, 1979).

Thompson (1979) categorised possessible objects into two groups. The author elaborated that objects can be either 'transient' (objects that have finite life-spans, thereby decreasing in value over time), or 'durable' (objects that have very long life-spans, ideally with their value unaffected over time). The author made use of the term 'overt' to characterise the objects from these two categories, since their utilities have form and are physically obvious. But when objects expire, either in terms of their value or their utility, they fall into a *covert*, third category; the category of waste. Here, the use of the term 'covert' is an accurate surrogate for the 'out of sight, 'out of mind' alchemy of waste 'management' that has characterised humans for millennia (Kasfikis, 2005).

With the arrival of large-scale recycling, the one-way linear flow of materials – extracted as production input, then transformed for consumption, and eventually (covertly) discarded as expired, valueless objects – is being irreversibly challenged. The concept of

waste as a material "which has no use" is changing to that of "a resource" by converting into \useful materials (Murray, 1999; Kasfikis, 2005; Kumar and Grover, 2007). The challenge has come not only in terms of legislation, logistics, or technology, but also in terms of the changes that society has to undergo, starting from within the very boundaries of the household (Kasfikis, 2005). As Hawkins and Muecke (2003) explain, recycling epitomises a massive reorganisation of social values, and a transformation in domestic habits and the self. The array of essays that they bring forward point towards the same argument; that "waste management in all its various forms and historical mutations is deeply implicated in the practice of subjectivity", because "...changing relations to waste mean changing relations to self".

An example of anthropological and ethnographic work around the relationships between waste and the self, waste and the body, and how this is viewed within a society is that of Larporte (2000). Laporte's work shows how a society's cultural and bodily relationships with its waste can radically change, with repercussions on what methods are selected to deal with the waste problem thereafter. In his exposition, Laporte (2000) presents an array of examples that portray how the relationships of society with its unwanted, valueless objects have been changing through the times. In one example, Laporte describes how the Hygiene edicts published in France in 1539 succeeded at domesticating and privatising human excrement in order to clean up the streets and educate people about being responsible for their wastes. Up to that time, defecating in the street was a common and socially acceptable act, with no shame involved, or the need for privacy. However, the edict mandated that cesspits were built in every home, and it litigated the (ir) responsibility of waste producers by stating that disobedience would result in imprisonment and property confiscation. By introducing the edict, the authorities not only incurred implications in the physical, architectural form of the house as a building, leading to changes that have since prevailed in the management of human excreta, but also introduced the notion of bodily

privacy during defecation, thereby shifting society's view of the body and its waste, now turned covert (Kasfikis, 2005). Kasfikis (2005) was quick to note that the epidemiological relationship between defecation and public health was not be known until three centuries later, adding that the purpose of the edict was precisely to establish an 'out of sight, out of mind' approach to dealing with human bodily wastes.

The kind of work that culture theorists and sociologists like Thompson (1979), Laporte (2000), or Hawkins and Muecke (2003) deliver is clearly valuable in giving perspective to the conceptualisation of the very properties of wastes. Not so much in terms of their physicality, but more so in terms of how cultural forces led to their genesis as problems, and how their physicality is understood and translated into either (socially-constructed) value, or mess of pottage. In this sense, it provides a useful extension - not a replacement - to the positivistic assessments for defining 'waste' that emerge from the current dominant policy/scientific/environmentalist discourses (Kasfikis, 2005).

As the new alchemy is about turning the covert-waste into overt-resource, this perspective also provides a useful conceptual compass for policy makers and waste managers alike, not least because of the following important point put accurately by Thompson (1979): "Only if one remains within several cultural and temporal confines can one sustain the commonsense belief that rubbish is defined by intrinsic physical properties. Step outside these limits and one sees that the boundary between rubbish and non-rubbish moves in response to social pressures"

2.2 Waste management and the 'sociology of waste'

In early pre-industrial times, waste generation was not an issue as populations were smaller. Waste was disposed of in the ground where it would turn to compost to improve soil fertility. Waste management became a growing problem during the transition from nomadic hunting and gathering to farming. Before the industrial revolution, waste reuse and recycling

were the major ways of waste management. However, as populations increased, especially in major cities and urban centres, space for disposing waste became limited and people needed to look for new and better ways for disposing waste. In 400 BC, the first municipal dumpsite was created in ancient Athens in Greece (Anon 1997).

In this early period and even until recently, waste has always been on the shadow side of the economy. In production and consumption, it is that which is rejected as useless and barren. Whatever the word (garbage, rubbish, refuse, waste), and whichever the language, the meaning is similar. The social task of waste management has been to get rid of it (Murray, 1999). Wastes, including agricultural residues are generally treated in an uncontrolled manner, and either burned in open-air fires or allowed to decay, in either case, resulting in significant environmental degradation while at the same time, potentially useful resources are wasted.

Despite the avalanche of waste generated world over today, and the implications of improper management in the society and on the environment, sociology or sociological theories, until recently, rarely deals with or acknowledges waste. Fagan (2002) argues that waste can be seen as a 'lost continent' in realms of social theory, a long way behind production and consumption in terms of analysis and understanding, adding that it is only recently that we see the beginnings of a sociology of waste. Fagan cited O'Brien (1999) who had earlier on argued that contemporary sociology as a discipline rarely deals with, theorises or acknowledges waste, even when dealing with production and consumption at the level of everyday life. His views are succinctly captured thus:

> "It is as if, for the discipline of sociology in general, and for sociological theory in particular, nobody ever throws anything away or ever carries out the bin-bags for a 'waste management authority' to deal with. It is as if, when you go to a shop, restaurant, club or place of work, you work, consume or take your leisure without ever producing rubbish or detritus of any kind. Sociology treats 'waste' as if it were literally immaterial, as if it existed in a world apart from the one we inhabit in our daily, routine lives (O'Brien, 1999: 6; Cited from Fagan, 2002).

While noting the above scenario to be the case in the so-called area of 'sociology of everyday life', Fagan (2002) argued further that even in the sociology of the environment, another fast growing substantive area, where one would expect to see a link made between global consumerism and global waste and wasting there is very little theoretical analysis done. Fagan acknowledged two major recent works in this substantive area (Becker and Jahn, 1999 and Spaargaren *et al.,* 2000) but, however, argued that the authors failed to address waste at all. Premised on the foregoing, therefore, Fagan concluded that, if one is to think of the earth as limited resources, then a 'sociology of waste', is urgently needed as it is key to understanding the relationship between social change and environmental change. It is equally as necessary as, and complimentary to, those sociologies of production and consumption that have so far led the field (Fagan, 2002).

The notions of discarding waste, simply through burning or decomposition, are now changing. There is current spate of transformation which presents new choices and opportunities, and provides lessons and pointers for industrial, social and environmental policy in the new post-industrial landscape. Three basic drivers of this change which are now turning waste and waste management into a dynamic, fast-changing, international economic sector include: growing concern about the hazards of waste disposal; broader environmental concerns, especially global warming and resource depletion; and economic opportunities created by new waste regulations and technological innovation (Murray, 1999).

The potential benefit of dealing with agricultural residues in a sustainable manner is increasingly being recognized. The environmental benefits such as reduction in greenhouse emissions as a result of burning, and conservation of natural resources are now being appreciated and emphasized. No doubt, agricultural extension which primarily renders its service to the rural farmers from whose immediate environment the farm waste items are generated should have a prominent role to play in sustainable utilisation of farm waste items.

In the next subsection, attempt was made to review the roles of extension in farm waste management towards attainment of sustainable rural environment and livelihoods.

2.3 Roles of extension in farm waste management and utilisation and attainment of sustainable rural environment and livelihoods

Agricultural extension which focus on rural dwellers and farmers has various dimensions; with the overall basic objective of communicating useful information and innovations to the rural beneficiaries and helping them to learn how best to use the information provided to enhance a better living conditions for themselves, their families, communities and environment. Describing the scope of extension by agricultural extension activities, Oakley and Garforth (1985) categorized extension activities into agriculture and non-agriculture related. Obibiakwu (1983), in his own contribution, opined that agricultural extension is not only concerned with agricultural development, but overall transformation of the rural areas. In the picture of extension given by Uphoff (2000) and Leeuwis (2004), as cited in Ajayi (2010), the authors submitted that extension is not just concerned with agriculture or relating to land use only; but also concerned more broadly rural resource management.

Agriculture, which is the mainstay of the rural economy continually, exploits the environment. Daunting development issues today, such as global warming and climate change menace, are believed to be attendant consequences of numerous human actions that emanated from their engagement in agriculture. Since the rural environment where farming taking place is consistently subjected to environmental degradation, there is therefore the need for extension agents and agencies to have guided interest in environmental management as it pertains to farm waste management and utilisation. The fact that every aspect of rural life ranging from economic to environmental is of interest to extension agents in recent times, as established by several authors of notable works in the field of extension as cited by Ajayi

(2010) prompted the need to get the agents and rural people involved in the promotion of sustainable environment.

Exploitation of natural resources is natural to agriculture and could not be stopped in the process; however the need to promote environmental friendly practices through well planned extension programme is inevitable. Hence rural environment which is given some deal of attention in this study through a painstaking look at farm wastes generated by rural dwellers in the pursuit of their daily livelihood activities is of concern to extension. Given the foregoing about the scope of extension on one hand, and the colossal amount of farm wastes that emanate from the rural environment during livelihood pursuit of the rural inhabitants, and the peril associated with improper management and disposal of these wastes, despite their immense benefits for attainment of sustainable rural livelihoods on the other hand, it becomes imperative to evaluate what role extension agents and agencies would play in the promotion of sustainable environment and rural livelihood through judicious utilisation of farm wastes.

2.4 Potentials of farm wastes for utilisation

Farm wastes have always been used in many ways. They have been an important source of household fuel and building material in many low-income countries; provided indispensable bedding and feed for animals, particularly ruminants, of all continents; offered an excellent substrate for cultivation of mushrooms; been used for making paper; and been tapped as sources for extracting organic compounds (Smil, 1999). In the succeeding lines, attempt is made to document the general uses of farm waste available in literature.

2.4.1 *Household fuel*

The bulkiness and relatively low energy content of crop residues make them inferior to wood but they are still an important source of energy in densely populated and arid or deforested regions of Africa and Asia. China's rural energy surveys show that during the late 1980s, roughly three-quarters of the country's crop residues, including more than two-thirds of all cereal straws, were burned in cooking stoves (Smil, 1993). Although, expanded supplies

of coal from small local mines has lowered the demand for residues as fuel in many countries, (Smith, 1992), yet, there have been records of use of farm waste items such as corn cobs, oil palm kernel shell, and coconut husks, amongst other residues as household fuel within rural environment. According to Gerety (2014) Nigerian medical doctor, Dr. Oluyombo Awojobi, who runs his clinic on corn cobs. Crop residues in conjunction with more nitrogen rich animal and human wastes can be also used as feeds stocks for biogas generation (Marchaim, 1992).

2.4.2 *Building materials*

Making bricks and walls from straw-clay mixtures is an ancient technique that is still used in house and shed construction in many poor countries, as is the use of cereal straws for roofing. A more modern, superior approach is to use clean shredded straw to make boards, mostly for interior partitioning, by heating and compression, a technique that prevents the use of binders (Smil, 1999). Findings of study by Adedeji (2011) had shown that stable cement-bonded composite panels produced from palm kernel fibres are comparatively cheaper, improved sound-proof, durable, lighter-weight and environmentally friendly than the conventional sandcrete blocks.

2.4.3 *Animal Feed and bedding*

Crop residues are fed to domestic animals in forms ranging from traditional stubble-grazing of harvested grain fields to preparation of chopped residue mixes that are made more palatable and nutritious by the addition of nitrogen-rich compounds. Ruminants can digest cellulose because microorganisms in the rumen produce the requisite enzymes. Indeed, to maintain normal rumen activity, at least one-seventh of the normal ruminant diet (in dry matter terms) should be in roughage (NRC, 1996).

The presence of lignin decreases the overall digestibility of crop residues; while they are also low in protein and deficient in minerals, energy that can be metabolized from them are low (generally between 5.8 and 6.5 MJ/kg for cereal straws fed to ruminants) (Bath *et al.*, 1997). That notwithstanding, feeding farm animals with crop residues are, in fact, the largest

off-field use of cereal straw in many poor countries, particularly those in Asian and African countries, where cattle and water buffaloes are still important draft animals (Matthewman and Dijkman, 1993). Relatively large shares of residues are fed to ruminants even in rich countries, where other forms of roughage (mainly grasses) are also readily available. Countries with large amounts of residues but limited supplies of concentrate feeds are now increasingly improving the palatability and digestibility of the feed by various treatments. The most effective methods involve alkali treatment (soaking or spraying with 1.5- 2% sodium hydroxide solution) and, preferably, enrichment with ammonia or urea (Sundstol and Owen, 1984; Schiere and de Wit, 1995).

In addition, according to Smil (1999), a combination of treated straw and such protein rich food processing wastes as oil cakes can replace hay or silage, making it possible to feed beef or dairy cattle without devoting farmland to concentrate and roughage crops. This option has the highest appeal in land-short Asian countries trying to increase their output of animal foodstuffs. Because of their excellent water-absorption capacity, cereal straws remain preferred materials for animal bedding. In addition to keeping animals clean and comfortable, bedding residues make manures easier to handle and limit the leaching loss of absorbed nutrients; where straw is plentiful, approximately 250 kg are used for each metric ton of excrement.

2.4.4 *Mushroom cultivation*

Use of residues in mushroom production, represents a valuable conversion of inedible phytomass to foodstuffs, which, despite their high moisture content, have two to three times as much protein as common vegetables and an amino acid composition similar to that of milk or meat (Crisan and Sands 1978). Wheat and rice straws provide excellent examples of very good substrates for the cultivation of *Agaricus bisporus* (white button mushroom) and *Volvariella volvacea* (straw mushroom), two of the four most commonly grown fungi. Straw for Agaricus cultivation is usually mixed with horse manure and hay, and a very high

conversion efficiency of the substrate into fungal bodies is possible (Wuest *et al.*, 1987; Maher 1991). Outdoor cultivation of Volvariella can be done with just wetted straw, but mixtures of rice straw and cotton waste, or cotton lint alone, are excellent for indoor cultivation (Hamlyn, 1989). Cassava peels and empty palm fruit bunch are example of farm waste items that could serve as substrate to grow edible mushrooms.

2.4.5 *Protecting soils against erosion and improving water retention.*

Excessive soil erosion is a major threat to sustainable farming, the effect of which can be ameliorated through judicious use of farm wastes. Residues control erosion primarily by two modes of action: reducing wind speeds below the threshold level for soil particle movement, and intercepting falling raindrops, preventing them from detaching soil particles. The kinetic energy of the largest raindrops is roughly 40 times their mass, making their impact two orders of magnitude more powerful than the resulting surface runoff; the rate of detachment of eroding particles is, therefore, highly correlated with rainfall intensity (Smil, 1991, 1999). In addition, the presence of residues reduces surface runoff of soil particles because it increases water infiltration rates. Even long straws are good absorbers of water, averaging 2-3 kg of water per kg of straw; shred-ding further enhances this capacity to 3-3.8 kg per kg of crop residue. Snow trapping by surface residues also significantly enhances soil water storage, with a more pronounced effect as stubble heights increase. These benefits have been demonstrated repeatedly since the 1930s by research done primarily in the Great Plains, where North America's most erosion prone as well as water scarce agro ecosystems requires careful management of residues to remain productive (Hatfield and Stewart, 1994).

2.4.6 *Enhancing soil organic matter*

A virtually universal consequence of converting grasslands to croplands has been an appreciable decline in concentrations of soil organic matter. In most cases, the rapid loss of soil organic matter during the years immediately following the conversion was replaced by slower, but continuing declines due to inappropriate agronomic practices. Long-term records

show soil nitrogen content falling by 25-70% over periods ranging from 30 to 90 years; these records also show soil carbon declining by up to 50% over similar time spans (Smil, 1991; Aref and Wander, 1998). Declines in soil organic matter are frequently accompanied by structural deterioration of affected soils, resulting in surface crusting. Also, reduced water infiltration and scarcer phytomass litter have led to reduced presence of the soil microorganisms and invertebrates whose activity is essential for the maintenance of highly productive soils (Reganold *et al.*, 1990; Madsen, 1995).

Earthworms are particularly effective in producing desirable physical and chemical changes in soils; their abundance declines sharply with the removal of crop residues and with burning of residues in the field (Edwards and Lofty 1979; Knight *et al.*, 1989). Such changes have significant long-term effects. A century of data from the Morrow Plots (at the University of Illinois at Urbana) shows that plots with higher soil organic matter content have higher yields than those with low soil organic matter content (Aref and Wander, 1998). On the other hand, declining soil organic matter can significantly reduce crop yields: Data from Russia suggest that reducing soil organic matter by 55 % cuts grain yields by half (Libert, 1995).

Recycling roots and stubble might suffice to maintain high levels of soil organic matter in some soils, particularly where crop rotations include "green manure" (i.e., leguminous cover crops grown for short periods of time and then ploughed under) or leguminous forages. Although, short-term trials comparing incorporation of residues with fertilizer applications may show that intensive recycling has few if any benefits. However, most long-term field experiments show a linear increase in soil carbon content with inputs of crop residues (Paul *et al.*, 1997). Apart from the crop residues mentioned above that can help improve soil fertility, livestock defecations such as poultry droppings, sheep and goat faeces and urine, cow dungs, amongst others have been documented to enrich soil fertility when composted.

2.4.7 *Recycling nutrients*

Smil (1999) illustrated the value of crop residue recycling by comparing nutrient removals and typical fertilizer applications for good harvests of two principal US crops: corn and winter wheat. Complete recycling of these residues and their eventual mineralization would supply approximately one-third of the nitrogen, between one-fifth and one-third of the phosphorus, and more than 100% of the potassium applied in inorganic fertilizers. But unlike nutrients from inorganic fertilizers, macronutrients in crop residues are not readily available. The high cellulose and lignin content of crop residues precludes rapid degradation, particularly in colder climates. In addition, the high C:N ratios of crop residues, which commonly range from 50 to 150, with only those of leguminous residues being below 40, are much higher than those of fresh leafy phytomass (12- 15 for grasses) or animal manure (typically 15-25). Biomass with C:N ratios below 20 will fairly rapidly release net nitrogen for plant growth; by contrast, the decomposition of high C:N ratio residues will actually withdraw nitrogen from the soil, temporarily immobilizing the nutrient during the early stages of decay and thereby reducing the short-term productivity of the soil. The pattern of phosphorus immobilization is similar to that of nitrogen. Of course, the immobilized nutrients become available eventually, but they cannot be counted on to enhance short-term growth, yields, or profits. How fast the nutrients will be released depends on the activity of microbial decomposers, which is highly temperature and moisture dependent. In colder climates and dry environments, more than one-half of the residues left on the surface may remain undecomposed after 1 year (Lynch, 1979, Schomberg *et al.*, 1994).

By contrast, in warm, humid climates, residues decompose rapidly, making nutrients much more readily available-but also making year-round reduction of soil erosion and water runoff much more difficult. In cold or dry environments, decomposition of residues can be speeded up by appropriate agronomic practices; experiments with wheat and sorghum straw in Texas showed that nitrogen in residues left on the surface was immobilized three times

longer than nitrogen in the buried phytomass and that decay rates increased linearly with the amount of applied water (Schomberg *et al.*, 1994).

The need to make a more comprehensive appraisal of residue recycling is demonstrated by experiments at the International Rice Research Institute (Cassman *et al.*, 1996). Rice straw was found to be a poor source of nitrogen when used alone, but its combination with fertilizer (applied as urea) resulted in agronomic efficiency just 15% lower than for the use of fertilizer nitrogen alone. This slight disadvantage was offset by several compensating factors: rice straw provided greater residual benefit (i.e., it provided nitrogen over a longer time period) than other organic sources of nitrogen and, with its high C:N ratio, was a better source of organic carbon and was able to increase bacterial fixation of nitrogen. Recycling of rice straw may thus have a greater potential for reducing requirements for applications of inorganic nitrogen than the use of green manure (Smil, 1999). Well-managed crops of tropical lowland rice could in fact derive nitrogen in the amount of 75 kg/ha from straw each year. Efficient recycling of this nitrogen would be promoted by optimized timing of fertilizer nitrogen application, by better incorporation of the recycled straw into soil, and, eventually, by using mechanical harvesters that leave straw in the field.

Clearly, crop residues should be treated as a valuable renewable resource to be managed carefully to maintain soil quality and promote crop productivity. This reality was explicitly recognized by provisions of the 1985 and 1990 US Farm Bills that link eligibility for federal farm program benefits to a Crop Residue Management Action Plan that was designed to 3 reduce soil erosion and promote water conservation (Schertz and Bushnell, 1993). Direct recycling is now by far the leading method of crop residue disposal in most US farming regions; nationwide, some 70% of straw and stover are left on land. Recycling of wheat and rice straw directly, or after being used for feed and bedding is also common in other countries, but so is the burning of residues in the fields (Smil, 1999).

Why then would farmers burn such a valuable resource, and what are the consequences of this practice? The next few lines attempt to appraise these questions.

Burning of crop residues

Andreae (1991) put the worldwide burning of agricultural residues at 2,020 metric tons per year, accounting for almost a quarter of his estimate of all biomass combustion; he also assumed the standard 45% carbon content and 90% combustion efficiency to calculate the release of approximately 800 Mt of carbon as carbon dioxide. However, Ilukor and Oluka (1995) argued that both of his assumptions appear to be on the high side, noting the carbon share of residues is often substantially less than 45% even as low as 30%. Nonetheless, the United Nations Environmental Programme (UNEP) and other organizations estimated that in low-income countries, approximately 25% of all residues are burned noting that the corresponding share in affluent nations is just 10% (UNEP *et al.,* 1995). The actual rate in low-income countries is almost certainly higher than 25%, especially when the use of residues for fuel is included. Even the rate in affluent nations is most likely higher because data on average burn fractions indicate regionally much higher burn rates both for field and orchard crops (Jenkins *et al.,* 1992).

The most common justifications that farmers give for burning are to get a seedbed that is easy to work and will not impede the growth of a new crop and to rid the fields of phytomass that can harbor pests and diseases waiting to reduce the next harvest. While acknowledging that these claims have some validity, Smil (1999) nonetheless disagreed that none of such claims could justify blanket burning of residues. Mechanical difficulties in tilling residue laden fields, he argued, can be managed either by using a straw chopper and dispersing the residues as evenly as possible or, preferably, by choosing an appropriate reduced tillage operation.

Annual carbon dioxide emissions from the burning of crop residues range between 1.1 and 1.7 Gt. However, as is the case with more massive savanna burning, these emissions do

not result in a net long-term tropospheric increase of carbon dioxide because an equivalent amount of gas (or, as the harvest increases, a slightly larger volume) is taken up by the next season's or the next year's crops. Annual emissions of carbon monoxide are most likely between 50 and 100 metric tons, and they clearly contribute to the carbon monoxide-rich plumes detected repeatedly by satellites above parts of Africa, Asia, and Latin America that are located far from any industrial or urban sources of the gas (Newell *et al.*, 1989). Emissions of methane are most likely between 5 and 7 Mt. Burning of crop residues also releases nitrogen as both NOx (NO and NO_2) and ammonia; in addition, 30-40% of the nitrogen present in the phytomass is converted during flaming combustion directly into nitrogen gas. Finally, combustion of residues is also a significant source of carbonyl sulphide (Kuhlbusch *et al.*, 1991; Nguyen *et al.*, 1994).

Although residue burning may make farmers' fields easier to cultivate and sometimes, perhaps, less pest infested, it is an undesirable practice, in an overwhelming number of cases, because it weakens the local capacity of the agro-ecosystem services, ranging from protection of soils against erosion to recycling of nitrogen. At the same time, residue burning contributes significantly to the build-up of tropospheric methane, a greenhouse gas that is approximately 60 times more effective than carbon dioxide in absorbing outgoing infrared radiation. Indeed, current methane emissions from crop residues may be equivalent to at least one-tenth of all methane emissions from the combustion of fossil fuels (Smil, 1999).

Seasonal burning of residues also has adverse regional health effects. These effects are most severe when stationary high-pressure cells still winds, limit atmospheric mixing, and cause overnight temperature inversions. For example, during the first week of October 1992, burning of wheat straw in southern Manitoba produced smoke concentrations high Proper management of crop residues Maintenance of highly productive cropping requires effective protection of soils against erosion, conservation of relatively high amounts of soil organic matter, and, to prevent undesirable environmental effects of high-level fertilizer applications,

the highest possible rate of recycling of plant nutrients. At the same time, minimizing the human impacts on tropospheric chemistry requires lower emissions of green-house and other gases, and avoiding serious health hazards posed by smoke necessitates severe restrictions, or outright elimination, of all unnecessary phytomass burning (Smil, 1999).

Appropriate field management of crop residues can help to achieve all of these goals. Residues in excess of carefully determined recycling requirements can make a major difference at both the local and regional levels in producing. Maintenance of highly productive cropping requires effective protection of soils against erosion, conservation of relatively high amounts of soil organic matter, provision of optimum conditions for soil biota, and, to prevent undesirable environmental effects of high level fertilizer applications, the highest possible rate of recycling of plant nutrients. At the same time, minimizing the human impacts on tropospheric chemistry requires lower emissions of green-house and other gases, and avoiding serious health hazards posed by smoke necessitates severe restrictions, or outright elimination, of all unnecessary phytomass burning.

Better ways of compacting residues would lower their transportation costs and improve their nutritional value, making their off-field use for feed, fibre, or substrate more economical. Perhaps the best way to promote these rational ways of dealing with straws, stalks, and leaves is to see them not as residues, as often undesirable left-over of much more highly prized crops, but as valuable resources that provide irreplaceable environmental services and assure the perpetuation of productive agro ecosystems and sustainable food production (Smil, 1999).

2.5 Concepts of entrepreneur and entrepreneurship

The concept of entrepreneurs and entrepreneurship could be traced back, at least, as far back as the publications of the Roman Empire (Badian, 1972). The noun entrepreneur, first found to be used in the 15th century and originated from the French verb 'entreprendre'

meaning 'to do something', was traceable to the 12th century (Hoselitz, 1960). The first formal economic theory of entrepreneurship however appeared in the later years of the mercantilist age as recorded in the writings of Richard Cantillon (McMullan and Long, 1990). Timmons and Spinelli (2004) describe entrepreneurship as a way of thinking, reasoning and acting, that is opportunity obsessed, holistic in approach and leadership balanced, adding that, at the core of entrepreneurship is the creation of recognition of opportunities and the ability to seize the opportunities. Timmons and Spinelli further describe an entrepreneur as a person who takes responsibility for a business project, organises the resources it requires and assumes the risks it entails. He is a person who ventures out, who prefers change as a means of growth and prepared to take a calculated risk in the process, during which he is aware of the possibilities, successes as well as consequences of failure of his actions.

Awe (2006), in his own contribution, listed the characteristics of an entrepreneur to include:

- *Self confidence and multi-skilled*: that is, he is a person who can make the product, market it and count the money, but above all have the confidence that let them move on comfortably through difficult situations and discouraging circumstances;
- *Innovatively skilful:* that is, he is not just an inventor, in the traditional sense of the word, but one who is able to carve out a niche in the market place, often invisible to others;
- *Result-oriented*: that is, he possesses the drives required of a successful business venture, which include ability to set goals and targets and getting pleasures in achieving them;
- *Risk-taker:* that is, he exhibits an incremental approach to risk taking, at each stage exposing himself to only a limited, measured amount of personal risk and moving from one stage to another as decision is proved;

- *Totally committed*: that is, he is hardworking, full of energy and single-mindedness, as these are part of essential elements of an entrepreneurship profile.

Awe (2006) furthermore listed some of the benefits of entrepreneurship to include: excitement, salary potential, flexibility and independence derived from being the sole administrator of the business. Recognising nothing in life has bed full of roses, Awe was quick to note some disadvantages of entrepreneurship which include: irregular salary, demanding work schedule, challenges of sole administration, and enjoys no limited liability policies.

Entrepreneurship in Nigeria is perceived as a major avenue to increase the rate of economic growth, create job opportunities, reduce import of manufactured goods and decrease the trade deficits that result from such imports. Government at all level is gradually beginning to realize that enterprises engaged in by entrepreneurs could be the corner stone of the greatness of Nigeria economy and therefore encouraging the development of private entrepreneurship most especially in the areas of agriculture in terms of provision of infrastructural facilities, policies, markets and moral encouragement, amongst others (Adisa and Sodique, 2008).

Since an entrepreneur, engages in one activity or the other, which may be referred to as enterprise, then it is important to equally appraise the concept of enterprise too. According to the Encyclopaedia Britanica (2012) enterprise is a systematic purposeful business activity, a project or undertaking that is risky. In the words of Nickels *et al.* (2002), it is a business idea in the mind of an entrepreneur that is transformed in a concrete terms into profitable activities that involve exchange of values for values.

Establishment of an enterprise is usually for a specific purpose, which usually qualifies such an enterprise. For instance, an enterprise purposefully established for profit making will be regarded as a business enterprise. The purpose, on the other hand, may be to

promote social interest, in which case, is referred to as public enterprise. Public enterprise is established to provide one essential need, whether goods or services, for the people, which private enterprises might not be able to adequately cater for. It may also be borne out of the government needs to fulfil its social responsibility towards its citizenry. Examples include government owned public institutions at all level, primary, secondary and tertiary, government hospitals, railways and Water Corporation owned by the government (Olagunju, 2004). It is however important to note government establishments described as public enterprises is not entirely free of charge. Citizens are required to a pay a price for them, may be in other for such outfits to sustain itself to a reasonable extent. There are also private individuals that established similar outfit as those described above, which may not be primarily for profit making. They offer services and provide goods to the people on philanthropic basis.

2.6 An empirical review of past studies on farm wastes utilisation

A study conducted by Kwaghe *et al.* (2011) in Borno State of Northern Nigeria focussed on the economic analysis of agricultural waste. Findings of the study indicated that about 62.5 per cent of the respondents indicated crop residues as major agricultural waste in the study area. Animal waste is also generated in the study area with cattle producing the highest animal waste as attested by 85 per cent of the respondents. Agricultural waste reuse is the major waste management method while other farmers still practice dumping and burning of their farm waste. The annual quantities of agricultural waste generated from crop residues and animal waste were 161 and 103 tonnes respectively. The study further revealed that annual revenue accruing to the respondents from the reuse of the agricultural waste was ₦900,000.00 representing about 4% of their total farm annual revenue. Ignorance on the waste management strategies and its associated benefits is one of the major factors affecting effective utilisation of agricultural waste in the study area. Premised on the findings of the

study, undertaking of extensive training on waste management for the farmers was recommended.

Another study by Onwuka *et al.* (1996) conducted in Ogun State, South-Western part of Nigeria focussed on the use of household wastes and crop residues in small ruminant feeding. Findings of the study revealed that cassava, yam, cocoyam, orange peels, maize cob and stalk, cowpea vines and husk, groundnut haulm, pods, cocoa pods, cola nut pods and rice milling by-products were predominant household wastes and crop residues, while the most commonly utilised were cassava and yam peels, cowpea husk and kitchen wastes like banana peels, plantain peels, pineapple waste, palm kernel meal, maize and sorghum fermentation wastes. Crop residue was reported to be underutilised as only 1 per cent, 2 per cent, 43 per cent and 44 per cent of the respondents fed maize stover, maize cob, cowpea husk and yam peels, respectively to their sheep and goats, while large amounts of various crop residues (29-100%) were left in the field to rot away or were burnt. The study suggested that more of the household wastes and crop residues could be used after proper processing.

A study by Adedeji (2011) focused on the potentials of using agro-waste composite panels, a constituent of cement reinforced with palm kernel fibre, a by-product of oil palm for cost-efficient building panels for walls. The research utilised two research methods namely experimental and survey methods. The experimental observation was used to determine chemical properties and the suitability of the agro-waste product for building while the empirical survey (case studies) was used to make a comparative analysis of the use of composite agro-waste panels with conventional types. Findings of the study showed that stable cement-bonded composite panels produced from palm kernel fibres are comparatively cheaper, improved sound-proof, durable, lighter-weight and environmentally friendly than the conventional sandcrete blocks.

Another survey conducted in Laguna, the Philippines, by Ocampo *et al.* (1990) investigated rice straw utilisation practices among dairy farmers and the factors influencing

these practices. The findings of the study revealed that that 72 per cent of the farmers were using rice straw; 96 per cent of whom used it as livestock feed. Most of the users (78 %) perceived rice straw as good feed; half of them used it as feed anytime during the year. Rice straws that were not utilised were left idle in the field and/or burned. Some farmers indicated reason for burning rice straws to include enrichment of the soil (38 %) and to immediately clear the land for the next cropping (63%), while 80 per cent indicated plan to continue doing so.

While acknowledging that agricultural wastes, including wood, herbaceous plants, crops and forest residues, as well as animal wastes are potentially huge source of energy, Oyeleke and Jibrin (2009) in their study submitted that large quantities of these wastes generated annually in Nigeria are vastly underutilised, through the usual practice of either burning them or leaving them to decompose on the field. The results of their study revealed that ethanol could be produced from agricultural residues, such as guinea corn husk and millet husk, using *Z. Mobilis* and *A. niger*as fermenting organisms. Considering the cost-effectiveness, in addition to being a means to control environmental pollution, the authors concluded the use of guinea corn husk and millet husk for ethanol production as a worthwhile venture.

In Hisar district of Haryana State in India, some technologies for waste management were recommended in the rural areas. These include vermi-composting, bio-gas, mushroom cultivation and *durrie* making. In a study conducted by Kumar and Grover (2007), the authors assessed the nature, extent and utilisation of waste generated among rural households, and management practices followed. Waste generated 'daily' included vegetable peels, animal dung and urine, 'frequently' polythene bags, fruit peels, tins, bottles, old clothes, dried twigs and weeds, 'occasionally' but in larger quantity were agri-waste in the form of stalk and straw. Utilisation pattern revealed that old clothes, cut pieces, animal dung, fruit and vegetable peels, wheat straw, cotton stalk were extensively reused while decorative items

were prepared from plastics bottles, polythene bags and empty bottles. Many women had received formal training in vermi-composting, some in mushroom production while all received subsidy for installing biogas plant. Majority of respondents were practicing the recommended waste management practices recommended by scientists and government departments mainly from last 2-5 years, had used personal savings for starting these micro enterprises. High economic motivation (i.e. growing mushrooms from wastes for market sale) usefulness of vermin compost in replenishing own field and use of biogas at household level were among reasons given by respondents for waste utilisation using the recommended technologies.

Another study conducted by Asaolu *et al.* (2006) focussed on the availability and potentials of crop residues and agro-processing by products in Osun State of Nigeria. The findings of the study revealed that maize stover was the most abundant crop residue, followed by cassava peels, cocoa pods, cocoyam peels and rice stover. Most of these crop residues and by products were mainly used as livestock feed for sheep and goat, while lack of organized systems of collection was reported as the commonest constraint to utilisation of these crop residues.

The foregoing reviews dwelt on various studies about farm wastes in Nigeria and beyond. While findings of some of the studies acknowledged the abundance and potentials of farm wastes, others documented the utilisation of a range of farm wastes and constraints to their successful utilisation. Nonetheless, none of these studies focussed on socio-cultural issues associated with farm wastes utilisation. Also, none of the studies provided holistic documentation of a wide range of materials the current study referred to as farm wastes in rural environment. These, amongst others, are identified gaps the current study attempted to fill.

2.7 Conceptual and theoretical frameworks for the study

Conceptual and theoretical frameworks provide understanding of the relationship between key concepts and variables investigated in a study. They provide explanation of interrelationship linking these variables (independent) and dependent variable of the study. Both conceptual and theoretical frameworks are used for the study. Firstly, attempt was made to expatiate on the concept of farm waste as understood and used in the study. Also, rational choice theory and theory of planned behaviour which were used to provide theoretical reinforcement for the study were discussed. Finally, hypothetical model derived from the understanding of the concept and key variables of the theories used for the study was presented and explained.

2.7.1 *Farm wastes as conceptualized in the study*

In conceptualising 'farm waste' as used in this study, attempt was first made to review literature broadly on the meaning of the term 'waste'. This was then streamlined to how farm waste was understood and used in the study, drawing from understanding of the literatures reviewed and preliminary survey carried out before the commencement of the study.

Oelofse and Godfrey (2008) in their publication which bordered on waste definition and its legal implications affirmed an on-going international debate surrounding the understanding of the term 'waste'. The authors averred that while there are clear cut situations an item would be regarded as waste for which re-use could not be considered (i.e. medical waste), resource discovery at landfill sites and waste dumps point to clear indication of existing re-use potential of waste being disposed off. Thus, the authors concluded, 'defining something as waste involves treading a very thin line between 'resource' and 'waste''.

In a World Bank (1999) publication which focused on waste management in Asia, waste in the context of the paper was 'defined as any unwanted material intentionally thrown away for disposal'. The publication, however, noted that certain wastes may eventually become resources valuable to others once they are removed from the waste stream. In an

official publication of European Commission edited by Jordan and Heidorn (2003), the term waste was used to refer to 'materials that are not prime products (i.e. products produced for the market) and that have to be disposed of; (and which) the waste-producer has no further use for his production process, transformation or consumption'. On when a waste item should no longer be considered waste, Bainbridge (2006) noted that the European case law legal resolution is when there is a financial advantage to be gained from the re-use of the substance in question; then it should not be regarded as waste but a legitimate product.

Oelofse and Godfrey (2008) in their earlier referenced publication gave overview of definitions of wastes from selected countries across the globe. In Singapore, the Environmental Public Health Act (EPHA) defines waste as 'any substance which constitutes a scrap material or an effluent or other unwanted surplus substance arising from the application of any process; and any substance or article which requires to be disposed of as being broken, worn out, contaminated or otherwise spoiled, and anything which is discarded or otherwise dealt with as if it were waste shall be presumed to be waste unless the contrary is proved'(Singapore Ministry of Environment, 2002). This definition of waste therefore assumes just about everything to be waste unless the producer or generator can provide proof that it is not.

In New Zealand, the New Zealand Waste Strategy defines waste as 'any material, solid, liquid or gas that is unwanted and/or unvalued and discarded or discharged' (New Zealand Ministry of Environment, 2002). This definition recognizes that, in fact, 'waste' is not necessarily a useless material but rather a renewable resource (Wakim, 2004). Availability of economically viable markets for these materials is therefore paramount in interpreting this definition.

In Taiwan, the Environmental Protection Administration (EPA) of Taiwan promulgates the Resource Recycling Act. The purpose of the Resource Recycling Act is to 'conserve natural resources, reduce waste, promote recycling and reuse of materials, mitigate

environmental loading, and [build] a society in which resources are used in a sustainable manner'. The act defines renewable resources as 'substances that have lost their original usefulness, are economically and technologically feasible to recycle and may be recycled or reused as announced or approved by the Act.'

In their own contribution on study of waste disposal in Nigeria, Onwughara *et al.* (2010a) noted that the term waste, garbage, trash, junk, debris and refuse are all names given to the "stuff" that is no longer useful in its current form. In another study, Onwughara *et al.* (2010b), while noting that collection and disposal of wastes differ from country to country, with the use of landfill disposal method in Australia, both landfill and incineration in USA, and incineration and recycling in Japan, submitted that open dump is common method of disposal in Nigeria.

Now coming to farm waste, Loehr (1978) defined agricultural wastes as the residues from the growing and first processing of raw agricultural products such as fruits, vegetables, meat, poultry, dairy products, and crops. They (the agricultural waste) are the non-product outputs of production and processing that may contain material that can benefit man but whose economic values are less than the cost of collection, transportation, and processing for beneficial use. In not so different context but more explicitly, Jayathilakan *et al.* (2012), asserted that raw materials enter into production process and exits as one of the following: desired products, product-specific waste or non-product specific waste. The authors explained further that after desired components of the raw materials are extracted during the production process, there are often other potentially useful components present in the remaining materials. These the authors refer to as product-specific waste.

For instance in the oil palm processing industry, palm oil is desired product. Yet, there are several other products, such as palm kernel shell, empty fruit bunch, amongst others, that are come by during the production process that are still potentially useful. Apart from the core

or desired products, the two latter parts of Jayathilakan *et al.*'s (2012) categorisation (i.e. product specific and non-product specific waste) may at best be referred to as by-products.

Although Jayathilakan *et al.* (2012) did not explain non-product specific waste in their write-up, but given their explanation of product-specific waste as described in preceding paragraph, it may be inferred that non-product specific waste would refer to other components of the production process that clear cut products are not derivable from them. It is interesting to note that Loehr's (1978) definition of agricultural waste did not reflect distinction between product-specific and non-product specific waste. Rather, the definition regarded waste as 'non-product output of production or processing that may contain material that can benefit man but whose economic value are less than the cost of collection, transportation and processing for beneficial use'.

The import to be drawn from the foregoing is that the perception of different individuals about the usefulness, or precisely put economic importance, of waste is relative. That is, what a 'waste generator' (i.e. the producer or processor) may regard as non-product specific waste may actually be useful item or even raw material for someone else in another situation. More explicitly, in the case of oil palm processing industry previously cited, the palm kernel shell which is a by-product is very important material of economic importance for local blacksmiths. They use it as source of fuel during manufacturing of farm tools and other metallic products. So, while palm kernel shell may be seen as non-product specific waste that further products are not derivable from to the processor, or non-product output which 'economic values' may be 'less than cost of collection' (borrowing Loehr's words), they are still very useful economically to the local blacksmiths.

The foregoing accounts allowed for possibility of re-use of certain items referred to as waste, given that they still possess potential for utilisation. As such, not all waste items may be seen as 'useless waste', i.e. medical wastes. That is to say, an item from which economic benefit could still be derived may not be regarded as useless waste. They are at best by-

products which could be useful by other individuals if those that generated do not make best use of them. More importantly, the aforementioned lent credence to the notion that if an individual deem an item as waste and as a result discards it, that doesn't simply imply that such items could not be re-used by other individuals who knows to how derive benefit from utilisation of the discarded items. In what follows, farm waste definition as used in the study is presented.

2.7.2 *Farm waste definition as used in the current study*

Farm waste refers to any item gotten from a crop or livestock animal (or parts of it) that is cultivated/processed or reared but not the primary focus of cultivation/processing or rearing. By being termed waste does not mean the item lacks potential for utilisation or necessarily discarded, rather, they are by-products which the producers or processors do not pay much attention to it after the obtaining the core produce or product for which they primarily engaged in the production or processing. As such, a producer or processor may still use some of these items, but ultimately, not to the fullest, as some of them are left unused or abandoned to 'waste' away.

It also includes certain plant materials that may not necessarily be cultivated by farmers but found growing on the farmers' farm and has potentials for utilisation, which rural dwellers have not fully harnessed.

Several factors are associated with farm waste utilisation. These range from perception of an individual about the farm wastes items, their knowledge about how to utilise them, their attitude towards farm wastes utilisation, societal stigma, societal norms, religious institutions, amongst others. The next sub section provides explanation of inter relationship between these key variables (which were derived from the theories used in the study) and farm waste utilisation. Specifically, rational choice theory and theory of planned behaviour which were used to provide theoretical underpinning for the study were critically reviewed showing their applicability for use in the current study. Criticisms levelled against them were

also reviewed and concluding remarks on the researcher's decision to make use of them in this study despite the criticisms were advanced.

2.7.3 *Rational choice theory*

Sociologists have tried to build theories around the idea that all action is fundamentally 'rational' in character and that people calculate the likely costs and benefits of any action before deciding what to do. This approach to theory is known as rational choice theory (Scott, 2000). A pioneering figure in establishing rational choice theory in sociology was George Homans in the early 1960's. Later, Thomas Blau, around mid 1960's and James Coleman in the early 1970's extended and enlarged his framework, and they helped to develop more formal models of rational action (Coleman, 1990).

The focus in rational choice theory is on actors. Actors are seen as being purposive, or as having intentionality. That is actors have ends or goals towards which their actions are aimed. Actors are also seen as having preferences (values), and of importance to rational choice theory is that actions are taken to achieve objectives that are consistent with actors' preference hierarchy. Coleman's rational choice orientation is clear in his basic idea that "persons act purposively toward a goal, with the goal (and thus the action) shaped by values or preferences. There are two elements therefore, in this theory – actors and resources. Resources are those things over which actors have control and in which they have some interest (Ritzer and Stepnisky, 2014).

The fact that people act rationally has, of course, been recognised by many sociologists, but they have seen rational actions alongside other forms of action, seeing human action as involving both rational and non-rational elements. Such views of action recognise traditional or habitual action, emotional or affectual action, and various forms of value-oriented action alongside the purely rational types of action. What distinguishes rational choice theory from these other views is that it denies the existence of any kinds of action other than the purely rational and calculative. All social action, it is argued, can be seen

as rationally motivated, as instrumental action, however much it may appear to be irrational or non-rational (Scott, 2000).

Rational choice theory takes into consideration at least two major constraints on action. These are scarcity of resources and effects of social institutions on individual actions within the social system. For the first, the theory posits that actors have different resources as well as differential access to other resources; in other words, there is scarcity of resources. This constrains on an individual's desire to perform an action. For those with lot of resources, the achievement of ends may be relatively easy, however, for those with few, if any resources, the attainment of ends may be difficult or impossible. Second source of constraints on individual action is social institutions. Succinctly put by Friedman and Hechter, as cited from Ritzer and Stepnisky (2014),

> [an individual typically will] find his or her actions checked from birth to death by familial and school rules; laws and ordinances; firm policies; churches, synagogues and mosques; ....By restricting the feasible set of action available to individuals, enforceable rules of the game – including norms, laws, agendas – systematically affect social outcomes.

These institutional constraints provide both positive and negative sanctions that serve to encourage certain actions and discourage others.

According to Heckathorn (1997), two other ideas that are basic to rational choice theory were by enumerated Friedman and Hechter. The first is aggregation mechanism or the process by which "separate individual actions are combined to produce the social outcome". The second, which has more relevance and bearing in this study, is the importance of information in making rational choices. At one time, it was assumed that actors had perfect, or at least sufficient, information to make purposive choices among the alternatives courses of actions open to them. However there is growing recognition that the quantity or quality of information is highly variable and that that variability has profound effect on actors' choices (Heckathorn, 1997).

Coleman argues that sociology should focus on social systems but that such macro phenomena must be explained by factors internal to them, prototypically individuals. He favours working at this level for several reasons, including the fact that data usually are gathered at the individual level and then aggregated or composed to yield system level. Among other reasons for favouring a focus on the individual level is that this is where "interventions" ordinarily are made to create social changes. And from Coleman's perspective is the idea that social theory is not merely an academic exercise but should affect the social world through such "interventions" (Ritzer and Stepnisky, 2014).

Giving his orientation to individual rational action, it follows that Coleman's focus in terms of micro-macro issue is the micro-to-macro linkage, or how the combination of individual actions brings about the behavior of the system. Although, according priority to this, Coleman is also interested in the macro-to-micro linkage, or how system (or institutions) constrains the actions of actors. Finally, he evinces an interest in the micro-micro aspect of the relationship, or impact of individual actions on other individual actions (Ritzer and Stepnisky, 2014).

The foregoing is synopsis of rational choice theory, mostly from Coleman's perspective. The theory, just like every other sociological theory, is not without its own criticism. Generally, several criticisms have been levelled against the rational choice theory, but the vast majority of them have come from the supporters of alternative positions within sociology (Wrong, 1997). For instance, Blau (1997) argued that sociology should focus on macro-level phenomena, and as a result, the explanation of individual behavior which is the priority of rational choice theory is outside the bounds of sociology. It has also been argued that the theory which basis of rationality stem from economics discipline is best seen as an economic theory, rather than sociological theory. Denzin (1990) offers a criticism one might expect from a diametrically opposed theoretical orientation:

> Rational choice theory... fails to offer a convincing answer to the question: How is the society possible? ... its ideals norms or rationality do not fit everyday life and the norms of rationality and emotionality that organize the actual activities of interacting individuals

As much as the rational choice theory has been criticized, it would be in order to provide an important and apt rejoinder by Herrstein (1990) and an interesting paradox by Goode (1997) to critics of the rational choice theory.

Herstein purported that:

> 'Not just economics, but all the discipline dealing with behaviour, from political philosophy to behavioural biology, rely increasingly on the idea that humans and other organisms tend to maximize utility as formalised in modern economic theory' (Herrstein, 1990).

The paradox – 'most sociologist use rational choice theory regardless of their stated antipathy to it' Goode (1997).

The criticisms levelled against rational choice theory notwithstanding, the researcher considered the use of rational choice theory as applicable to the current study. An attempt is made in the following lines to expatiate on this. Given that there is a thin line of demarcation between waste items and useful resources, considering farm waste items as 'potential resources', is the beginning point of application of rational choice theory to this study. As scarce as resources are as proposed by the theory, an important question to reflect on is: how best are even the available farm waste items (potential resources) available within the rural environment utilised by the rural inhabitants (i.e. actors)?

Furthermore, following the premise of the theory, rural dwellers who are the 'actors' (subject of focus) in this study would 'rationally' seek to utilise farm waste items given that there is assurance of a profitable economic outcome as a result. As such whether an individual within the rural environment would regard a particular farm waste item as important local resource and subsequently make use of it would depend largely on what he stands to gain in terms of economic benefit derivable there from. Also, social institutions

which the theory identified as constraining on individual's action within a social system, may not necessarily derive from economic motive. This, therefore, the researcher believes gave allowance for inclusion of social cultural factors that might affect farm waste utilisation among rural dwellers. In addition, the availability of 'qualitative information' about farm wastes utilisations' potentials which could significantly influence and sustain rural dwellers' decision to engage in farm waste utilisation were well captured within the purview of the theory.

2.7.4 *Theory of planned behaviour*

The theory of planned behaviour which was developed by Ajzen in 1985 posits that human behaviour is largely influenced by the very intention to carry out the behaviour, as well as the perceived control over the behaviour in question. The TPB has been proven to be extremely useful for understanding and analysing multiply-determined behaviours. The theory's underpinning is that performance of behaviour is a joint function of 'intentions' and 'perceived behavioural control' (PBC) (Ajzen, 1991). PBC refers to people's confidence in their ability to perform the behaviour, as well as to their perception of how easy or difficult it is to carry it out. Intentions, on the other hand, reflect the motivational factors that influence that behaviour. They are indications of how much people are willing to try, and how much effort they are planning to invest in order to carry out the behaviour in question. Both combined, it is self evident that the stronger the intention and the higher the PBC, the more likely it is that the behaviour is performed.

Furthermore, the theory posits that intentions themselves are determined by PBC, as well as by two other independent constructs: 'attitude' and the 'subjective norm'. Attitude refers to a person's disposition to respond favourably or unfavourably towards a behaviour. It is a hypothetical construct, that being inaccessible to direct observation, must be inferred from measurable responses. The second construct refers to the person's perceived social pressure to perform the behaviour or not. In other words, it reflects whether the individual

perceives that a significant number of people endorse/disapprove the behaviour of interest. The theory postulates further that the PBC has a strong influence on behavioural intentions because, for example, if an individual believes that they have little control because of, say, lack of necessary resources to undertake the behaviour, then their behavioural intentions may be negatively influenced, despite positive attitudes and/or subjective norms (Ajzen *et al.*, 1992). Overall, the more favourable the attitude and subjective norm and the higher the PBC, the greater the willingness (intention) to perform that behaviour of interest (Ajzen, 1991).

There has been recent interest in exploring the use of models from social psychology (i.e. the TPB) to provide a theoretical framework for understanding householders' recycling behaviour (Davies *et al.*, 2002). The literature indicates that environmental attitudes and situational and psychological variables are likely to be important predictors of recycling behaviour. Further investigation of the influence of these factors requires a theoretical framework. The Theory of Planned Behaviour (TPB) (Ajzen, 1991) provides a theoretical framework for systematically investigating the factors which influence behavioural choices. According to Davis and Morgan (2008), the TPB has been widely used to investigate behaviours, such as leisure choice (Ajzen and Driver, 1992), driving violations (Parker *et al.*, 1992), shoplifting (Tonglet, 2002) and dishonest actions (Beck and Ajzen, 1991).

Another application of the Theory of Planned Behaviour is in the field of environmental psychology. Generally speaking, environmentally friendly actions carry a positive normative belief. That is to say, sustainable behaviours are widely promoted as positive behaviours. However, although there may be a behavioural intention to practice such behaviours, perceived behavioural control can be hindered by constraints such as a belief that one's behaviour will not have any impact. For example, if one intends to behave in an environmentally responsible way but there is a lack of accessible recycling infrastructure, perceived behavioural control is low, and constraints are high, so the behaviour may not occur. Applying the theory of planned behaviour in these situations helps explain

contradictions between sustainable attitudes and unsustainable behaviour. The Theory of Planned Behaviour model is thus a very powerful and predictive model for explaining human behaviour.

Several studies have applied the TPB to investigate waste recycling and reuse behaviours. These include: Tonglet *et al.* (2004), which investigated determinants of recycling behaviour in Brisworth, UK; Zhou (2010) which sought to determine sustainable waste management practices in College and University dining services in Kansas, and Ho (2002) where Singaporean's household waste recycling behaviour was understudied, with a view to ascertaining recycling as a sustainable waste management strategy for Singapore. Furthermore, Davis and Morgan (2008) cited several other studies that have used the TPB to investigate recycling behaviours.

The strength of the model lies in its flexibility, in that, it allows for incorporation of additional predictors (Ajzen, 1991) where necessary, provided that the variables would make significant contribution to the explanation of behaviour under study. Tonglet *et al.* (2004) have taken advantage of this capacity and have included a number of additional variables to test whether they could explain recycling behaviour in their case study. Likewise, Kasfikis (2005) included additional variables with an aim to encapsulate environmental worldviews and socio-demographic parameters, as well as other constructs that might be of predictive significance of either Waste Prevention at the Point of Purchase (WPPP) or Waste Prevention through Reuse/Repair (WPTR). In the same vein, the current study has incorporated variables such as perception of rural dwellers about farm waste items, knowledge about farm waste utilisation potentials, community related and cultural factors (such as information sources and presence of rivalry/dispute) and institutional factors (such as roles of religion and extension) associated with farm waste utilisation.

Despite the remarkable applications of the TPB in several waste management studies, it is not without its own inadequacies. The theory is based on cognitive processing and level

of behaviour change. Compared to affective processing models, the theory of planned behaviour overlooks emotional variables such as threat, fear, mood and negative or positive feeling and assessed them in a limited fashion. Another shortcoming of the theory from a social- psychological perspective, according to Nigbur *et al.* (2010), is that the theory is rather individualistic view of human behaviour, which does not explicitly take into account the role of identity and remains under-defined with regard to the functioning of norms.

These shortcomings notwithstanding, the TPB is found suitable for use in the present study because of its perceived usefulness and applicability in encapsulating the key variables that are significant determinant of farm waste utilisation, on one hand, and its flexibility which allows for incorporation of other variables, some of which catered for the perceived inadequacies of the theory.

The next section presents hypothetical model developed for the study, based on the foregoing theories concepts and theories reviewed. An explanation on operation of the model is thereafter presented.

2.8 Model for the study

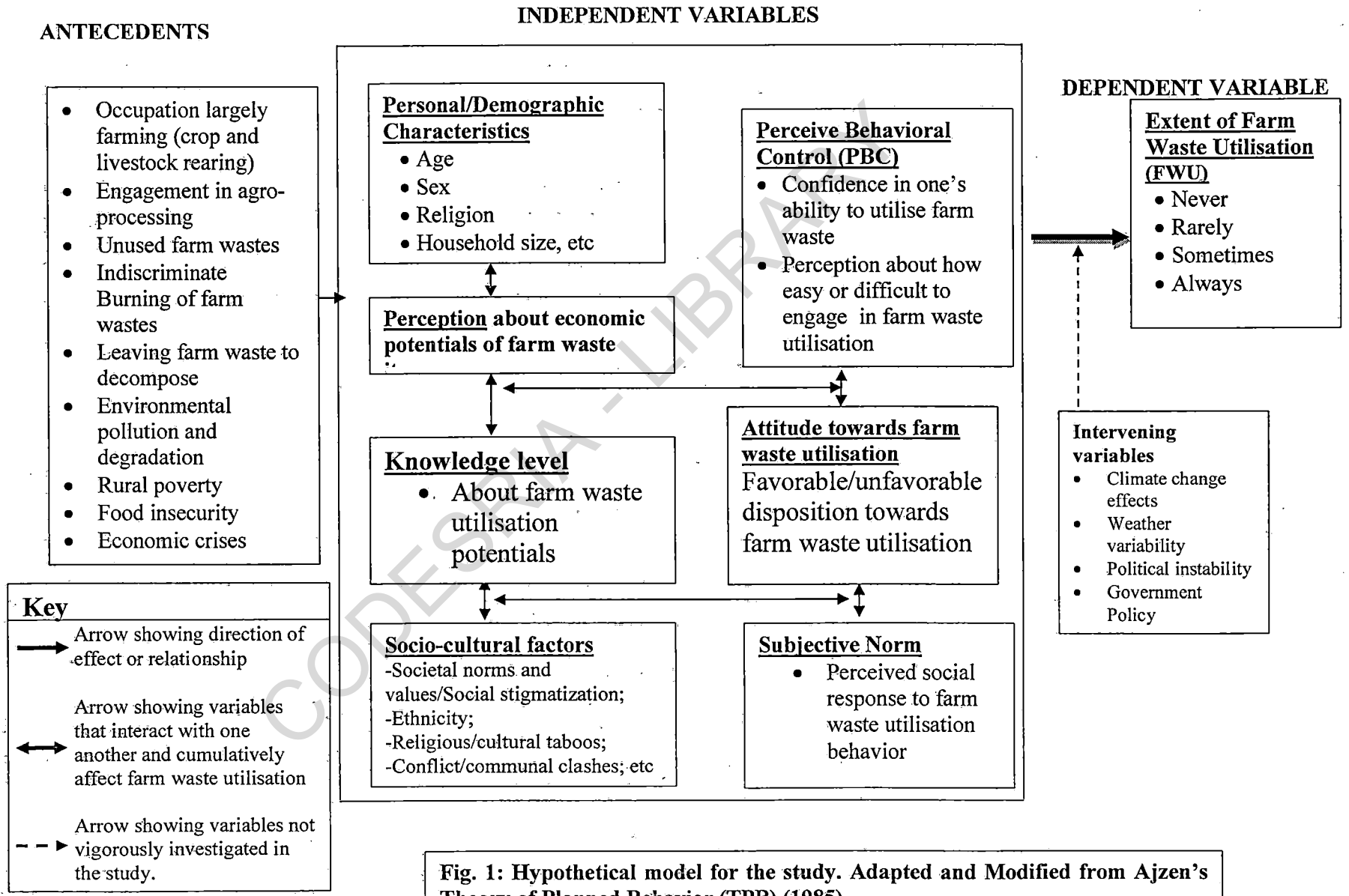

Fig. 1: Hypothetical model for the study. Adapted and Modified from Ajzen's Theory of Planned Behavior (TPB) (1985).

2.9 Operation of the model for the study

The model comprises the following variables: the antecedent, independent, intervening variables, and the dependent variable. The antecedent refers to the prevailing conditions of rural households. The independent variables refer to the 'input', 'stimulus' or 'cause' variables which influences directly the dependent variable. The dependent variable is thus regarded as the 'output', 'reaction' or 'effect' variable that is, the variable being affected by the independent variables. The intervening variables on the other hand comprise factors that may influence and/or enhance the relationship between the independent variables and the dependent variable, but are not investigated in this study.

2.9.1 *The antecedent*

This is the entry point into the model. This segment of the model shows the current situation in the rural environment, which is the focus of the study. It shows that the conventional livelihood activities of the rural people is cultivation of crop and rearing of animals, with hosts of people engaged in agro-processing. It also shows that much attention is yet to be paid to utilisation of various farm wastes despite their enormous potentials for wealth generation and other uses. On the other hand, as the model reflects, most of these wastes are either burned or allow to naturally decompose on the farm after harvest. The attendant consequent of the farm waste burning is environmental pollution and degradation is also reflected. Amidst all these is wide spread poverty, food insecurity and economic crises in the rural environment.

2.9.2 *The independent variables*

This is the second segment of the model. It shows hosts of variables interacting with one another, and cumulatively or individually affects farm waste utilisation. On the right side of the box are the primary variables contained in the Theory of Planned Behaviour. These are Perceived Behavioural Control, Attitude and Subjective norm. On the left side are other

variables derived from rational choice theory and others incorporated into the study. These are Personal and demographic characteristics, Perception, Knowledge and Socio-cultural factors.

Starting with the left side, respondents personal characteristics such as age, sex, religion, household size, etc, are such variables that may affect farm waste utilisation. For instance, while a male may go around the rural collecting discarded farm waste, a female might consider this action uncomfortable and embarrassing. Also, relatively younger individuals may gladly do this, while older people may find it difficult going around the community picking farm wastes. In the same vein, rural dwellers' perception about farm wastes and their knowledge about farm wastes' potentials and how to utilise them may hinder or enhance their desire to utilise farm wastes. For example, someone who perceives handling poultry and sheep and goat feacal droppings as abhorrent may not be interested in utilising of them for organic fertilizers. Similarly, an individual who does not possess the technical know to make use of cow dung for biogas production may not be interested in its utilisation. Lastly, on this side of the model are socio-cultural factors such as societal norms and values, religious and cultural taboos, which may inhibit farm waste utilisation.

On the right side, confidence of individual in his ability to utilise farm waste, and his perception of how easy or difficult it is for him to carry out this task (which imply PBC) may influence his farm waste utilisation behaviour. Similarly, his attitude (i.e favourable or unfavourable disposition) towards farm waste may affect his predisposition to make use of certain farm wastes. Lastly, is the subjective norm, which refers to influence of consideration or regard for other people on one's behavior. An individual might personally not abhor going from farm to farm to collect cassava peelings for mushroom production, but the thoughts that other people, like his close friends, parents, relatives may consider such task repulsive may, however, put him off.

2.9.3 *The intervening variable*

This segment of the model shows variables such as political instability, climate change effects, weather variability, which may indirectly affect respondents' farm waste utilisation behavior but would not be investigated in the study.

2.9.4 *The dependent variable*

The dependent variable of the study is extent of farm waste utilisation. The model shows that the various independent variables, whether singly or collectively, affect farm waste utilisation. The degree or extent to which the various farm wastes included in the study are utilised is indicated in the model.

CHAPTER THREE

METHODOLOGY

3.1 The study area

The study was conducted in Osun state of Nigeria. The state came into existence on 27th August, 1991 with the creation of nine new states by the then Federal Military Government. It is located in South-Western region of the country and lies within coordinates $7^0$30'N and $4^0$30'E occupying 9026 sq. Km land area (NBS, 2010). It is bounded by Ondo and Ekiti States in the East, Oyo State in the West and Kwara and Ogun States in the North and South, respectively. The average annual rainfall of the area ranges from 1125 mm in derived savannah to 1475 mm in the rain forest zone. Raining season commences around March and ends in October. However, rainfall pattern is nowadays erratic due the climate and weather variability. Dry season spans between November to February. According to the information obtained from the National Bureau of Statistics (NBS), the average of mean annual minimum temperature was 21.1^{0}C between 2005 and 2009, while average of mean annual maximum temperature was 31.9^{0}C within same period (NBS, 2010).There is high humidity trend throughout the year. The vegetation allows for agricultural production which facilitates engagement of inhabitants, especially rural populace, in crop and livestock production, while at the same time, they engage in non-farm activities too, to make ends meet. According to Nigeria Bureau of Statistics (NBS, 2010), the national population census estimate of Osun state was 3,416,959. The Yoruba are the predominant inhabitants of the state, with some other tribes from various ethnic groups. The primary occupation of the people is farming. They engage in cultivation of food crops and tree crops such as maize, cassava, yam, cocoyam, citrus, oil palm and kola nut, as well as processing of farm produce. Figure 2 below shows the map of Osun State by agro-ecological zones.

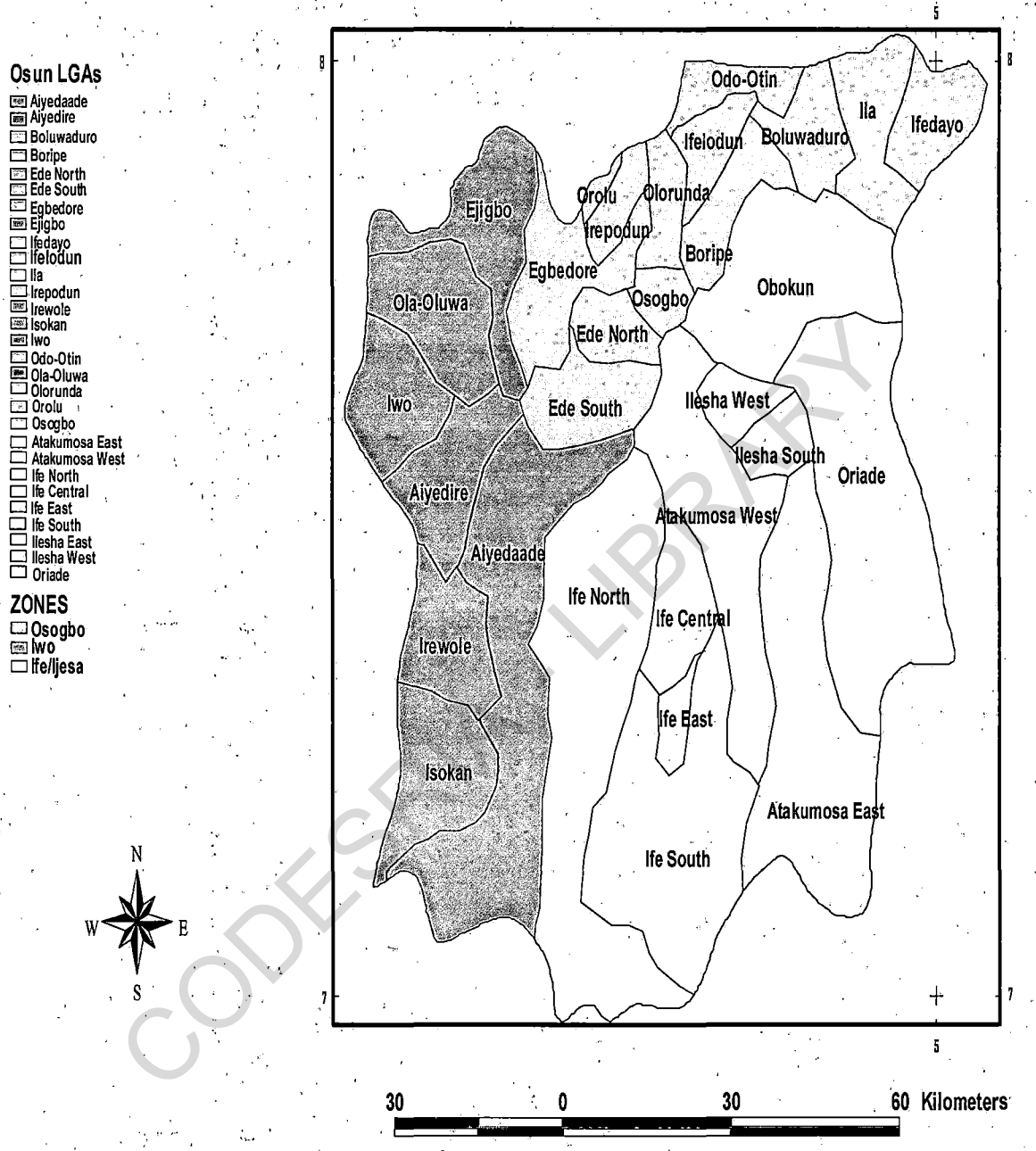

Fig 2: Map of Osun State showing 30 LGAs by Agro-ecological zones.

Source: GEO-Spatial, Department of Geography, Obafemi Awolowo University, Ile-Ife

3.2 Sample size and sampling procedure

The study was carried out in Osun State, using the three agro-ecological zones of the state Agricultural Development Project (ADP), namely: Osogbo (derived savannah) zone, Ife/Ijesha (rainforest) zone and Iwo (savannah) zones which have 13 Local Government Areas (LGAs), 10 LGAs and 7 LGAs, respectively. A multistage sampling procedure was used to select the respondents sampled for the study.

At the first stage, 20 per cent of the total number of LGAs in each zone was used to select three, two and one rural LGAs, respectively, from the three zones. These were: Odo-otin, Egbedore, Orolu LGAs, from Osogbo zone; Atakumosa west and Ife south LGAs from Ife/Ijesha zone and Ayedade LGA from Iwo zone. At second stage, using proportionate sampling, five per cent of the total number of communities in each LGA was used to select 28 communities. Finally, 13 respondents involved in farm waste utilisation were purposively chosen from each of the selected communities, giving a sample size of 364 respondents.

Furthermore, one FGD session, comprising 7 – 10 participants, and two key informant interviews were conducted in each agro-ecological zone. Criteria for selection of FGD participants included: individuals who have lived for up to 5 years in the community and are members of a community based organization; while criteria for key informants were: individuals who have lived for up to 5 years in the community, who must be head of household and currently holding leadership positions in a community based organization. Table 1 shows summary presentation of the sampling procedure.

3.3 Research instrument and data collection.

Primary data sources were used for data collection in the study. Interview scheduled was used to obtain quantitative data, while Focus Group Discussion (FGD) and Key Informant (KI) Interview were used to elicit qualitative information. In addition, pictures of various farm wastes were taken in order to facilitate their visual documentation.

Table 1: Distribution of respondents sampled for the study

Zones	LGA	*Total number of communities	5 % of total number of communities	Total number of respondents
Ikirun	Odo-otin	34	2 (Eekosin, Iyekụ)	26
Ede	Egbedore	50	3 (Ojo, Aro, Akinlade)	39
Osogbo	Orolu	42	2 (Owode, Kajola)	26
Ilesha	Atakumosa West	56	3 (Iloba, Onikoko, Iwaro)	39
Ile-Ife	Ife-south	168	8 (Idi obi, Ifetedo, Egbejoda, Olode Orafidiya, Amula saliu,Surulere Amula soji)	104
Iwo	Aiyedade	190	10 (Akiriboto oke, Akiriboto Isale, oogi, Bembe, Obebe balogun, Oluwada, Wakajaye, Ogbaaga, Alagbede, Ago ebira)	130
Total		**540**	**28**	**364**

*Locality Summary Listing of National Population Commission (NPC), 2006.

Information such as demographic and socio-economic attributes of respondents, their livelihood activities, and farm wastes generated in the pursuit of their livelihood activities, knowledge about farm wastes' utilisation potential and perception about farm waste items were collected through use of interview schedule. Focus Group Discussion were also used to obtain information in some of those aforementioned areas in order to buttress quantitative findings, while Key informant interview were conducted on specific individuals identified to be involved in farm wastes utilisation. The data were collected by the researcher assisted by some trained enumerators between August and October, 2013.

3.4 Measurement of variables

The dependent variable of the study was 'extent of farm waste utilisation' and was measured on a four-point response scale. Respondents were required to indicate how many of the identified farm wastes they make use or have ever made use of for the purpose indicated as compiled during preliminary survey and from literature. Each of the waste identified by the respondent was scored 1 point each. Then, on a 4 point response scale, they were required to indicate the extent of their utilisation of these farm wastes, and were scored as follows: Never utilised (0 point), rarely utilised (1 point), sometime utilised (2 points), always utilised (3 points).

Then weighted mean score was calculated for each item by multiplying the frequencies of responses for each option by its corresponding point and dividing the summation by the total number of respondents (i.e. 364). With this, weighted mean score values obtainable ranged from 0 to 3. Thereafter, the scale below was used to classify the obtained weighted mean score describing the extent of utilisation of each waste item for the identified purposes as follows: 0 – 1 = Very low; 1 – 1.4 = Low; 1.5 – 2 = High; and 2 – 3 = Very high

Also, summation of scores obtained from the responses of the respondents were calculated, and regarded as *utilisation score,* which was used for hypotheses testing. With 75

statements emanating from various ways the identified wastes could be utilised, maximum score obtainable was 225, while minimum score 0. Then using mean plus/minus standard deviation, level of utilisation were categorised into high, medium and low.

The independent variables were measured as follows:

Demographic characteristics of respondents

1. **Age**: The respondents were asked their age and values recorded as given. The values were then grouped for descriptive purposes as follows: 20-34 years, 35-49 years, 50-64 years and 65-79 years.

2. **Sex**: It was measured at nominal level. Male was coded 1 and Female 2.

3. **Religious affiliation**: It was measured at the nominal level. Respondents were asked to indicate their religion from the options provided. The options Christianity, Islam and Traditional religion were coded 1, 2 and 3 respectively.

4. **Marital status**: This was measured at nominal level. The options single, married, divorce, separated, and widow were coded 1,2,3,4 and 5 respectively.

5. **Household size**: This variable was measured at ratio level. Respondents were asked to indicate the total number of male and female children, wives and other dependents living together under same roof. The total value was regarded as household size and grouped for descriptive purposes as follows: Less than 6 persons (Low), 6 – 12 persons (Medium), Above 12 persons (High).

6. **Family type**: This was measured at nominal level. Respondents were asked to indicate whether their family type is monogamous or polygynous. Responses were coded 1 and 2 respectively, for monogamous and polygynous family type.

7. **Literacy level:** It was measured at ratio level. Respondents were asked to indicate whether they could read or write. The response 'Yes' was scored 2 points and 'No' 1 point.

8. **Year spent on formal education**: Respondents were asked the total number of years they had formal schooling. The value would be recorded as a ratio variable and grouped into 1 – 6 years, 7 – 12 years, and above 12 years, for ease of description.

9. **Level of education attainment:** respondents were asked to indicate highest level of educational attainment. The responses 'Koranic school', 'Adult education', 'primary school complete' and 'primary school incomplete' were coded 1, 2, 3 and 4 respectively. 'Secondary incomplete', 'secondary school complete' and 'tertiary institution completed' would be scored 5, 6 and 7, respectively.

10. **Nativity**: Respondents were asked to indicate whether they are native of the area they inhabit or not. Yes response was coded 2 and No coded 1.

11. **Ethnic group**: Respondents were asked to indicate their ethnic group. The options given were coded thus: Yoruba 1, Hausa 2, Ibo 3, Fulani 4 and others 5

12. **Residency length**: respondents were asked to indicate how many years they have been living in the study area. Responses given were recorded as ratio variable and grouped as follows, for ease of description: Below 20 years, 21 – 40 years, Above 40 years.

13. **Occupation:** Respondent were asked to indicate from list provided which of the occupations listed are their major or minor occupations. The options 'farming', 'agro-processing', 'petty trading' would be coded 1, 2 and 3 respectively, while 'livestock rearing', 'hunting' and 'civil servant' were coded 4, 5 and 6, respectively.

14. **Crop cultivated and Farm size:** respondents were asked to check from the list provided which of crop listed they cultivated. Each option taken was scored 1 point each. They were also required to indicate the acreage of land put to cultivation of these crops, and value given were so recorded, as a ratio variable.

15. **Animal raised and size:** respondents were asked to check from the list provided which of the animal listed they rear. Each option taken was scored 1 point each. They were also required to indicate the size of animal raised, and values given were so recorded.

16. Income: respondents were asked to give approximate annual income they made from farming, livestock and agro-processing for the year 2010, 2011 and 2012. Values given under each enterprise were summed together for each year to obtain total annual income for that year. The total annual income values obtained were then averaged for the three years to arrive at estimated annual income of the respondent

17. Farmland tenancy: respondents were asked whether the land they cultivate belong to them. The option 'yes' and 'no' were coded 2 and 1 respectively.

18. Farmland acquisition: respondents were asked to indicate, as much as applicable, which of the options is their source of farmland. The options: 'illegal occupant', 'pledge', and 'lease' were coded 1, 2 and 3 respectively, while 'gift', 'inheritance' and 'outright purchase' were coded 4, 5 and 6, respectively.

19. Years of farming experience: respondent were requested to estimate the total number of years they have been engaged in farming. The values given were recorded as ratio variable and then groped for ease of description.

20. Association membership: respondent were asked to indicate whether they belong to any association or not. The options 'yes' and 'no' were scored 2 and 1 respectively.

21. Membership status: respondents were required to indicate their membership status in the respective associations they belong to. The option 'ordinary member', 'committee member' and 'executive member' were scored 1, 2 and 3 respectively.

22. Benefits derived from association membership: respondent were requested to check, as much as applicable from the options provided, the benefits derive from their membership in the associations they belong. Each option taken was scored 1 point each.

23. Extension contact: respondents were asked whether they had had extension contact in the past three years. Response 'yes' and 'no' were scored 2 and 1 respectively.

24. Source of extension contact and frequency of visit: respondents were requested to check which ones from the options provided is their of extension contact. The options were:

state ADP (OSSADEP), university outreach and NGOs. Each option taken was scored 1 point each.

25. Perception about farm waste items' economic potentials: respondents were asked to indicate their perception about the usefulness (i.e. potential for utilisation) of each of the identified items listed as farm wastes. The options were scored thus: 5 very valuable, 4 somewhat valuable, 3 not sure, 2 somewhat worthless, 1 very worthless. Total score obtainable shall be 200 points while minimum possible is 40 points and was used in hypothesis testing.

26. Perception about specific utilisation potentials of farm wastes: Respondents were asked to check whether they considered each of the 40 identified farm wastes serve listed purposes. Each option taken (for food, increased income, medicinal purpose, livestock feed and enhances soil fertility) for each farm waste item was scored 1 point. Total points obtainable was 200 while minimum was zero.

27. Knowledge of farm wastes' potential for utilisation

Respondents' knowledge about the farm wastes utilisation potentials were measured on a 5 point scale. They were asked to respond to some statements (35 in all) designed to evaluate how knowledgeable they were about potentials of the identified farm waste for utilisation. The response options were scored on a scale of 1 point (definitely false) to 1 point (definitely true). Maximum score obtainable was 175 and minimum 35. Total score from the responses provided were obtained and used to determine the respondents' knowledge level using mean plus or minus standard into three categories, namely: Low/little knowledge (below mean - standard deviation , average knowledge (in between low point and high point) and High/much knowledge (above mean + standard deviation)

28. Attitude towards utilisation of farm waste: this was measured by requesting respondents to respond to some statements (20 in all) using a 5 point Likert scale response. The responses strongly agreed, agreed, undecided were scored 5, 4 and 3 points respectively, while disagree

and strongly disagree were scored 2 and 1, respectively. Total score was obtained for each respondent, with maximum score obtainable as 100 and minimum 20. This was used for hypothesis testing. Furthermore, using mean plus or minus standard deviation, respondents were classified into three categories, namely: favourable disposition (above mean + standard deviation), indifference (in between low point and high point) and unfavourable disposition (below mean minus standard deviation).

29. Perceived behavioural control (PBC):

Respondents' confidence in their ability to utilise farm waste and perception of how easy or difficult it is to do this (i.e. utilise these farm wastes) were measured on a 5 point scale. They were requested to react to some statements and their responses were scored as follows: Extremely difficult (5 points), somewhat difficult (4 points), Not sure (3 point points), somewhat easy (2 points), and extremely easy (1 point).

30. Subjective norm

To evaluate how likely or otherwise concern or consideration for other people (like relatives, friends, etc) might influence farm waste utilisation behaviour of respondents, they were requested to respond to statements on a 5 point scale with the following options: Extremely likely (5 points), most likely (4 points), not sure (3 points), most unlikely (2 points), and extremely unlikely (1)

3.5 Validation of research instrument

Content and Construct validity techniques were employed to validate the research instrument (Frankfurt-Nachimias and Nachimias, 2009).

Content Validity: Lecturers in the Department of Agricultural Extension and Rural Development were requested to critically examine and review the research instrument in relation to the objectives of the study. Suggestions and recommendations given were employed in restructuring of the research instrument prior to field survey.

Construct Validity: The instrument was considered alongside variables included the hypothetical model of the study to ensure that conformity; that is, all variables derived from the conceptual and theoretical backgrounds were included in the instrument.

3.6 Reliability of the research instrument.

Test-retest reliability was carried out on the research instrument to determine the degree of consistency to which it measures the variables it was designed to measure (Frankfurt-Nachimias and Nachimias, 2009). The interview schedule was administered on ten individuals in two communities from Ife-East and Atakumosa East Local Government Areas, which were not included amongst Local Government Areas sampled for the study. At two weeks interval, it was re-administered on these same set of respondents. The two test scores were correlated using Spearman's Ranked Order Correlation (SROC) analysis. With correlation coefficient ($r = 0.80$) obtained from the analysis, the research instrument was adjudged reliable since the correlation value of 0.7 and above are considered as satisfactory or good for a test-retest reliability (Statistics.com, 2014).

3.7 Data analysis

Data collected were analyzed using descriptive statistic, such as frequency count, percentages, mean and standard deviation and weighted mean score values. Also, bar chart and pie chart were used to diagrammatically illustrate some of the findings. The results of qualitative data were analyzed in line with principles of FGD and KI analyses, and presented and discussed alongside quantitative findings where appropriate. Chi-square, Correlation and Multiple Regression Analyses were used to draw inferences from the hypotheses formulated while factor analysis was employed to identify factors associated with farm waste utilisation amongst the respondents.

In hypothesis one, correlation analysis was used to establish relationship between the dependent variable and demographic and socio-economic variables measured at ratio level (such as age of household heads, household size, and years spent on formal education, e.t.c), while Chi-square analysis was used for other variables measured at nominal level (such as sex, religion, nativity, marital status, e.t.c.). In hypotheses two three and four, correlation analysis were used to establish relationship between farm waste utilisation and knowledge level, perception about farm waste and key variables of TPB. In addition, multiple regression analysis was used to determine cogent variables that significantly contributed to extent of farm wastes utilisation, and their strength of relationship.

All the statistical computation were done using SPSS (Statistical Package for Social Sciences) version 16. Significant relationship between the dependent variable and independent variables were established at $p \leq 0.05$ and $p \leq 0.01$ significant levels.

3.8 Justifications for choice of statistical tools

Correlation analysis establishes the presence or otherwise of a relationship between two variables measured at interval/ratio level. It was thus an appropriate tool to use to establish relationship between the dependent variable of the study and respondents' characteristics measured at ratio level in hypotheses one, two, three and four. Chi-square analysis on the other is used to establish relationship or association between variables measured at nominal level (i.e. categorical variable) and the dependent variable. It was thus appropriate test statistic for establishing relationship between respondents' characteristics measured at nominal level and the dependent variable in hypothesis one.

Multiple Regression Analysis shows which of the independent variables significantly contributes to change in the dependent variable of a study, and also determines the magnitude or strength of the relationship, thereby establishing cause and effect. Hence, appropriate to use the tool to determine which of the independent variables significantly contributed to extent of

farm waste utilisation. Given a relatively large number of variables, measurement overlap indicating that there may be fewer, more basic and unique variables underlying the large number; factor analytic procedure takes the variance defined by the inter-correlations amongst the set of variables, and attempt to allocate it in terms of fewer underlying hypothetical variables, called factors. Therefore in order to isolate factors associated with rural dwellers farm waste utilisation behaviour, factor analysis (principal component analysis) was appropriate tool to use.

The rule of decision adopted for identifying which factors to extract in the analysis was based on Kaiser's criterion. Kaiser's criterion, according to Bryman and Gramer (1997) was to select and retain those factors with Eigen value greater than one. The factors retained were named based on either one or all the following criteria (Koutsoyianis, 1977):

1. Consideration of variables of highest loading on each factor.
2. Collective interpretation derivable from the combination of highly loaded variables on each factor.
3. Naming based on the similarity of the features common to the variables contributory to the factor.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the results of analyses and discussions of the data collected.

Presentation is based on the following sub-headings:

1. Demographic and socioeconomic characteristics of respondents
2. Identified farm wastes from arable crops available in the study area and their economic potentials.
3. Identification farm wastes from field crops and available in the study area and their economic potentials.
4. Perception of rural dwellers about economic potentials of farm waste items
5. Knowledge level of respondent about utilisation potentials of farm wastes
6. Level of utilisation of farm wastes by rural dwellers in the study area
7. Attitudes of rural dwellers towards farm waste utilisation
8. Factors associated with farm waste utilisation
9. Results of Hypotheses testing

4.1 Demographic and socio-economic characteristics of respondents

This subsection presents results of the demographic and socio-economic characteristics of respondents.

4.1.1 Sex

Results in Table 2 show that about half (50.8 %) of the respondents were male while 49.2 per cent were female. The results indicated that almost equal proportion of male and female respondents were sampled for the study. The inference is that the study equally focused on both male and female gender that are major components of rural farm family and therefore information peculiar to each gender as regards ways of utilising farm waste items for enhancing rural dwellers' livelihood would be documented.

4.1.2 Age

Results in Table 2 show that about 30 per cent and 29 per cent of the respondents were aged between 35 – 49 years and 50 – 64 years, respectively. While, 23.6 per cent were within 65 – 79 years age range, few (11.3 %) were within 20 – 34 years range, and very few (6.8 %) were aged above 80 years. Mean age of respondent was 52.73 years with a standard deviation of 14.74. The findings agreed with Jibowo's (2003) assertion that the rural areas in most countries have higher proportion of its population aged above 45 years. These results indicated that the respondents were vibrant, within their productive age range and in a period where they might have more financial obligation to meet towards household members and therefore faced with more economic challenges. The findings implied that respondents could still actively engage in waste utilisation and should be encouraged to derive economic benefit from waste items emanating from their daily livelihood pursuits in order to improving their standard of living.

4.1.3 Religion

About 57 per cent and 41 per cent of the respondents were Christians and Muslims, respectively, while very few (1.1 %) were adherents of traditional religion, as shown in Table 2. The results indicated that all the respondents had one religious affiliation or the other, although higher proportion belonged to Christian faith. The findings lent credence to the submission of Alao (2010) who reported that higher proportions of rural inhabitants within the study area were Christians. The implication is that religious affiliation could be a useful indicator in identifying and mobilising rural inhabitants for meaningful participation in development programmes relating to waste management and utilisation.

Table 2: Distribution of respondents by some demographic characteristics

Variable	Frequency	Percentage	(n = 364)
Sex			
Male	185	50.8	
Female	179	49.2	
Age (Years)			
20 – 34	41	11.3	
35 – 49	108	29.7	Mean = 52.73
50 – 64	104	28.6	SD = 14.74
65 – 79	86	23.6	
80 and above	25	6.8	
Religion			
Christianity	209	57.4	
Islam	151	41.5	
Traditional religion	4	1.1	
Marital status			
Married	299	82.1	
Widowed	34	9.3	
Single	27	7.4	
Divorced	2	0.5	
Separated	2	0.5	
Family type			
Monogamy	254	69.8	
Polygyny	96	26.4	
No response	14	3.8	
Household size			
Below 6	151	41.5	
7 – 12	190	52.2	Mean = 7.47
Above 12	23	6.3	SD = 3.21
Nativity			
Indigene	200	54.9	
Non-indigene	164	45.1	
Ethnicity			
Yoruba	283	77.7	
Hausa/Fulani	21	5.7	
Igbo	18	4.9	
Others	42	11.5	
Length of residency (years)			
Below 20	102	28.0	
21 – 40	222	61.0	Mean = 25.75
41 – 60	36	9.9	SD = 12.99
Above 60	4	1.1	

SD = Standard deviation

Source: Computed from field survey, 2013

4.1.4 Marital Status

Results in Table 2 further show that majority (82.1 %) of the respondents were married, while about 9 per cent and 7 per cent were widowed and single, respectively. This was not unexpected given respondents' age profile, since rural inhabitants are generally known to marry at early ages. This may not be unconnected with the desire to have children to help with the family's economy on one hand and perpetuating family's lineage on the other. Also, marriage is considered as respected tradition where married people are regarded as mature and responsible with divorce being a culturally rare occurrence due to stigmatization attached to it within the rural set up (Fadipe, 1970).

With over four-fifths of the respondents married, the implication is that they would have more responsibility to meet up with as household members increase through procreation. This may necessitate the need for respondents to diversify their sources of livelihood which may be achieved through judicious use of waste items emanating from their livelihood pursuits.

4.1.5 Family type

Majority (69.8 %) of the respondents came from monogamous family while 26.4 per cent came from polygynous family, as shown in Table 2. The results indicated that higher proportion of the respondents came from monogamous family. It may be inferred from this finding that the predominant traditional practice of marrying multiple wives prevalent in the rural areas is gradually waning.

4.1.6 Household size

About 52 per cent of the respondents had 7 – 12 members (medium) within their household. While 41.5 per cent had household size consisting less than 6 individuals (small), very few (6.3 %) had above 12 members (large). Mean household was approximately 7 with standard deviation of 3.2. The results indicated that respondents had a relatively large household size. The finding was similar to report of Ekong (2003) who estimated average

household size in rural areas of Nigeria as 6. Large household size has implications within rural farm families where household members assist in the family farming and related activities.

4.1.7 Nativity, ethnicity and length of residency within study area

Results in Table 2 show that about 55 per cent of the respondents were indigene of various communities sampled within the study area, while about 45 per cent were non-indigene. Majority (77.7 %) belonged to Yoruba ethnic groups, while about 6 per and 5 per cent belonged to Hausa/Fulani and Igbo ethnic group, respectively. Also, majority (61 %) of the respondents had lived for between 20 – 40 years in the study area, despite their indigene-ship status. While 28 per cent had lived for up 20 years, about 11 per cent had been living for over 40 years within the study area. Mean length of stay of respondent in the study area was 25.75 years with a standard deviation of 12.99.

The result confirmed the findings of Famakinwa (2011) and Olanrewaju (2014) that the majority of rural dwellers within the study area were indigenes of their communities. It also indicated that respondents had been staying for a relatively long period in the study area. It may be inferred from these findings that there would have been acculturation amongst the non-indigene and the native inhabitants in the study area. The implication of long length of stay of non-indigene within the study area is that this might increase their chances of acquisition of beneficial resources, such as land.

4.1.8 Level of educational attainment and years of formal education

Results in Table 3 show that 30.8 per cent and 11.5 per cent of the respondents completed primary and senior secondary education, respectively, while very few (1.9 %) completed tertiary education. About 8 per cent and 4 per cent had only adult education and Quranic education, respectively. Also, while 38.5 per cent spent up to 6 years to obtain formal education, 31.3 per cent spent between 7 and 12 years. Average number of year spent by

respondent on attaining formal education was about 7 years with a standard deviation of 4.8 years. In addition, 65.4 per cent of the respondents indicated they could read and write.

It may be inferred from these results that the respondents were literate. The findings, which disagreed with the position of Olanrewaju (2014), aligned with the submissions of Soyebo (2005) and Alao (2010) that rural dwellers in the study area were literate. The implication of this submission is that respondents are likely to be more receptive of innovations and improved practices and new ideas introduced to them.

4.1.9 Major and minor occupation

Majority (81.3 %) of the respondents engaged in farming as major occupation, as reflected in Table 3. While 34.1 per cent and 29.7 per cent engaged in agro-processing and petty trading as major occupation; 23.4 per cent and 15.7 per cent primarily engaged in livestock rearing and hunting, respectively. Also, few proportions amongst the respondents engaged in these various occupational activities as minor means of livelihood, as shown in Table 3. The results, which concurred with the findings of Yusuf (2011), indicated that rural dwellers engaged in a variety of activities as occupation with agriculture usually the prime. They engaged in these varieties of activities including non-farm in order to make ends meet and spread their risks better.

The implication of the findings is that rural inhabitants are multi-tasked people and are likely to engage in supplementary activities that will fetch them additional income. This situation may be explored and exploited through sensitising rural dwellers and drawing their attention to potentials and opportunities that abound in utilisation of farm waste items available within the rural environment as useful resources. Extension has a great role to play in the promotion of acknowledging various farm waste items as part of natural assets base which rural dwellers can benefit from.

Table 3: Distribution of respondents by some socio-economic characteristics

Variable	Frequency	Percentage	(n = 364)
Years of formal education			
Below 6	140	38.5	
7 – 12	114	31.3	Mean = 7.24
Above 12	25	6.9	SD = 4.83
Had no formal education	85	23.4	
Level of educational attainment			
Koranic education	15	4.1	
Adult education	32	8.8	
Primary school incomplete	25	6.9	
Primary school completed	112	30.8	
Secondary school incomplete	46	12.6	
Secondary school completed	42	11.5	
Tertiary education completed	7	1.9	
Not applicable	85	23.4	
***Major occupation**			
Farming	296	81.3	
Agro-processing	124	34.1	
Petty trading	108	29.7	
Livestock rearing	85	23.4	
Hunting	57	15.7	
***Minor occupation**			
Farming	36	9.9	
Agro-processing	39	10.7	
Petty trading	32	8.8	
Livestock rearing	49	13.5	
Hunting	6	1.6	
Farmland ownership			
Yes	223	61.3	
No	141	38.7	
***Farmland acquisition**			
Lease	151	41.5	
Inheritance	111	30.4	
Outright purchase	110	30.2	
Gift	22	6.0	
Pledge	36	9.9	
Total farm size cultivated (acres)			
0.01 – 10.00	175	48.1	
10.01 – 20.00	81	22.3	
20.01 – 30.00	14	3.8	Mean = 19.56
30.01 – 40.00	19	5.2	
40.01 – 50.00	28	7.7	
50.01 – 60.00	47	12.9	

* Multiple responses

Source: Computed from field survey, 2013

4.1.10 Farmland tenancy and farm size

Results in Table 3 further show that majority (61.3 %) of the respondents indicated they owned their farmland, while 38.7 per cent did not. Also, about 30 per cent obtained their land through inheritance and outright purchase, respectively, while 41.5 per cent got their land through lease. Very few (6 % and 9.9 %) got their land through gift and by pledge, respectively. Also, about 48 per cent of the respondents cultivated up to 10 acres of land, while 22.3 per cent cultivated between 10 to 20 acres of land. Mean acreage of land cultivated was 19.56 acres. The results indicated that lease, inheritance and outright purchase were prominent means of land acquisition among rural inhabitants in the study area. With majority of the respondents owning their farmlands, the implication is that respondents would have the liberty to grow crop of their choice.

4.1.11 Distribution of respondents by association membership and extension contact

Results in Table 4 show that 47.8 per cent of the respondents belonged to some associations, while 52.2 per cent did not belong to any association. Of those who belonged to certain associations, 28.6 per cent and 18.1 per cent were members of religious association and farmers group, respectively. Very few belonged to other groups such as cooperative societies (6.4 %), social clubs (5.8 %) and community development associations (4.7 %), amongst others. The results which indicated low association membership amongst the respondents underscored the need to encourage rural inhabitant to relate with one another through membership in various associations which might enhance social network amongst them.

Results in Table 4 further show that 56.6 per cent of the respondents indicated they had contact with extension within the past the three years, while 43.4 per cent did not. Of those who had contact with extension, about 52 per cent indicated state agricultural development programme as source of contact, while very few (4.1 % and 0.8 %) indicated University based extension and Non Governmental Organisations as source of extension contact.

Table 4: Distribution of respondents by association membership and extension contacts

Variable	Frequency	Percentage (n = 364)
Association membership		
Yes	174	47.8
No	190	52.2
***Associations belonged to**		
Farmers group	66	18.1
Religious association	104	28.6
CTCS	25	6.4
Social club	21	5.8
Descendant union	18	4.9
Vigilante group	13	3.6
CDA	17	3.6
Contact with extension		
Yes	206	56.6
No	158	43.4
Source of extension contact		
ADP/OSSADEP	188	51.6
NGOs	3	0.8
University based	15	4.1

*Multiple responses applicable

Source: Computed from field survey, 2013

Although, over half of the respondents had extension contact and state ADP was prominent source of contact, the results however indicated that ample proportion (over 40 %) of the respondents lacked extension contact. The implication of the finding is that state ADP would need to increase its coverage so that higher proportion of rural inhabitants would benefit from extension activities. This may be achieved by improving on already low extension agent to farm family ratio. The finding also underscored the need for University and NGOs to engage more in extension activities, thereby complementing government's efforts.

4.1.12 Arable crop cultivated by respondents with mean acreage of cultivation

As shown in Figure 3, 88.5 per cent and 84.1 per cent of the respondents cultivated cassava and maize crops, respectively, using 2.65 and 1.87 acres of land. Also, 72 per cent, 64.6 per cent, 62 per cent and 59.1 per cent cultivated yam, vegetable, cowpea and cocoyam, respectively, on 3.4, 1.49, 1.75 and 1.77 acres of land. Few (18.7 % and 19.5 %) cultivated soybean and rice, using 1.8 and 1.7 acres of land, while 51 per cent cultivated sweet potatoes on 0.5 acres of land. The results indicated that respondents cultivated a variety of arable crops, amongst which cassava and maize were most prominent, followed by vegetable, yam and cocoyam. The implication of the findings is that farm waste items generated from these crops after harvest, such as cassava peels, maize husk, cob, and shaft, cocoyam corm, cowpea and soybean husk and vine, etc, which have economic potentials for utilisation that may be judiciously put to use by the rural dwellers were available in the study area.

4.1.13 Permanent crop cultivated by respondents with mean acreage of cultivation

Results in Figure 4 show that 71.2 per cent and 67 per cent of the respondents cultivated oil palm and cocoa, on 4.97 and 8.5 acres of land, respectively. Furthermore, 52.7 per cent and 53 per cent cultivated citrus and banana/plantain crops, using 2.23 and 1.8 acres of land, while 39 per cent cultivated cashew crop on 2.82 acres of land. Others (48 % and 43 %) cultivated coconut and kola nut on 1.5 acres and 0.8 acres of land, respectively.

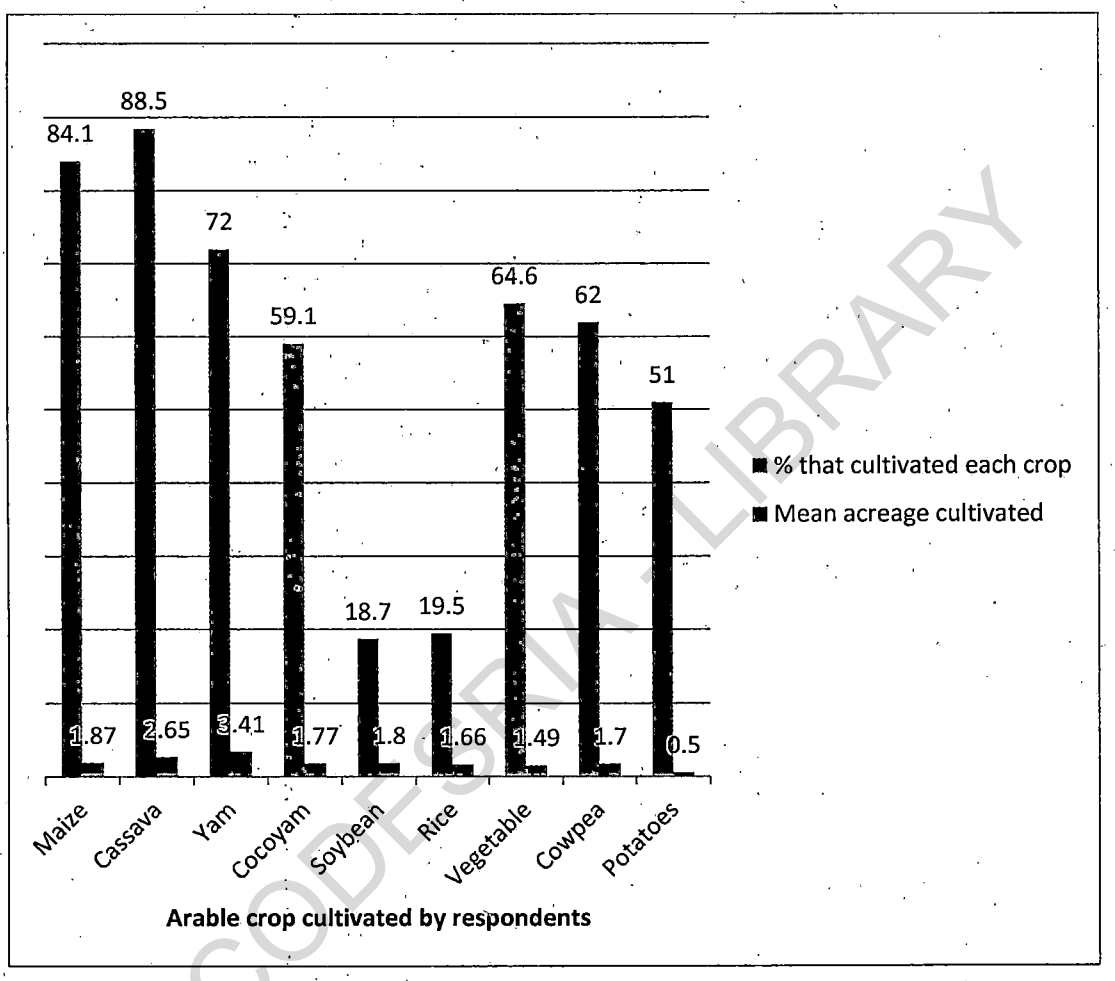

Fig. 3: Distribution of respondents by arable crop cultivated with mean acreage of cultivation

Source: Computed from field survey, 2013

The results indicated that respondents cultivated a variety of field crops amongst which oil palm and cocoa were prominent. The implication of the findings is that farm waste items generated from these crops after harvest or during processing such as palm kernel shell, empty palm fruit bunch, cocoa pods, etc, which have economic potentials for utilisation are available in the study area that could be harnessed for economic empowerment of the rural inhabitants.

4.1.14 Livestock reared by respondent with mean size of livestock

More than half (58.5 %) of the respondents raised poultry birds, as shown in Figure 5. Also, 28.8 per cent, 50 per cent and 22.5 per cent reared sheep, goat and cattle, respectively, while about 21 per cent each reared fish and rabbit. Average number of poultry bird raised was 12, while average number of sheep, goat and cow reared was 6, 8 and 4 respectively. Furthermore, about 25 per cent of the respondents are involved in piggery with average number of pig as 12. The results indicated that respondents engaged in rearing of livestock too, apart from crop cultivation, and poultry birds and goats were most prominent amongst these livestock. However, scale of production of livestock was low.

It may be inferred from the findings that farm waste items generated from rearing of livestock such as poultry droppings, goat and sheep faeces, and cow dung which have economic potentials for utilisation might, although available within the study area, might be inadequate for utilisation. The implication of the findings is that respondents may be encouraged to increase their scale of livestock production and with adequate training opportunities they may be empowered on various ways of converting the livestock wastes into useful resources that can generate wealth and translate to additional income for them.

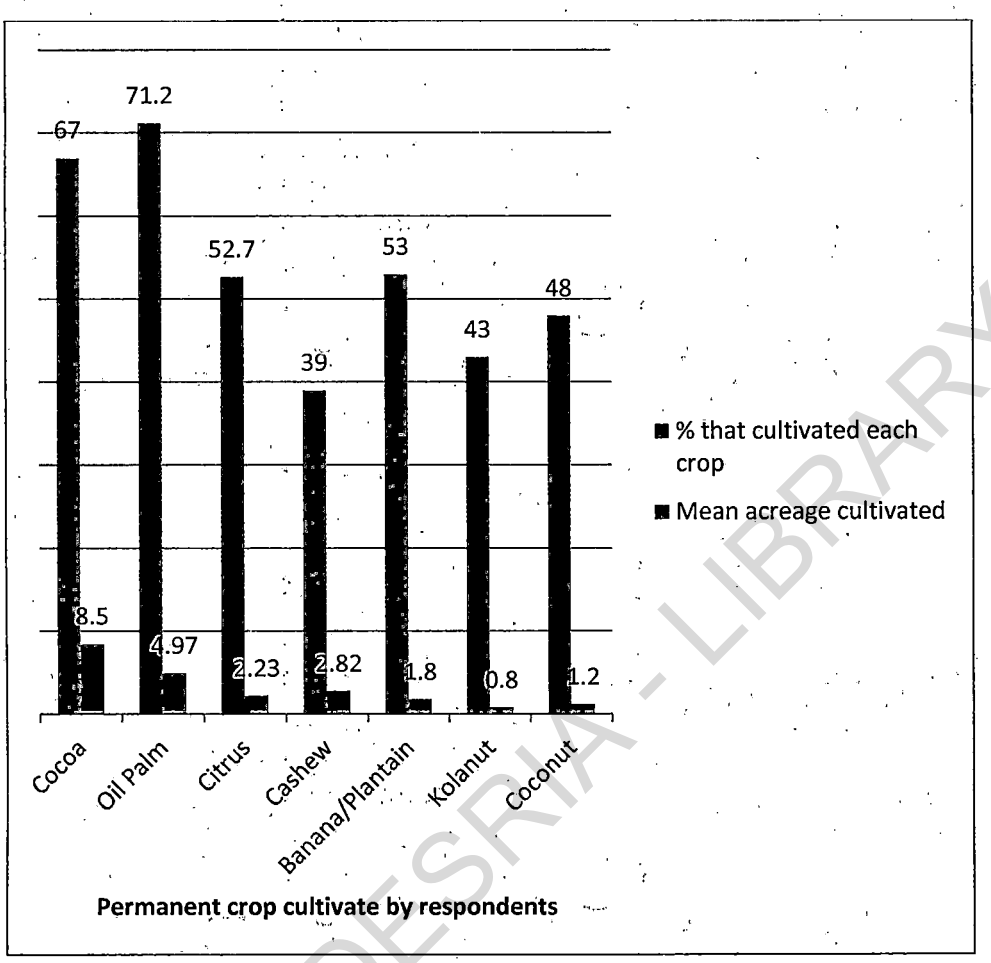

Fig. 4: Distribution of respondents by field crop cultivated with mean acreage of cultivation

Source: Computed from field survey, 2013

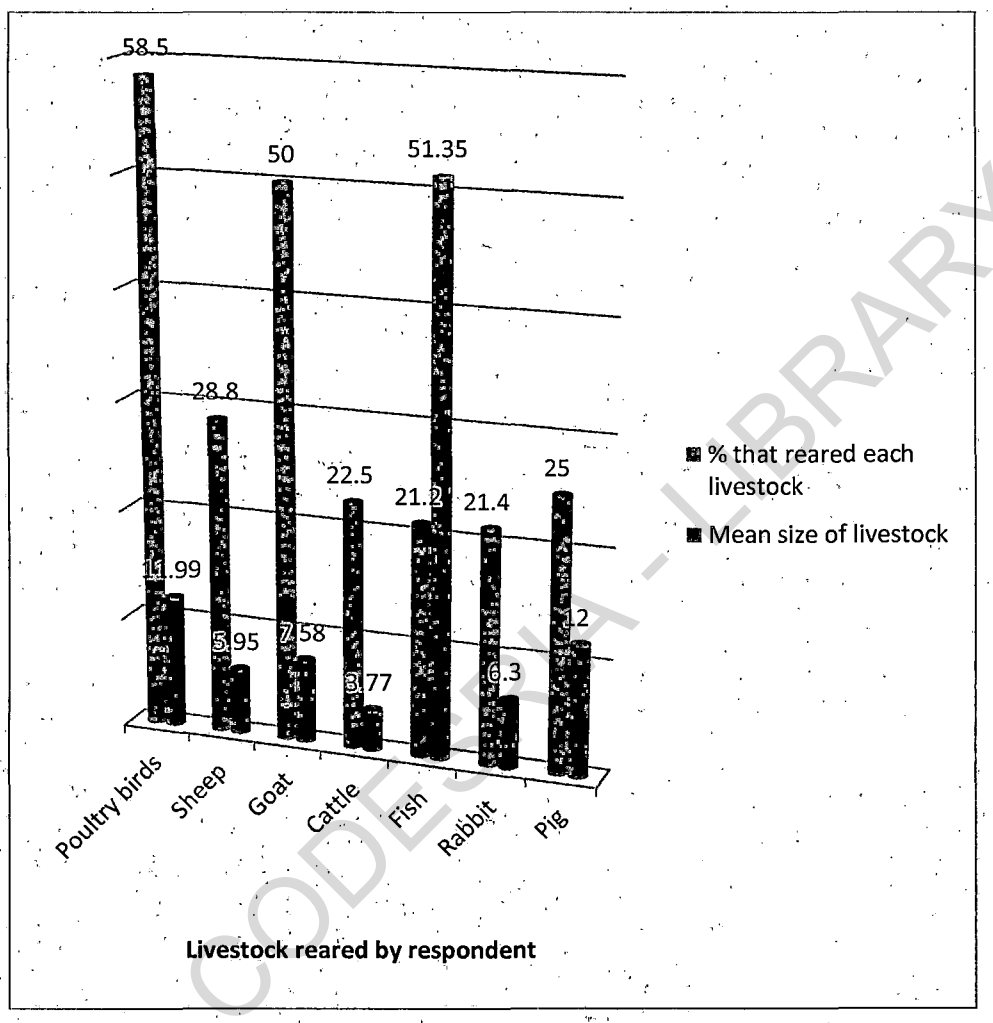

Fig. 5: Distribution of respondents by livestock reared with mean size of livestock

Source: Computed from field survey, 2013

4.1.15 Income

Results in Figure 6 show that, on an annual basis, 39 per cent of the respondent earned below ₦ 200, 000 while 15.1 per cent and 16.2 per cent earned between ₦ 200,000 and ₦ 400,000 and ₦ 400,000 and ₦ 600,000, respectively. Mean annual income was ₦ 382,500. This value represents annual income of respondents from crop cultivation (arable and permanent crops), livestock rearing and agro-processing pulled together which translated to ₦ 31,875 monthly.

This is still a meagre amount considering the degree of drudgery involved in the various activities rural inhabitants go through before earning this amount. In fact, findings during field survey further reveal that, most times, respondents' earnings were used to settle debts often incurred beforehand as soon as earning them. The implication of the findings is that rural inhabitants could be empowered economically through judicious use of farm waste items available at their disposal, through which they could increase their earnings and be better enabled to meet their financial obligations.

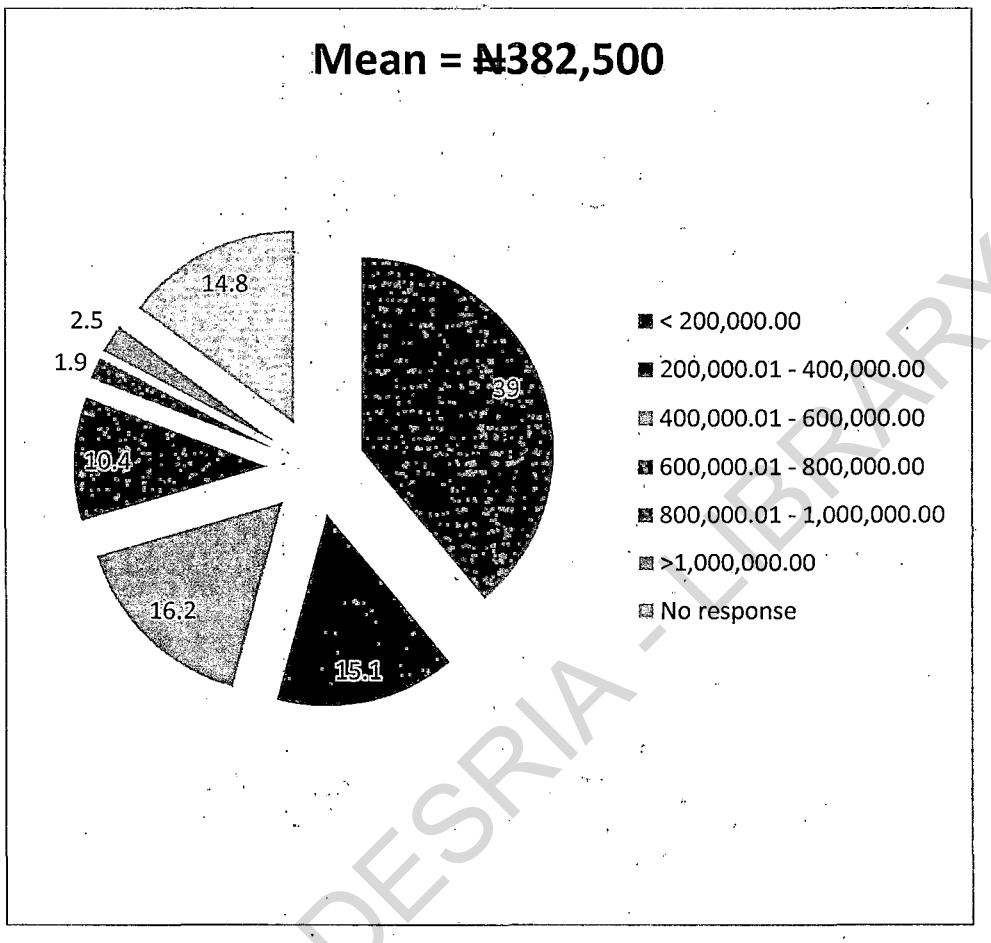

Fig. 6: Distribution of respondents by total annual income

Source: Computed from field survey, 2013

4.2 Identified farm wastes available in the study area and their economic potentials

Based on various literatures reviewed and preliminary field survey, a variety of items identified as farm waste available in the study area were documented. These items emanated from the rural dwellers' livelihood activities which are primarily cultivation of various arable and field crops, rearing of livestock, and agro processing. They also include some plant that grow in the wild and have potentials for utilisation, but whose potentials are wasting away in the rural environment. They are categorised as follows: i) those from arable crops; ii) those from field crops; iii) those from other selected plants that grow in the wild; and iv) those from livestock.

It is important to note that these items are not 'useless wastes' (as previously explained under conceptualisation of farm wastes). As such, while some rural dwellers make use of them, others do not. Also, the utilisation of the waste items varies from one location to another. An item may often be discarded in an area, and yet be commonly utilised in another area. Below are various waste items that emanated from each of the category mentioned above (See Box 1 for a summary of presentation).

Arable crops

The main arable crops cultivated by the respondents in the study area were cassava, maize, yam, cocoyam, cowpea, soybean, sweet potatoes, and vegetables. As for cassava, the cassava tuber is major focus of cultivation and processing for most rural dwellers. Other parts of the crop such as the leaves, stem, and peelings are examples of waste item from the cassava crop. In maize, the grain is usually the primary focus of cultivation. The grains are eaten when cooked or preserved by sun drying for further processing into other food items. Such part of the maize crop seen as waste items in the study area were the maize stover, leaves, stalk, cob and shaft.

Box 1: Showing various farm waste items within the rural environment that emanated from the common crop cultivated, livestock reared and selected plant that grow in the wild

Livelihood category from which waste items are generated	Waste item associated with each category
Arable crop	
Cassava	Cassava peels, leaves, stem,
Maize	Maize stover, leaves, stalk, cob, shaft
Yam	Yam peels, leaves
Cocoyam	Corm, leaves
Cowpea	Cowpea husk, vine, leaves
Potatoes	Leaves, peels, vines
Soybean	Husk, vine and leaves
Vegetable	Succulent stem, flowers
Guinea corn	Leaves, stem
Others: Ginger	Rhizome
Field crops	
Oil palm	Palm fronds, trunk, flower, palm kernel shell, empty fruit bunch, Palm oil mill effluents
Cocoa	Cocoa pods, bark, cocoa extract/sap, seed pulp, pod gum
Citrus (sweet orange)	Peels, seeds
Plantain and banana	Fruit peels, leaves, sap
Cashew	Tree bark, leaves and nut
Kolanut	Leaves and pods
Coconut	Coconut tree fronds, coconut shell, stem
Plants that grow from Wild	**Useful parts of the plants**
Bamboo (*opaarun*)	Stems and leaves
African spice tree (àì*dan*)	Pods and leaves
Wall nut (*awùsá*)	The nut shell
West african indigo (*èlú*)	Leaves
Moringa (*ewé* ì*gbalè*)	Leaves, seed, fruit
African pear (pía)	Leaves, seed
Kigelia africana (*pándòrò*)	Fruit, leaves, tree bark
Bush mango (*òro*)	Seed, unripe fruit
Livestock	
Poultry	Droppings, feather
Goat	Faeces, blood, bones, urine
Sheep	Faeces, blood, bones, urine, wool
Cow	Dung, horn
Pig	Faeces
Fish	Fish guts
Rabbit	Faeces

Source: Preliminary field survey, 2013

For yam, the tuber is major focus of cultivation. The yam peels and leaves are common waste items from the yam crop. For cocoyam the root is the major focus of cultivation. Other parts such as the corm, peels are common waste items of the crop. As for cowpea and soybean, the beans are major focus of cultivation. The husk, vines and leaves are common waste items from these crops. In sweet potatoes the roots are major focus of cultivation. The potato leaves, peels, vines are common wastes of the potato crop. In vegetable, the succulent stems and flowers are common waste items.

Field crops

The main field crops cultivated by the respondents in the study area were oil palm, cocoa, banana, plantain, citrus (sweet oranges), cashew, kolanut and coconut. As for oil palm, the palm fruit is usually the major focus of cultivation. The fruit is processed into palm oil and in the process several waste items are generated. Although, the widespread notion among rural dwellers in the study area was that no part of the oil palm tree is useless, nonetheless common waste items of the crop, most of which emanated from the processing of the fruit into palm oil include the mill effluents, palm kernel shell, empty fruit bunch, stem, flower. In cocoa, the beans are the major focus of production. Items often regarded as waste here include the cocoa pod husks, cocoa extract/sap, seed pulp, pod gum.

As for banana and plantain, the fruit is the major focus. The fruit peels, leaves, stem and sap are often unused items. In cashew, apart from the fleshy part of the fruit, other parts such as nut, leaves, barks are common items left unused. In kolanut, the leaves and pods are often unused item. For coconut, the husk and tree fronds are common wastes, while for citrus (sweet orange) the peels, and seeds are common waste items.

Selected plants that grow in the wild

Selected plants that grow in the wild but have utilisation potentials not well harnessed by the rural dwellers include: bamboo tree, rattan, African spice tree, wall nut, West African indigo, moringa and African pear and *Kigelia africana*

The useful parts of bamboo for utilisation are the leaves and stem. African spice tree's leaves and pods are of economic importance useful in making local dye. The wall nut shell is important item in making dye. Similarly, the leaves of West Africa indigo tree is important local item for making dye. The leaves, seeds and fruits are part of the moringa tree which economic and health benefits are not often harnessed. The fruits and leaves of *Kigelia africana* have useful economic and medical benefits.

Livestock

Common livestock reared in the study area were poultry birds, sheep, goat, cow, fish and rabbits. The poultry birds, sheep and goat are found within most households and often kept by women within the households. The poultry birds are raised for their meat or eggs. Waste items from poultry that have potential for utilisation include the droppings and feathers. With respect to sheep and goat, they are raised for their meat and sometimes to generate additional income by selling them. Waste items associated with the sheep and goats include the faeces, hooves, blood. The pigs are reared for consumption and selling. As for the cow, common waste items from it cow are the dung, horn, blood and hides.

4.2.1 Utilisation of the identified farm waste items

In what follows, results of utilisation of identified farm waste items and extent of their utilisation by rural dwellers in the study area were presented. Also, potentials for utilisation of these items and significance of converting them into useful resources that can be judiciously utilised by the rural inhabitants as means of generating additional income thereby enhancing attainment of sustainable livelihood were particularly emphasized. The discussion was made to reflect the following: farm waste items identified from arable crop; those identified from field crops and other plants that grow in the wild; and those from livestock.

4.2.1.1 Identified farm wastes items from arable crop utilised by respondents and extent of utilisation

4.2.1.1.1 Cassava peels for livestock feeding and mushroom production

Results as presented in Table 5 show that 84.1 per cent of the respondents utilised cassava peels for livestock feeding. Amongst these, 78.6 per cent always used it while 15.9 per cent had never used cassava peels for this purpose. Utilising cassava peels for feeding livestock recorded very high weighted mean score value (2.45). Also, majority (62.6 %) of the respondents utilised cassava peels for mushroom production. However, while 14.6 per cent always did this, 33 per cent rarely made mushroom from cassava peels and 37.4 per cent had never done this. Weighted mean score recorded here was low (1.07).

These results show the uses which peels of cassava tuber were put to after peeling. The findings indicated that majority of the respondents utilised cassava peels for both livestock feeding and mushroom production. However, using it as livestock feed was more preponderant than utilising it for mushroom production, judging by the weighted mean values obtained. These findings agreed with Onwuka *et al.* (1996) and Asaolu *et al.* (2006) who reported that using cassava peel as livestock feed was very common way of utilising it among cassava producers and processors. Heuze *et al.* (2014) documented various satisfactory attempts where the cassava peels have been used to feed varieties of livestock including pigs, sheep, goat, poultry birds, tilapia fish and rabbit.

It could be implied from these findings that given the preponderance of cassava peels generated amongst rural dwellers, utilising them for mushroom production may be a viable and alternative income and protein sources for the respondents. The mushrooms may be cooked into special delicacies and also sold for cash. This submission concurred with the assertions of Fasidi *et al.* (1993) and Hussain (2001) that cultivation of mushroom serves as the most efficient and economic viable option for the conversion of waste materials to high protein food which will naturally open up new job opportunities especially in the rural areas.

Miles and Chang (2004) and Biosciences Africa (2014) also attested to the nutritional value, medicinal effect, environmental impact of mushroom cultivation and its potentials to enhance income diversification among rural dwellers.

Therefore, with adequate capacity building workshop and training opportunities, rural dwellers already involved in mushroom production may be empowered to acquire skills in modern mushroom production, while others that had never utilised cassava peels for mushroom production (37.4 %) might become interested in considering it as alternative and additional income source. On the other hand, those that had never utilised cassava peels for livestock feeding (15.9 %) may be encouraged to go into livestock production whereby they can use the cassava peels to feed their livestock, or may be encouraged to process them by sun drying and sell as feed to those keeping livestock. By doing these, better ways of utilising cassava peels to enhance sustainable livelihood among rural inhabitants may be enhanced.

4.2.1.1.2 Cassava peel for flour production

About 35 per cent of the respondents utilised cassava peel for flour (*èlùbó*) production while majority (64.8 %) had never utilised cassava peels for this purpose. 14.6 per cent and 15.1 per cent always and sometimes utilised it, respectively. Weighted mean score was very low (0.79). The results indicated that utilisation of cassava peels for cassava flour production was not common practice in the study area. This was evident in some of the respondents' disposition as revealed during data collection, when they posited that cassava peel was not part of items used in making *èlùbó*. Since there are alternative sources through which *elubo* could be made, the implication of the finding is respondents may be encouraged to channel cassava peel into other uses, such as for livestock feeding or for mushroom production.

4.2.1.1.3 Cassava leaves (*òmùnú ègé*) and cocoyam leaves (*òmùnú kókò*) as vegetable

Majority (71.7 %) utilised young cassava leaves (*òmùnú ègé*) for cooking vegetable soup. 15.7 per cent and 37.4 per cent always and sometimes did this, respectively, while 28.3 per cent had never used young cassava leaves for vegetable soup cooking. Weighted mean

score was 1.40. Also, majority (82.7 %) utilised young cocoyam leaves (*òmùnú kókò*) for cooking vegetable soup. While 32.1 per cent and 38.2 per cent always and sometimes used it, respectively, 17.3 per cent had never used young cocoyam leaves for vegetable production. Weighted mean score was 1.85.

Although, extent of utilisation of young cassava leaves and cocoyam leaves as vegetables were not very high given the mean values obtained, the results albeit indicated that rural inhabitants traditionally consume young cassava leaves and young cocoyam leaves as vegetables. While respondents regarded vegetable soup thereby cooked as revered delicacies, some however opined that such acts are no longer common nowadays as it used to be. It has been documented that the cassava leaves are a rich in protein and the total essential amino acid content in the protein is higher than in soybean protein (Nguyen *et al.*, 2010). The implication is that reviving the act of consuming young cassava leaves as vegetable should be encouraged among rural dwellers in order to provide cheap source of protein.

4.2.1.1.4 Cassava stem as firewood for household cooking

About 59 per cent utilised cassava stem as firewood for household cooking. While 25.8 per cent and 26.9 per cent sometimes and rarely utilised it, respectively, 40.7 per cent had never utilised cassava stem as firewood. Weighted mean score was 0.98. The results indicated low extent of utilisation of cassava stem as firewood. This may be because, as revealed from field during data collection, the cassava stems were not primarily used as firewood; rather they were kept after harvest of cassava tubers for cultivation in subsequent season. It was only few sticks that were considered not good for replanting after being used and re-used for some seasons that were put aside as wastes. So the main way of utilising cassava stem is using them as stem cuttings for cultivation during next planting season.

Table 5: Distribution of respondents by utilisation of farm waste items from arable crops

Items description	Utilised		Extent of utilisation								Weighted mean score
			Always		Sometimes		Rarely		Never		
	Freq.	Per cent	Freq.	Per cent	Freq.	Per cent	Freq.	Per cent	Freq.	Per cent	
Cassava peels for livestock feeding	306	84.1	286	78.6	15	4.1	5	1.4	58	15.9	2.45
Cassava peels for mushroom production	228	62.6	53	14.6	55	15.1	120	33.0	136	37.4	1.07
Cassava peel for flour production (*elubo*)	128	35.2	53	14.6	55	15.1	20	5.5	236	64.8	0.79
Young cassava leaves (*omunu ege*) for vegetable soup	261	71.7	57	15.7	136	37.4	68	18.7	103	28.3	1.40
Cassava stem as firewood	216	59.3	24	6.6	94	25.8	98	26.9	148	40.7	0.98
Yam peels for flour (*elubo*)	330	90.7	227	62.4	33	9.1	70	19.2	34	9.3	2.24
Young cocoyam leaves (*omunu koko*) for vegetable soup	301	82.7	117	32.1	139	38.2	45	12.4	63	17.3	1.85
Potato leaves as livestock feed	258	70.9	136	37.4	42	11.5	79	21.7	106	29.1	1.57
Maize leaves for herbal concoction	188	51.6	36	9.9	116	31.9	36	9.9	176	48.4	1.03
Maize stalks for yam staking	241	66.2	63	17.3	68	18.7	110	30.2	123	33.8	1.19
Maize stover as livestock feed	207	56.9	63	17.3	5	1.4	139	38.2	157	43.1	0.93
Maize cob (*shuku agbado*) for livestock feeding	227	62.3	68	18.7	102	28.0	57	15.7	137	37.7	1.28
Maize cob as fuel for household cooking	315	86.5	211	58.0	74	20.3	30	8.2	49	13.5	2.22
Maize shaft as livestock feed	301	82.7	148	40.7	27	7.4	126	34.6	63	17.3	1.71
Guinea corn leaves as food colorant and condiment	295	81.1	125	34.3	127	34.9	43	11.8	69	18.9	1.85
Guinea corn stem (*poporo oka*) for yam staking	279	76.6	104	28.6	44	12.1	131	36.0	85	23.4	1.46
Guinea corn stem as blood tonic (when cut into pieces and cook in water to drink)	311	85.4	151	41.5	133	36.5	27	7.4	53	14.6	2.05
Guinea corn bran for livestock feeding	240	65.9	46	12.6	55	15.1	139	38.2	124	34.1	1.06
Cowpea husk for livestock feed	252	69.2	42	11.5	163	44.8	47	12.9	112	30.8	1.37
Rice husk and bran for livestock feed	207	56.9	105	28.8	34	9.3	68	18.7	157	43.1	1.24

Source: Computed from field survey, 2013

4.2.1.1.5 Yam peels for flour production

Majority (90.7 %) of the respondents used yam peels for flour (*èlùbó*) production (see Table 5). Also, majority (62.4 %) always utilised yam peels for this purpose, while 9.3 per cent had never utilised yam peels for making flour. Utilising yam peels for *elubo* production recorded second highest weighted mean score of 2.24. The findings which indicated the widespread utilisation of yam peels agreed with Onwuka *et al.*'s (1996) submission that yam peels were amongst most utilised household wastes and crop residues. The implication of the findings is that respondents not used to utilising yam peels may be encouraged to convert it to livestock feed, rather than throwing it away as waste items.

4.2.1.1.6 Sweet potato leaves as livestock feed

Majority (70.9 %) utilised potato leaves as livestock feed from which 37.4 per cent always used it. 21.7 per cent rarely used it while 29.1 per cent had never used potato leaves for feeding livestock. Weighted mean of extent of utilisation was 1.57. The results indicated that feeding sweet potato leaves to livestock was not an uncommon practice in the study area.

On the suitability of sweet potato as livestock feed, Heuze *et al.* (2013) reported from some various previous works that sweet potato vines and foliage can be fed to cattle, sheep, goats, pigs, rabbits and goats. Its forage can be an emergency supply of cattle feed in periods of water stress (drought or dry seasons). It may be fed fresh, dried or ensiled, and makes make very palatable silage with a pleasant fruity smell (Heuze *et al.*, 2013). The implication of the finding is that the potentials of sweet potato leaves as livestock feed if exploited by rural dwellers will greatly supplement available materials within the rural environment that could be utilised as feed for a wide varieties of livestock.

4.2.1.1.7 Maize leaves for herbal concoction

About 52 per cent of the respondents utilised maize leaves for making herbal concoction (see Table 5). While 31.9 per cent sometimes used it, 48.4 per cent had never used maize leaves to make herbal concoction. Weighted mean score was 1.03. The result indicated

that extent of utilisation of maize leaves was low, albeit, it implied that rural dwellers make use of most part of any grown crop that they consider to have significant importance. MDidea Extracts Professional (2013) reported that decoction of leaves and roots of maize are used in treatment of stragury and dysuria. In some other part of the world, India for instance, corn leaves are used to make herbal tea. They are also dried and ground into flour to make porridge, breads and drinks (Sanjay, 2014). The potential of the maize's leaves and roots to treat frequent urge to urinate (stragury) and difficulty or painful discharge of urine (dysuria) make maize leaves very important. The implication is that rural inhabitants may benefit immensely from the maize leaves as important local resource.

4.2.1.1.8 Maize stalks for yam staking (see Table 5)

Majority (66.2 %) of the respondents utilised maize stalks for yam staking out of which few (17.3 %) always used it. About 30.2 per cent rarely used it while 33.8 per cent had never used maize stalks for yam staking. Using maize stalks for yam staking recorded low weighted mean score of 1.19. Despite the preponderance of maize stalk on the maize field after harvest, the results indicated that few proportions amongst the respondent who regularly utilised maize stalk for yam staking.

The respondents although realised usefulness of maize stalk for yam staking, however, they believed that this practice was not necessary in the study area. Rather, that is only applicable to northern part of the country where there are insufficient wooden materials, such as bamboo stem, for yam staking. The common practice in the study area was to leave maize stalk standing on the field after harvest only to be cleared by next planting season. FGD excerpts below buttressed this point.

> "*(Maize stalk) is only common in the northern region (ilè papa); they do not have trees to use for staking there, but we have more than enough to use for that purpose here*"

> "*(Maize stalk) is not strong and doesn't last long before collapsing*".
> FGD excerpts at Ifetedo community, Ife south LGA
> (Source: Field survey, 2013)

4.2.1.1.9 Maize cob as livestock feed and as fuel for household cooking

About 62 per cent of the respondents utilised maize cob (*shùkú àgbàdo*) for feeding livestock like pigs, out of which 18.7 per cent always used did that (see Table 5). About 37.7 per cent had never used maize cob to feed livestock. A low weighted mean score of 1.28 was obtained here. Also, majority (86.5 %) of the respondents made use of maize cob as fuel for household cooking, out of which 58 per cent always used maize cob for this purpose. 13.5 per cent had never made use of maize cob as fuel for household cooking. However weighted mean score recorded here was high (2.22). In addition, it was gathered from field during data collection that hundreds on maize cobs litter the rural environment after maize shelling.

The results indicated that utilising maize cobs as household fuel for cooking was more prevalent that using it for feeding livestock. The results corroborated the findings of Onwuka *et al.* (1996) who reported underutilisation of maize cobs with majority left to rot away or burnt. With increasing cost of livestock feed, so much so that pig rearer had to abandon rearing pigs due to his inability to break even as a result of increasing cost of feeding material (see excerpt of key informant interview below), utilisation of maize stock for livestock feeding becomes a very important and economically viable option for consideration.

> *'Our scenario is a very pathetic situation. The major market for our pigs is in the eastern part of the country, particularly Benin, Edo state. Middle men from the area come to buy from us at extremely ridiculous prices, yet cost of feeding the pigs kept increasing and we are unable to break even. The most unfortunate thing is that these middle men would not allow the final buyers or consumers of the pig to buy from us when we take the products directly to them (in the east).These middlemen are really exploiting us and it became a case of 'we doing the job, they making the money'. I had to stop rearing pigs altogether as a result'.*

An account of livestock farmer who abandoned pig rearing due to inability to break even because of high cost of pig feed (Source: Field survey, 2013).

The implication of these findings is that the rural dwellers, most of whom cultivate maize, need to be sensitised on the utilisation potentials of this item wasting away in the rural environment. Those that raise livestock such as pigs may be empowered and taught how to

convert them into pig feed, while others not engaged in livestock rearing may be encouraged to keep some livestock whereby they would be able to utilise the maize cobs as feed or even sell to others who might need them even at token price.

4.2.1.1.10 Maize shaft as livestock feed

Majority (82.7 %) utilised maize shaft to feed livestock, such as sheep and goats (see Table 5). Out of this proportion, 40.7 per cent always used maize shaft as livestock feed, 36.6 per cent rarely used it, while 17.3 per cent had never used maize shaft for this purpose. Using maize shaft for livestock feeding recorded a high weighted mean score (1.71). The results indicated that feeding livestock with maize shaft was a common practice in the study area. However, another way rural dweller could sustainably do away with maize shaft is not to sieve their maize after grinding, rather they should grind to obtain a near smooth mixture. This is more beneficial from the health point of view.

4.2.1.1.11 Guinea corn leaves as food colorant and condiment (see Table 5)

Majority (81.1 %) of the respondents utilised guinea corn leaves as food colorant and condiment, from which 34.3 per cent and 34.9 per cent always and sometimes used guinea corn leaves for this purpose, respectively. 17.3 per cent had never utilised guinea corn leaves as food condiment. This recorded a weighted mean score of 1.85. The results indicated that it was common utilising guinea corn leaves as food colorant and condiment in the study area. Oyetayo and Ogunrotimi (2012) submitted that guinea corn leaf is a potential source of nutrients and essential antioxidant compounds which could supplement human and animal diets instead of constituting a waste and source of environmental pollution. The implication of this finding is that these inherent potentials of the guinea corn leave could be utilised to the benefit of the rural inhabitant.

4.2.1.1.12 Guinea corn stem as blood tonic and for yam staking (see Table 5)

Majority (85.4%) utilised guinea corn stem as 'blood tonic' when cut into pieces and cook in water to drink, out of which 41.5 per cent always did that. 14.6 per cent had never

done this, while weighted mean score obtained was 2.05. Majority (76.6 %) utilised guinea corn stem (*pòpórò ọkà*) for yam staking, out of which 28.6 per cent always did that. 36.0 per cent rarely used guinea corn stem for yam staking while 23.4 per cent had never used guinea corn stem for this purpose. Weighted mean score for this was 1.46. The results indicated that utilisation of guinea corn as 'blood tonic' was far more prevalent than using it for yam staking. The reason for low utilisation of guinea corn stem for yam staking was similar to the same reason advanced for not using maize stalks for yam staking, as previously discussed.

4.2.1.1.13 Guinea corn bran, cowpea husk, rice husk and bran as livestock feed

About 66 per cent utilised guinea corn bran for livestock feeding. 38.2 per cent amongst these rarely used it while 34.1 per cent had never used guinea corn bran as livestock feed. Weighted mean score was 1.06. Also, 69.2 per cent of the respondents utilised cowpea husk for livestock feeding, of which 44.8 per cent sometimes did, while few (11.5 %) always used it. 30.8 per cent had never utilised cowpea husk as livestock feed. Weighted mean score was low (1.37). In the same vein, while about 60 per cent utilised rice husk and bran for livestock feed, only 28.8 per cent always did this. While 18.7 per cent rarely utilised rice husk and bran as livestock feed, 43.1 per cent had never utilised these farm wastes. Weighted mean score was also low (1.24).

The results indicated low utilisation of guinea corn bran, cowpea husk, rice husk and bran which have a very good potential for feeding livestock. In other parts of the country, from North Central upwards, it is a common practice to gather these items, dry and sell them at the market for buyers to use as livestock feed. This was very uncommon in the study area. The findings underscored the need for utilisation of these waste items as important resource by using them as livestock feed.

4.2.1.2 Identified farm wastes items (by-products) from field crops and other sources utilised by respondents and extent of utilisation

4.2.1.2.1 Oil palm fronds for broom making, basket weaving and shed construction

Results from Table 6 show that 89.6 per cent of the respondents utilised oil palm fronds for making brooms. Amongst this proportion, 45.1 per cent and 42.9 per cent always and sometimes utilised oil palm fronds for broom production, respectively. A very high weighted mean score of 2.23 was recorded with respect to utilisation of oil palm fronds for broom production. Similarly, 89.6 per cent utilised oil palm fronds for roof of shed from which 50.3 per cent always did that. 30.2 per cent rarely used oil palm fronds for shed construction while 10.4 per cent had never used oil palm fronds for this purpose. Low weighted mean score (1.99) was however recorded here. In addition, majority (66.2 %) utilised oil palm fronds for basket weaving. 17.3 per cent and 18.7 per cent always and sometimes utilised oil palm fronds for basket weaving, respectively, 30.2 per cent rarely did so, while 33.8 per cent had never done so. Weighted mean score was also low (1.19).

It was also gathered from during field survey that some part of the oil palm fronds called *fùlù* in local parlance is used to make cages for housing of birds. These results show variety of things oil palm fronds were used for in the study area. It was a general believe among the respondents that no part of the oil palm tree is regarded as un-useful. This perhaps informs the variety of things several parts of the oil palm trees are used for, starting from the fronds. The findings indicated that utilisation of oil palm fronds for broom production was more prevalent than using it as roofing material for shed construction and basket weaving.

Although, utilisation of oil palm fronds for broom production was very common practice, yet brooms are still being brought in to the south-western part of the country from the eastern part. This is an indication that the ones produced down south alone could not meet the demand for it. When asked about bringing brooms from the east for sale down south, a key informant responded as below:

People only engaged in these (broom making) as pastime, no one will leave their farming work and face squarely broom production. It is only when the children are on holiday that they engage actively in broom production.
(Source: Key informant interview, 2013)

The implication of this is that rural inhabitants need to be sensitised on the need to engage more intensively in broom production and not considering it only as amusement. By doing this, there will be increase in broom production, which will not increase rural inhabitants' earnings but also serve as diversified income source for them.

4.2.1.2.2 Oil palm trunk as timber

Majority (86.5 %) of the respondents (see Table 6) used to utilise oil palm stem or trunk to obtain wood for house roofing construction. 64.3 per cent always did this, while 13.5 per cent had never made use of wood obtained from oil palm stem. Using oil palm stem as wooden material for roof construction recorded a high weighted mean score of 2.34. The respondents believed that wood obtained from oil palm stems are generally strong and often resistance to attack by termites, thus making them last longer than other types of wood used for similar purpose. Hence they have preference for it. However, it was revealed during field survey that oil palm stems were only cut down to be used as timber only when they becomes extremely tall and becomes difficult and dangerous to climb, or when they become unproductive.

According Abdullah and Sulaiman (2013), various types of wood such as saw-wood and ply-wood or lumber had been produced from oil palm trunk. The oil palm trunks have been chipped and waxed with resin to produce pre formed desk tops and chair seats for schools. The furniture is characterised for resistance against knocks, scratches, ink, termites and fungus. The ply-wood or lumber can be utilised as core in producing blackboard. The practice of utilising old and unproductive oil palm trunk as timber is a good practice. Contrary to this is leaving the trunk to decompose either while standing, or felling them.

Table 6: Distribution of respondents by utilisation of farm waste items from field crop

Items description	Utilised		Extent of utilisation								Weighted mean score
			Always		Sometimes		Rarely		Never		
	Freq.	Per cent	Freq.	Per cent	Freq.	Per cent	Freq.	Per cent	Freq.	Per cent	
Oil palm fronds for broom production	326	89.6	164	45.1	156	42.9	6	1.6	38	10.4	2.23
Oil palm fronds for shed construction	326	89.6	183	50.3	33	9.1	110	30.2	38	10.4	1.99
Oil palm fronds for basket weaving	241	66.2	63	17.3	68	18.7	110	30.2	123	33.8	1.19
Oil palm stem to obtain wood for house roofing construction	315	86.5	234	64.3	68	18.7	13	3.6	49	13.5	2.34
Oil palm flower (when dried and burnt) to drive away soldier ant	324	89.0	169	46.4	46	12.6	109	29.9	40	11.0	1.95
Oil palm kernel shell for prevention of soil erosion	300	82.4	157	43.1	119	32.7	24	6.6	64	17.6	2.01
Oil palm kernel nut for palm kernel cake (PKC) production	257	70.6	112	30.8	46	12.6	99	27.2	107	29.4	1.45
Oil palm kernel shell as household fuel for cooking	321	88.2	249	68.4	66	18.1	6	1.6	43	11.8	2.43
Coconut shell for household fuel	314	86.3	125	34.3	120	33.0	69	19.0	50	13.7	1.88
Coconut palm fronds for broom production	263	72.3	91	25.0	64	17.6	108	29.7	101	27.7	1.39
Coconut palm fronds for basket weaving											
Coconut stem for roof construction	274	75.3	90	24.7	75	20.6	109	29.9	90	24.7	1.45
Cocoa extracts (*omije koko*) as attractant for bees	275	75.5	105	28.8	149	40.9	21	5.8	89	24.5	1.74
Cocoa pods (*paadi koko*) + *soso* (oil palm fruit bunch left over) for black soap production	301	82.7	132	36.3	79	21.7	90	24.7	63	17.3	1.77
Cocoa tree bark and root used as blood tonic when cooked	291	79.9	120	33.0	150	41.2	21	5.8	73	20.1	1.87
Cocoa leaves for wrapping of pap	292	80.2	113	31.0	94	25.8	85	23.4	72	19.8	1.68

Source: Computed from field survey, 2013

The practice of leaving old palm trunk to decompose, according to Lim (2000), not only disturbs the process of plantation due to the low decomposition rate, it also encourages the spread of diseases and insects like *rhinoces beetles* and *ganoderma* that are harmful to the plantation.

4.2.1.2.3 Oil palm flower (*àrán òpe*) for soldier ant repellent

Majority (89 %) of the respondents (see Table 6) utilised dried and burnt oil palm flower (*àrán òpe*) to drive away soldier ant. 46.4 per cent always utilised oil palm flower for this purpose while 11 per cent had never utilised it for such purpose. Weighted mean score was high 1.9. It is believed that the odour emanating from the burnt oil palm flower drives away dreadful soldier ants that at times pervade rural settlements. The chemical component of this item may be researched on, and through value addition it may be developed into a spray which can be used in cities.

4.2.1.2.4 Palm kernel shell (*ésan*) as fuel for household cooking and for prevention of erosion

Majority (82.4 %) utilised palm kernel shell (see Table 6) for prevention soil erosion, amongst which 43.1 per cent always and 32.7 per cent sometimes used it. Weighted mean score was very high (2.01). Similarly, 88.2 per cent utilised oil palm kernel shell as household fuel for cooking, 68.4 per cent of this proportion always used it. Few (11.8 %) had never used oil palm kernel shell as household fuel for cooking. This item recorded highest mean score (2.43) in this category. Oil palm kernel shell was very much in abundance in the study area and most commonly used as household fuel for cooking, as indicated by the results above.

However, other uses of this item were discovered during field work. Some respondents noted that people from cities used to come to buy the oil palm kernel shell in large quantities paying meagre amount which they (the buyers) use as part of house building materials. Some other respondents prefer to use the oil palm kernel for cooking and leave the remaining to rot

away rather than selling to the buyers at such ludicrous amount. Excerpts below were obtained through key informant (KI) interview during field survey:

> *"We used to mix it with gravel and use it as building material in Delta area where I come from"*

> *"Primarily, we use it (PKS) for cooking; of late some people started coming with vehicle to buy them, but we didn't sell to them because they are useful to us, otherwise, we won't have something to cook again. Asides, indiscriminate buying made us not to sell to them; they wanted to pay just N60 for a full 50 kg bag. We declined and told them we won't sell even if they offer N200. They came back about twice and offered to pay more (about N100), but we still declined, since we consider them of immense use to us.*

> *...blacksmith also used to come and pack them from within and outside the village; we did not use to collect any money from them, but give them as gift; they are in excess, and we consider it better to give them as gift, who knows, one might also at other time need the help of the blacksmith.*

> (Source: Field survey, 2013)

It could be deduced from the above excerpts that rural inhabitants would not mind to sell items they have in excess of their needs that waste away in their environment. However, when they perceive the buyers as being exploitative, particularly when they come from outside the rural areas, they may decline to sell. Also, giving them as gift was another way they disposed such items, as they believe that gift is reciprocal; the one giving today, may be the one receiving at other times latter. The implication of the findings is that rural inhabitants need to be sensitised on the need to appreciate the economic potentials of this farm waste item and the need to reach a fair bargain with interested buyers. Since they have the palm kernel shell in abundance and in excess of their needs, selling them to willing buyers will augment their earnings.

4.2.1.2.5 Palm kernel nut for palm kernel cake production

About 70.6 per cent utilised oil palm kernel nut for palm kernel cake (PKC) production (see Table 6). Out of this proportion, 30.8 per cent always made PKC from oil palm kernel nut

while 27.2 per cent rarely and 29.4 never utilised oil palm kernel nut. Weighted mean score was low (1.45). The results indicated that production of PKC was low. PKC is a very important ingredient in poultry feed. Given the abundance of oil palm plantation in the study area, production of PKC is a viable economic venture rural inhabitants could be empowered to undertake.

4.2.1.2.6 Coconut shell as fuel for household cooking

Majority (86.3 %) utilised coconut shell as household shell for cooking (see Table 6). Of this proportion, 34.3 per cent always and 33 per cent sometimes used coconut shell as fuel for household cooking. High weighted mean score value (1.88) was obtained here. The results indicated that the utilisation of coconut shell as household fuel for cooking was a common practice amongst the respondents in the study area.

4.2.1.2.7 Coconut fronds for broom production (see Table 6)

(Majority) 72.3 per cent utilised coconut tree fronds for broom production of which only 25 per cent always used it. 27.7 per cent had never used coconut palm fronds for broom production. Weighted mean score was low (1.39). This suggests low extent of utilisation of coconut tree fronds for broom production, unlike the case for oil palm fronds. The reason for this as revealed during field survey was that fronds from coconut tree are tougher and thus difficult to use for making broom. The kind of broom made from coconut tree fronds are tougher and last longer, and subsequently costlier than those made from oil palm fronds. The coconut tree fronds are also used to make very strong type of local mat often used as bedding material.

4.2.1.2.8 Coconut stem as wooden materials for roof construction

Majority (75.3 %) utilised coconut stem for roof construction (see Table 6). Of this proportion, 24.7 per cent and 20.6 per cent always and sometimes used it, respectively. 24.7 per cent had never used coconut stem for roof construction. Weighted mean score obtained

was 1.45. The coconut stem used as stem are very strong, lasts longer and defy attack from termite. It is therefore a very good material for roof construction.

4.2.1.2.9 Cocoa extracts as bee attractant (see Table 6)

About 76 per cent used cocoa extracts (*omije kòkó*) as attractant for bees out of which 28.8 per cent and 40.9 per cent always and sometimes utilised it. 24.5 per cent had never utilised never utilised cocoa extracts as attractant for bees. Weighted mean score was 1.74. The results indicated that respondents were familiar with use of cocoa exudates for baiting of bees. Bee rearing could provide alternative and multiple income streams for rural dwellers. It is less time demanding, profitable and lucrative. Training rural inhabitants about modern way of bee keeping and encouraging them to keep bee hives around their cocoa plantation could be a means of empowering them.

4.2.1.2.10 Cocoa pods plus left over of empty palm fruit bunch for local black soap production

Majority (82.7 %) utilised cocoa pods (*pádì kòkó*) plus left over of oil palm fruit bunch (*soso*) for local black soap (*ose dúdú*) production (see Table 6). About 36 per cent always used it, 21.7 per cent sometimes used it and 24.7 per cent had never used combination of cocoa pods and left over of oil palm fruit bunch for black soap production. Weighted mean score was 1.77. Although the extent of utilisation of these items for producing local black soap was high, however comparing the proportion that indicated they used these items for said purpose and those always using it, it may be inferred that larger fractions of the respondent were yet to embark on the production of local black soaps for business venture. This is another area of economic potentials for income diversification for the rural dwellers. Local black soaps are fast selling locally, and could also provide potential raw materials for industries manufacturing black soaps in the cities.

4.2.1.2.11 Cocoa tree bark as blood supplement (see Table 6)

Majority (79.9 %) utilised cocoa tree bark and root used as blood tonic when cooked, out of which 33 per cent always and 41.2 per cent sometimes utilised bark of cocoa tree and its root as blood tonic. Weighted mean score was 1.87. The result indicated high degree of utilisation of bark of cocoa tree as blood supplement among the rural inhabitants. Through value addition, local items such as this that has health benefit may be collated and well packaged such that it could be sold beyond the shores of the rural environment, even exported outside the country. Such items are imported from countries such as China and sold to people who utilise them for their health benefit. The ones packaged in Nigeria, if well made, will attract sale too, and consequently translate into additional income stream for the rural inhabitants engaged in these acts.

4.2.1.2.12 Plantain and banana tree as fish feed and livestock feed

Results in Table 7 show that 41.2 per cent of the respondents utilised plantain and banana tree leaves as fish feed. Of this proportion, about 6.0 per cent only always utilised it. Larger proportion (58.8%) had never utilised plantain and banana trees for feeding fish. Using these items as fish feeds recorded very low weighted mean score (0.60). Conversely, 82.1 per cent of the respondents indicated they utilised plantain and banana peels as livestock feed out of which 54.9 per cent always utilised did so. Only 17.9 per cent never utilised. Weighted mean score of 2.17 obtained here indicate high extent of utilisation.

The results pointed to the fact that utilisation of plantain and banana peels as livestock feed was a predominant practice, while feeding fish with banana and plantain leaves was a rarely known practice. Cost of fish feed is a significant amount that fish farmers have to contend with. However, the practice of feeding fish with leaves of banana and plantain could largely subsidise these costs. The leaves when decomposed are eaten by the fish. The implication is that respondents may be empowered by teaching and encouraging them to

engage in fish production. This will supplement source of their protein intake, and provide additional incomes for them as well.

4.2.1.2.13 Plantain and banana sap to stop bleeding

Majority (84.9 %) of the respondents utilised plantain and banana sap to stop bleeding while 15.1 per cent never done this (see Table 7). Analysis of the extent of utilisation revealed that 40.9 per cent always practiced this while about 30.5 per cent rarely did. A high weighted mean score of 1.80 was obtained here. The results indicated that utilisation of banana and plantain sap to stop bleeding was a predominant practice amongst the rural inhabitants. The implication is that the component of the sap may be researched into and made into product that be sold in the cities to stop bleeding.

4.2.1.2.14 Bamboo stem for shed construction, making 'go to hell' for harvesting, and as pole for raising TV antennae (see Table 7)

Majority (88.7 %) indicated that they utilised bamboo stem for shed construction, 53.6 per cent always utilised it and only 11.3 per cent had never utilised it; weighted mean score was 2.27. Similarly, majority (86.5 %) of the respondents utilised bamboo stem for making 'go to hell' used for crop harvesting. Of this proportion, 47.5 per cent always utilised it, 29.1 per cent rarely utilised and the weighted mean score was 1.91. Likewise, majority (86.5 %) utilised bamboo stem as a pole for rasing TV antenna out of which 44.8 per cent always utilised. Weighted mean score was 2.15. These results indicated that the utilisation of bamboo stem for multipurpose functions was a predominant practice amongst the respondents in the study area. .

Table 7: Distribution of respondents by utilisation of farm waste items from some field crops and other sources

Items description	Utilised		Extent of utilisation								Weighted mean score
			Always		Sometimes		Rarely		Never		
	Freq.	Per cent	Freq.	Per cent	Freq.	Per cent	Freq.	Per cent	Freq.	Per cent	
Cocoa stem for house building construction	166	45.6	10	2.7	130	35.7	26	7.1	198	54.4	0.87
Plantain and banana tree leaves as fish feed	150	41.2	22	6.0	26	7.1	102	28.0	214	58.8	0.60
Plantain and banana peels as livestock feed	299	82.1	200	54.9	92	25.3	7	1.9	65	17.9	2.17
Plantain and banana sap used to stop external bleeding	309	84.9	149	40.9	49	13.5	111	30.5	55	15.1	1.80
Pseudo stem of banana and plantain for organic fertiliser production	274	75.3	85	23.4	157	43.1	32	8.8	90	24.7	1.65
Bamboo (*opaarun*) stem for construction of fences	321	88.2	158	43.4	51	14.0	112	30.8	43	11.8	1.89
Bamboo stem for shed construction	323	88.7	195	53.6	115	31.6	13	3.6	41	11.3	2.27
Bamboo stem for making 'go to hell' used for crop harvesting	315	86.5	173	47.5	36	9.9	106	29.1	49	13.5	1.91
Bamboo stem used as pole for raising TV antenna	315	86.5	163	44.8	140	38.5	12	3.3	49	13.5	2.15
Leaves of Africa spice tree (aidan) for dye production	168	46.1	34	9.3	30	8.2	104	28.6	196	53.9	0.73
Wall nut (*awusa*) for dye production	162	44.5	106	29.1	54	14.8	2	0.5	202	55.5	1.18
Young leaves of *elu* for dye production	252	69.2	83	22.8	35	9.6	134	36.8	112	30.8	1.24
Agbayun used as food sweeteners	295	81.0	118	32.4	60	16.5	117	32.1	69	19.0	1.62
Agbayun roots for herbal usage	243	66.8	63	17.3	160	44.0	20	5.5	121	33.2	1.45
Agbayun leaves for medicinal treatment of malaria	222	61.0	57	15.7	75	20.6	90	24.7	142	39.0	1.13

Source: Computed from field survey, 2013

4.2.1.2.15 Leaves of african spice tree (*aidan*), wall nut (*awùsá*) and West African Indigo leaves (*ewé èlù*) for dye production (see Table 7)

About 46.1 per cent of the reepondents utilised leaves of Africa spice tree (*àìdan*) for dye production while large proportion (53.9 %) had never utilised. About 28.6 per cent rarely utilised while only 9.3 per cent always utilised. Weighted mean score of 0.73, which indicate low extent of utilisation, was recorded here. Similarly, 44.5 per cent of the respondents utilised wall nut (*awusa*) for dye production out of which only 29.1 per cent always utilised it. Again, large proportion (55.5%) had never utilised this item for producing dye. Weighted mean score of 1.18 obtained was also low. However, while 69.2 per cent of the respondents indicated that they used young leaves of *èlú* for dye production, only about 22.8 per cent of this proportion always utilised it, while 30.8 per cent had never utilised the leaves for dye production. Weighted mean score was 1.24.

Excerpts from FGD session below buttressed the foregoing assertions:

> *They (ewé èlú) are abundant in the forest; (they) are very useful to make dye but people don't use them again, we clear them and burn the remnant...*
>
> *People have abandoned it (dye making); it was not as common as it used to be before. However, dye making is still in areas where tye and dye materials are appreciated...*

The results, which indicated low utilisation of these locally available items for dye production, imply that respondents rarely harnessed economic potentials of these items to their utmost advantage. Dye production could be another economical viable outfit rural dwellers can be empowered to undertake. It may be implied from these findings that empowering rural inhabitants through training and capacity building workshops may enhance their utilisation of these locally available items to their economic benefits.

4.2.1.2.16 *Àgbáyun* as food sweeteners and its roots and leaves as herbal medicine (see Table 7)

Majority (81.0 %) of the respondents utilised *agbayun* as food sweetners while only 19.0 per cent had never used it as food sweetners. From those that used it, 32.4 per cent always utilised it while 16.5 per cent sometimes utilised it as sweetener. The weighted mean score of extent of utilisation was 1.62. In addition, 66.8 per cent and 61.0 per cent utilised *agbayun* roots for herbal usage and its leaves for medicinal treatment of malaria, respectively, while 33.2 per cent and 39.0 per cent had never utilised these items, respectively. Extent of utilisation revealed that only 17.3 per cent and 15.7 per cent of the respondents always utilised it as herbs and specifically for malaria trearment, respectively. The weighted mean scores for the utilisation of *àgbáyun* roots and its leaves were 1.45 and 1.13, respectively. As with other items that have health benefits, the roots and leaves of *agbayun* may also be processed and packaged for sell.

4.2.1.2.17 Moringa seeds as water purifier; its leaves as livestock feed and fruits as bee forage

Results in Table 8 show that 39.8 per cent of the respondents utilised seeds of *Moringa oleifera* (*ewe igbale*) as water purifier out of which only 4.9 per cent always utilised it. Majority (60.2 %) had never utilised moringa seeds to purify water for drinking. Weighted mean score obtained here was very low (0.83). Also, 41.5 per cent and 44.2 per cent utilised moringa leaves and fruits as livestock feeds and bee forage, respectively, while only 4.4 per cent and 3.8 percent of these proportions always utilised them, respectively. Large proportions of the respondents (58.5 % and 55.8%) had never utilised moringa leaves as livestock and its fruits as bee forage, respectively. The weighted mean scores for these items were 0.59 and 0.91, respectively. The results indicate low extent of utilisation of the moringa crop by respondents in the study area.

It may be inferred from these findings that rural dwellers in the study were yet to harness the full potentials and better utilise the moringa crop. Water clarification using moringa seeds has health benefits, while keeping bees which can forage on its fruits has both economic and health benefits. These findings underscored the need to canvass for cultivation and subsequently better utilisation of the moringa crop by the rural dwellers in the study area.

4.2.1.2.18 African pear leaves and fruits for feeding snails

Results in Table 8 show that 56.9 per cent of the respondents utilised stem of african pear tree as wood for furniture and building purposes, while 43.1 per cent had never never utilised. Only 12.1 per cent of the former always utilised it. Weighted mean score was 0.95. Also, 55.2 per cent utilised african pear leaves and fruits for feeding snail out of which only 8.8 per cent always did that. The weighted mean score for the extent of utilisation was 1.15. The results indicate low extent of utilisation of African pear leaves and fruits for feeding snail. The implication of the findings is that respondents may be encouraged to engage in snail rearing whereby African pear leaves and fruits and other household waste food items could be utilised in feeding the snails. This would both enhance their protein intake and augment their earnings.

4.2.1.2.19 *Kigelia Africana* (*Pándòró*) as pesticide for yam sett protection

Majority (70.3 %) utilised pandoro fruits as pesticides for protection of yam sett with only 21.7 per cent who always utilised it; weighted mean score of 1.49. The results indicated low extent of utilisation of *pandoro* for protection of yam sett from pest attack.

Participants during FGD buttressed the fact that *pandoro* enhances growth of yam sett when they averred as follows:

> *If one digs the ground and places it (pandoro) therein before planting the yam sett, it enables the yam to grow big very well*
>
> *If we use the knife that was used to cut it (pandoro) to cut yam set for planting, it will prevent the yam sett from pest attack*
>
> (Source: FGD participants, 2013)

4.2.1.2.20 Branches of shear butter tree as chewing stick and bark as treatment for malaria

Results in Table 8 show that 56.3 per cent of the respondents utilised shea butter (*Vittellaria paradoxa*) tree branches as chewing stick where only 4.9 per cent indicated that they always utilised with a weighted mean score of 1.05. Also, 61.5 per cent utilised bark of shear butter for the treatment of malaria and just 10.4 per cent always utilised with a weighted mean score of 1.09. The results indicated low extent of utilisation of bark and branches of share butter tree. These items too, through value addition, may be packaged well and sold as herbal medicine.

4.2.1.2.21 Black pepper shrub branches as chewing sticks (see Table 8)

Majority (70.3 %) of the respondents used to utilise shrub branches of black pepper (*iyere*) tree as chewing sticks out of which 23.4 per cent always utilised it. Weighted mean score was 1.52. This item, like other stick made from local trees or shrubs, has provided oral hygiene not only for Africans, but the Middle East and Asia. Due to antimicrobial agents in these sticks, pathogens are killed and disease prevented. The shrub branches may be well packaged by neatly cutting them into pencil size shape which may then be sold beyond the shores of the rural environment.

4.2.1.2.22 *Xylopia aethiopica (eru)* for driving away soldier ants

Majority (74.1 %) used to utilise dried and burnt fruits of *Xylopia aethiopica* for driving away solder ants while only 25.9 per cent had never utilised it. 25.0 per cent of the proportion that utilised it always did and the weighted mean score was 1.51. the results indicated that rural dwellers believed in the efficacy of the this item to drive away soldier ants. The implication of the findings is that the chemical component of the fruit may be investigated such that it could be made into spray that can be sold to resist and dispel soldier ant.

Table 8: Distribution of respondents by utilisation of farm waste items from other sources (continued)

Items description	Utilised		Extent of utilisation								Weighted mean score
			Always		Sometimes		Rarely		Never		
	Freq	Per cent	Freq	Per cent	Freq	Per cent	Freq	Per cent	Freq	Per cent	
Moringa Oleifera (*ewe igbale)* seeds as water purifier	145	39.8	18	4.9	121	33.2	6	1.6	219	60.2	0.83
Moringa leaves as livestock feed	151	41.5	16	4.4	33	9.1	102	28.0	213	58.5	0.59
Moringa fruits for bee forage	161	44.2	14	3.8	143	39.3	4	1.1	203	55.8	0.91
African pear stem as wood for furniture and building purposes	207	56.9	44	12.1	51	14.0	112	30.8	157	43.1	0.95
African pear leaves and fruits for feeding snails	201	55.2	32	8.8	155	42.6	14	3.8	163	44.8	1.15
Pandoro fruit used as yam sett pesticides	256	70.3	79	21.7	127	34.9	50	13.7	108	29.7	1.49
Shea butter (*Vittellaria paradoxa*) tree branches used as chewing stick	205	56.3	18	4.9	140	38.5	47	12.9	159	43.7	1.05
Bark of shear butter tree for malaria treatment	224	61.5	38	10.4	97	26.6	89	24.5	140	38.5	1.09
Black pepper (*iyere*) tree branches as chewing sticks	256	70.3	85	23.4	126	34.6	45	12.4	108	29.7	1.52
Eeru (*Xylopia aethiopica*) dried and burnt fruits for driving away solider ant	270	74.1	91	25.0	96	26.4	83	22.8	94	25.9	1.51
Cactus planted as fence against large mammalian pest	195	53.6	67	18.4	38	10.4	90	24.7	169	46.4	1.00

Source: Computed from field survey, 2013

4.2.1.2.23 Seed of bush mango fruit (*Irvingia gabonensis*) for soup cooking and unripe fruit for treating measles

Results in Figure 7 show that majority (80.7 %) of the respondents utilised the seed of bush mango tree for cooking soup, out of which only 40.8 per cent utilised it always. 19.5 per cent and 20.6 per cent sometime and rarely utilised it, respectively, while 19.2 per cent had never utilised it for soup cooking. Weighted mean score was 1.82. Also, results in Figure 8 show that 69.8 per cent utilised unripe but mature fruit of bush mango tree for treating measles while 30.2 per cent had never utilised it. 18.7 per cent always utilised it and 20.1 per cent and 31 per cent sometimes and rarely utilised it, respectively. Weighted mean score was 1.27.

The results indicated low extent of utilisation of unripe but mature fruit of bush mango for treating measles, but high extent of utilisation was recorded for utilisation of seed of bush mango for making *apon* soup. It might be that respondents had other ways of treating measles, and would rather prefer to allow bush mango to ripe, so it could be eaten and its fruit used for cooking soup.

4.2.1.2.24 Poultry droppings as fish feed and sheep and goat faeces as manure

Results in figure 9 show that 54.1 per cent of the respondents indicated they utilised poultry droppings as fish feed, out of which 18.4 per cent always did. 27.5 per cent sometimes utilised it, while 45.9 per cent had never utilised poultry droppings as fish feed. Weighted mean score was 1.19. About 69.2 per cent of the respondents utilised sheep and goat faeces as manure, as shown in Figure 10. From this proportion 25.2 per cent regularly did, while 30.8 per cent had never utilised it. Weighted mean score was 1.61.

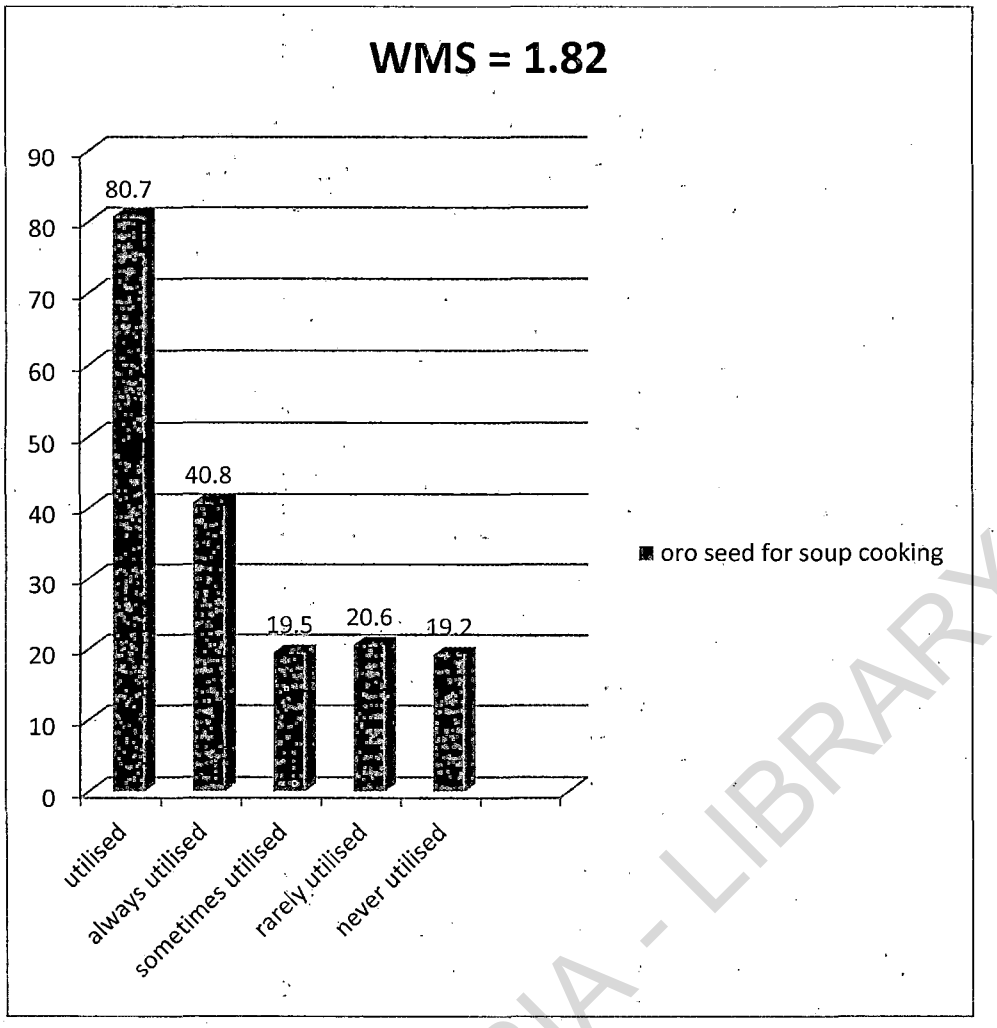

Fig. 7: Distribution of respondents by utilisation of bush mango seed for soup cooking

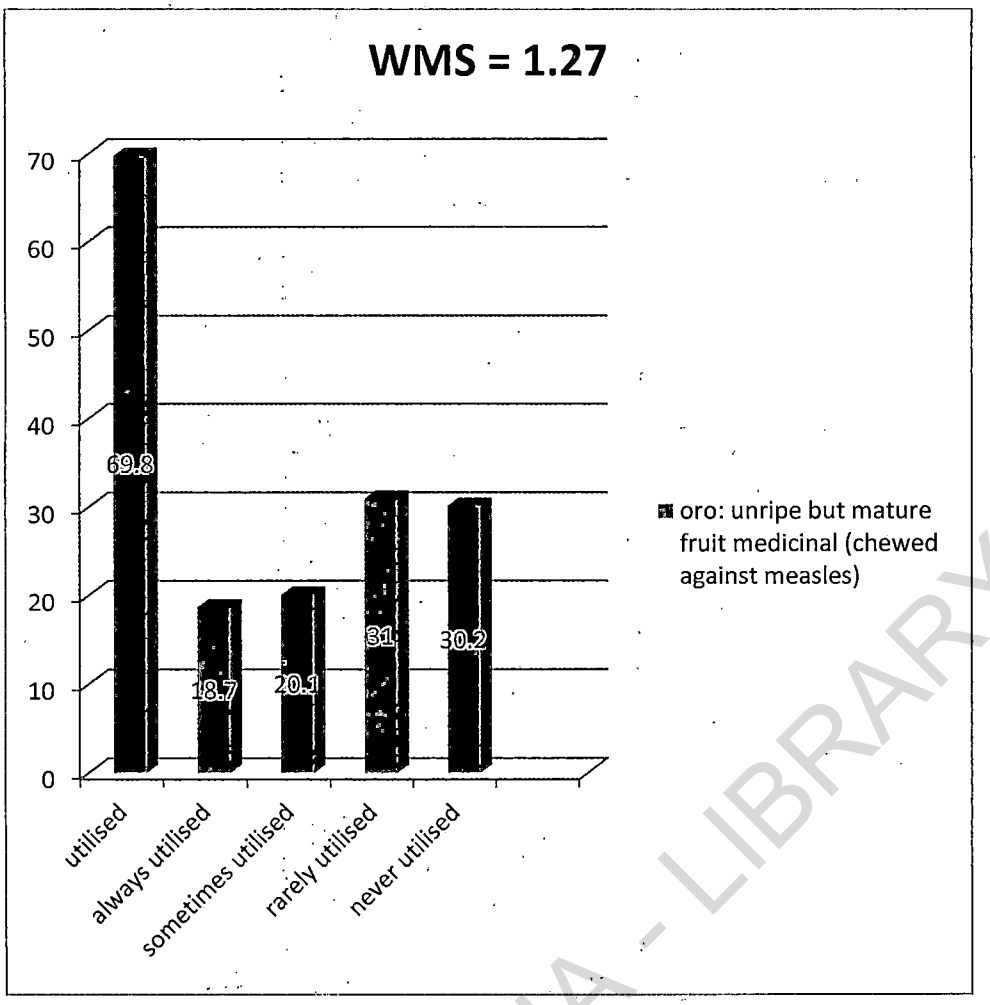

Fig. 8: Distribution of respondent by utilisation of unripe bush mango fruit for treating measles

Source: Filed survey, 2013

The findings indicated low extent utilisation of poultry droppings as fish feed, while utilisation of sheep and goat faeces was high. The poultry droppings can be used as substrate to grow maggot which can then as serve as feed for fish and other livestock.

Asides the above, it was revealed during field survey that rural inhabitants use faeces of sheep and goat to protect their cocoa beans from being eaten by these livestock. The smell of the faeces when soaked in water and sprayed over the cocoa beans prevent the sheep and goat from eating them. While this may affect the quality and subsequently lower the grade of the cocoa bean, some rural inhabitants consider this a viable option for protecting their produce. Also, revealed during field survey was that these livestock were not tethered and therefore difficult to collect their faeces since they were kept on free range.

4.2.1.2.25 Animal bones for bone meal production for livestock feed

Figure 11 show 67 per cent utilised animal bones for producing bone meal, out of which 19 per cent always did. 33 per cent had never utilised animal bones to make bone meal. The bone meal is vital component of the fish feed. Weighted mean score was low (1.43). The results indicated low extent of utilisation of animal bones. There are lots of animal bones across several slaughter slabs in the rural communities. The implication is that rural inhabitants may be empowered about processing of animal bones for making bone meal which they can subsequently sell to feed mill industries to produce livestock feed. Alternatively, rural youths may be sensitised to gather slaughtered animal bones from various slaughter slab and sell them at feed mill industries.

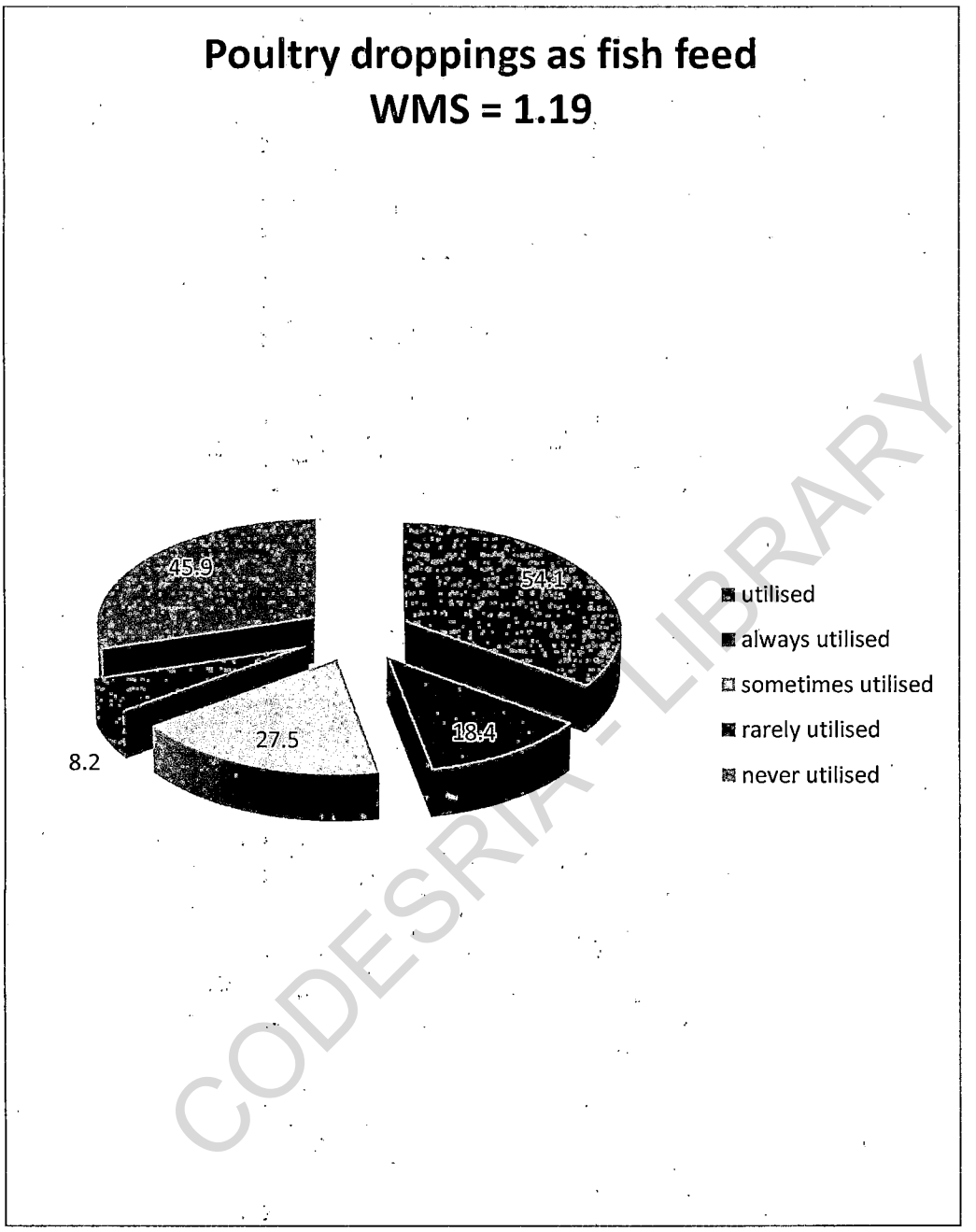

Fig. 9: Distribution of respondents by utilisation of poultry droppings as fish feed

Source: Field survey, 2013

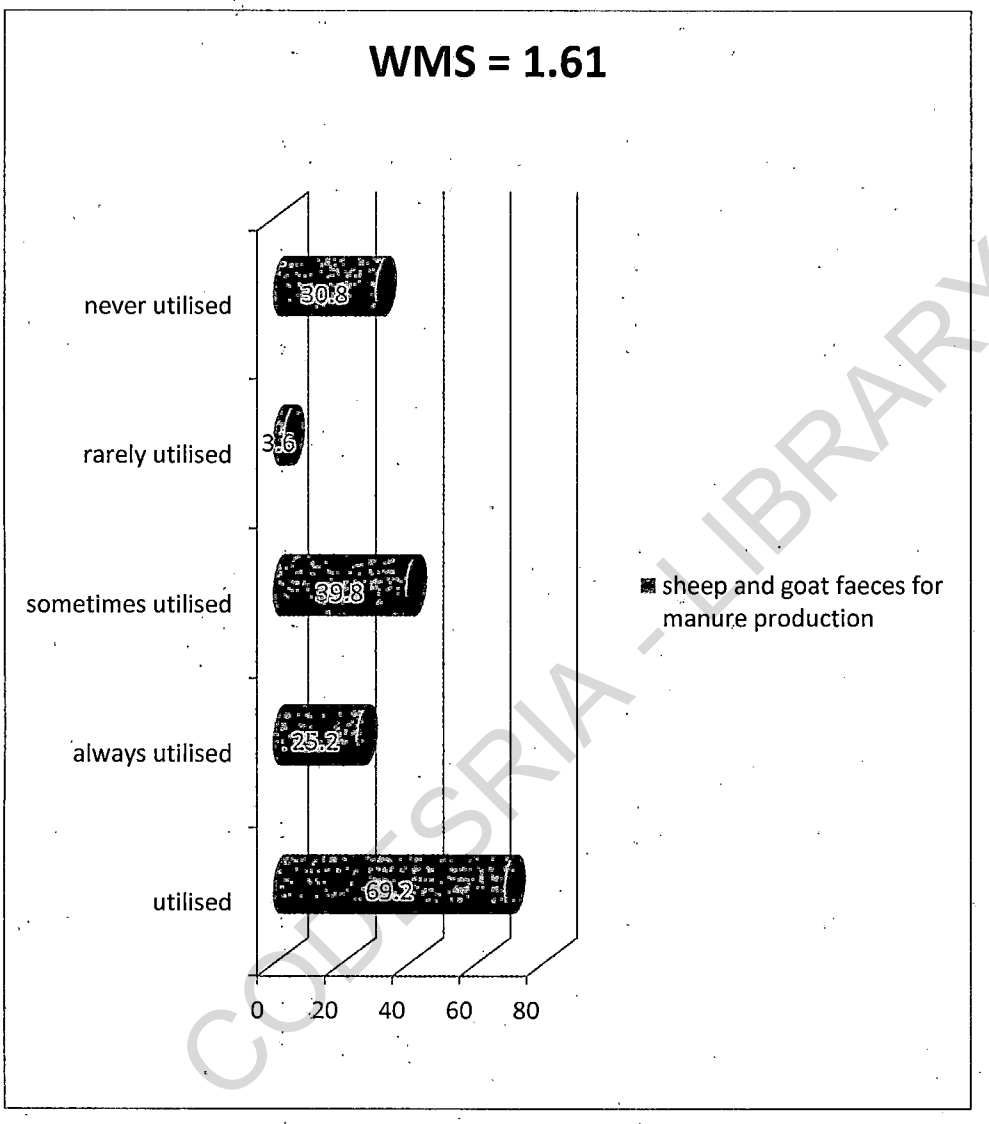

Fig. 10: Distribution of respondents by utilisation of sheep and goat faeces as manure

Source: Field survey, 2013

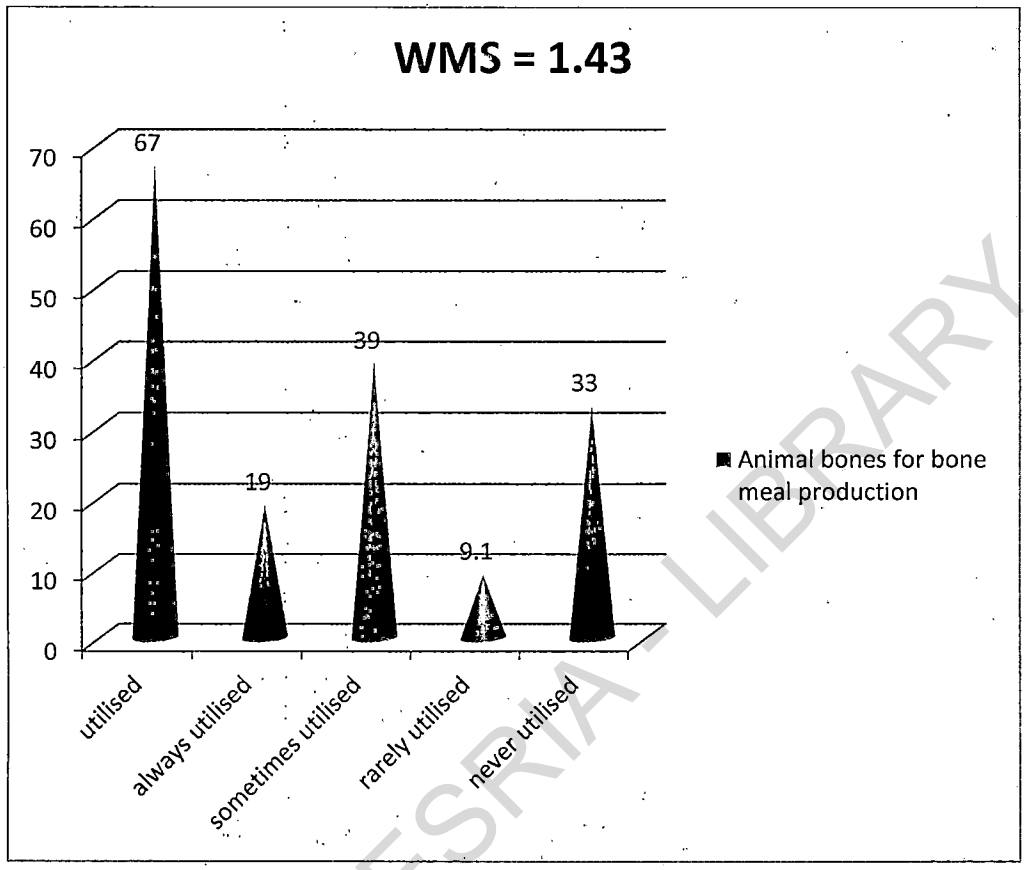

Fig. 11: Distribution of respondent by utilisation of animal bones for bone meal production

Source: Field survey, 2013

4.3 Perception of rural dwellers about the economic potential of farm wastes

There seemed to be the general notion among rural inhabitants that there is nothing the Almighty created that is useless, although, everybody might know the importance and uses of everything. It then means that that rural dwellers did not make use of certain items did not imply there regarding it useless. In respondents' own words: *there is nothing God creates that is not useful, except those that do not know their usefulness, but those that know know.* This view permeates through responses of the respondents about their perception on importance and economic potential of farm waste items. In this section, perceptions of the rural dwellers about the economic potentials of identified farm waste items were presented.

4.3.1 Cassava peels

Results in Table 9 show that 59.6 per cent and 31.3 per cent regarded cassava peels as very valuable and somewhat valuable, respectively. While very few (less than 6 %) regarded it as worthless, only about 3 per cent were not sure about the economic potentials of cassava peels. The results indicated that majority (90.9 % each) perceived cassava peels as valuable economically.

Furthermore, results in Table 10 show that 45.1 per cent and 52.2 per cent of the respondents regarded cassava peels as potential food and income source, respectively. While majority (90.9 %) regarded cassava peels as valuable livestock feed, very few (7.7 %) of them considered it as useful for soil improvement fertility. Respondents explained that edible mushroom could be produced used from heaps of cassava peels which could either be consumed or sold for money. Also, those that reared livestock used to feed them with cassava peels.

Excerpts from FGD and KI below lent credence to some of the above findings:

Cassava peel is very useful item...

We use it to feed our livestock....

Some people use to produce mushroom from it

The findings indicated that the rural dwellers considered the cassava peels as economically important item. The implication is that they could be empowered on better ways to judiciously utilise this waste item for their economic benefit. Encouraging cassava processors to sundry cassava peels in excess of their needs in order to preserve them is very paramount. This practice was very uncommon in the study area as previously mentioned. The dried cassava peels would last longer as livestock feed which could be used by those rearing livestock animals or sold for cash, thereby generating additional income stream for the cassava processors.

Furthermore, producing mushroom from the cassava peels is another way to better judiciously utilise them. Rural dwellers, particularly those engaged in cassava production and processing, should be encouraged on this practice. As previously shown, ample proportion of the respondents were yet to engage in this act. When well produced, the mushroom could provide a cheap protein source and also sold for cash thereby providing additional income source for the rural inhabitants. In addition, cassava peels plus some other waste items could be used for producing organic manure that helps in sustainably replenishing soil nutrient. Very few of the respondents had this perception about the potential use of cassava peels as indicated earlier on.

The aforementioned are areas where rural dwellers could be enlightened and encouraged to better make use of cassava peel wastes. Also and most importantly, unemployed rural youth can benefit in any of these areas by setting up a small scale enterprise that focus on utilisation of cassava peel waste alone. With the agricultural transformation agenda of the present day government which is expected to boost the rate of cassava production, the cassava peels remain a very important natural asset that can be judiciously utilised to economically empower both the rural youth and other dwellers at large.

4.3.2 Cassava leaves

Results in Table 9 show that 56.6 per cent and 12.4 per cent regarded young cassava leaves (*omunu ege)* as somewhat valuable and very valuable, respectively, while few (22 %) regarded it as worthless. About 9 per cent remained indifference. These results indicated that majority (69 %) perceived young cassava leaves as valuable economically. Results in Table 10 further show that 69.5 per cent regarded cassava leaves as potential food source (when cooked as vegetable). About 20.3 per cent considered it as a potential income source from the perspective that when cooked as vegetable; money that would have been used to buy the vegetable could be saved for some other uses. Also, about 21 per cent regarded the cassava leaves as important livestock feed. Some specifically mentioned using it to feed rabbits.

Some excerpts from FGD are presented below:

We use the cassava leaf to cook soup in the past; it makes a very palatable soup, however, it is not as common as it was before now; people have started neglecting it....

We use it as livestock feed, it is very good in feeding rabbits.....

The results indicated that, although rural inhabitants used to consume cassava leaves, the habit is gradually waning.

4.3.3 Cassava stems

Results in Table 9 show that 39.8 per cent and 22.5 per cent considered cassava stems as very valuable and valuable, respectively, while very few (0.8 %) regarded extremely worthless. Another 24.2 per cent viewed it as somewhat worthless and remaining 12.6 per cent were indifferent. Results in Table 10 further show that about 62 per cent of the respondents considered the cassava stem as potential income source. The cassava stems, they said, were sold for planting to other farmers who do not have sufficient quantity to use. The results indicated that cassava stems were largely perceived as valuable items by the rural dwellers. The stems are sold and used as cuttings for planting of cassava.

4.3.4 Yam peels

About 54.7 per cent and 27.2 per cent amongst the respondents, as shown in Table 9, viewed yam peels as very valuable and somewhat valuable, respectively, while about 14 per cent regarded it as worthless. These results indicated that majority (about 82 %) perceived yam peels as valuable item. Results in Table 10 further show that majority (82.1 % and 81.3 %) considered yam peels as potentially useful for food and livestock feed, respectively. About 43.1 per cent indicated that it could also be potential income source, while about 3 per cent opined that it is a useful item for making compost that enhances soil fertility improvement.

Yam peel is very valuable economically....

We use it to make yam flour which is sold for money at the market

FGD excerpts about economic importance of yam peels in Ayedade LGA.

The import of the results is that rural inhabitants had favourable perception about utilisation potentials of peels.

4.3.5 Cocoyam leaves

Results in Table 9 show that 29.7 per cent and 31.6 per cent of the respondents considered young cocoyam leaves as very valuable and somewhat valuable, respectively, while 3.5 per cent and 8 per cent viewed it extremely worthless and somewhat worthless, respectively. Remaining 33 per cent were unsure about the economic potentials of young cocoyam leaves. Results in Table 10 further show that 69.8 per cent of the respondents regarded cocoyam leaves as potential source of food (when cooked as vegetable), while 45.1 per cent and 23.9 per cent regarded it as potentially useful for livestock feed and income source, respectively. These results indicated that respondents had favourable perception about the economic potentials of cocoyam leaves. The implication of the findings utilisation of cocoyam leaves as vegetable and livestock feed are potentials ways to judiciously utilise them among the rural inhabitants.

Table 9: Distribution of respondent by perception about economic potentials of identified farm wastes from arable crops

Items	Very valuable		Somewhat valuable		Indifferent/ unsure		Somewhat worthless		Extremely worthless	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Cassava peels	217	59.6	114	31.3	12	3.3	14	3.8	7	1.9
Young cassava leaves	45	12.4	206	56.6	33	9.1	40	11.0	40	11.0
Cassava stems	145	39.8	82	22.5	46	12.6	88	24.2	3	0.8
Yam peels	199	54.7	99	27.2	14	3.8	20	5.5	32	8.8
Young cocoyam leaves	108	29.7	115	31.6	120	33.0	8	2.2	13	3.5
Potato leaves	63	17.3	160	44.0	28	7.7	87	23.9	26	7.1
Maize stalk	128	35.2	102	28.0	26	7.1	63	17.3	45	12.4
Maize cob	73	20.1	153	42.0	109	29.9	12	3.3	17	4.7
Maize shaft	115	31.6	85	23.4	96	26.4	25	6.9	43	11.8
Guinea corn leaves	142	39.0	106	29.1	8	2.2	31	8.5	77	21.2
Guinea corn stem	117	32.1	79	21.7	45	11.3	108	29.7	15	4.1
Guinea corn bran	58	15.9	116	31.9	104	28.6	61	16.8	25	6.9
Cowpea husk	53	14.6	201	55.2	60	16.5	16	4.4	34	9.3
Rice bran and husk	57	15.7	96	26.4	43	11.8	51	14.0	117	32.1

Source: Computed from field survey, 2013

Table 10: Distribution of respondents by perception about specific utilisation potentials of farm waste from arable crops

Items	Food		Income		Medicinal		Livestock feed		Improving soil fertility	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Cassava peels	164	(45.1)	190	(52.5)	-	-	331	(90.9)	28	(7.7)
Young cassava leaves	253	(69.5)	74	(20.3)	-	-	76	(20.9)	-	-
Cassava stems	-	-	221	(61.8)	-	-	-	-	-	-
Yam peels	299	(82.1)	158	(43.3)	-	-	296	(81.3)	12	(3.3)
Young cocoyam leaves	254	(69.8)	87	(23.9)	-	-	164	(45.1)	-	-
Potato leaves	107	(29.4)	76	(20.9)	-	-	164	(44.8)	-	-
Maize stalk	-	-	-	-	-	-	76	(20.9)	145	(39.8)
Maize cob	-	-	102	(28.0)	-	-	145	(39.8)	34	(9.3)
Maize shaft	-	-	127	(34.9)	-	-	280	(76.9)	-	-
Guinea corn leaves	129	(35.4)	112	(30.8)	228	(62.6)	40	(11.0)	26	(7.1)
Guinea corn stem	124	(34.1)	35	(9.6)	119	(32.7)	25	(6.9)	16	(4.4)
Guinea corn bran	-	-	-	-	-	-	173	(47.5)	86	(23.6)
Cowpea husk	-	-	-	-	-	-	244	(67.0)	43	(11.8)
Rice bran	-	-	36	(9.9)	-	-	135	(37.1)	-	-

Source: Field survey, 2013

4.3.6 Sweet potato leaves

Results in Table 9 show that 44 per cent and 17.3 per cent viewed young potato leaves as somewhat valuable and very valuable, respectively; while about 31 per cent regarded it worthless. These results indicated that 61.3 per cent held the view that potato leaves are valuable. Results in Table 10 further show that 29.4 per cent and 20.9 per cent regarded potato leaves as potential food and income source, while 44.8 per cent considered it useful feed for livestock. Although, the results might imply favourable perception about utilisation potentials of potato leaves, however with about one-third regarding it as worthless, it may be inferred that respondents were yet to realise full utilisation potentials of the sweet potato crop as important natural asset.

4.3.7 Maize stalk

About 35.2 per cent and 28.0 per cent, as illustrated in Table 9, considered maize stalk as very valuable and somewhat valuable, respectively, while about 30 per cent regarded it worthless. This indicated that a total of 63.2 per cent regarded maize stalk as important item. Results in Table 10 further show that 20.9 per cent of the respondents regarded maize stalk as useful for livestock feed, while 39.8 per cent considered it useful for soil fertility improvement. It may be inferred from the results that higher proportion of the respondents did not harness the potentials of maize stalk as livestock feed or to improve fertility of their farm land. Also, as previously discussed, they did not consider maize stalk as useful for yam staking. These are areas respondents could be encouraged to utilise maize stalk after harvest, rather than burning them in the open field.

4.3.8 Maize cob

Results in Table 9 show that about 42 per cent and 20.1 per cent of the respondents viewed maize cob as somewhat valuable and very valuable, respectively, while very few (about 8 %) regarded it worthless. About 30 per cent were irresolute about the economic potentials of maize cobs. This indicated that a total of 62.1 per cent considered maize cob as

economically important. Results in Table 10 further show that 39.8 per cent 28 per cent of the respondents considered maize cob as potential livestock feed and income source, respectively, while few (9.3 %) viewed it as useful material for making compost for improvement of soil fertility.

Furthermore, FGD excerpt below revealed perception of the respondents about the usefulness of maize cob

We use it as fuel for cooking...

We do not know of any use for it apart from using it for cooking and throwing the remaining away...

Those rearing pig make use of it as feed for the pigs....

These findings, which agreed with Onwuka *et al.*'s (1996) submission about gross underutilisation of maize cob, indicated that most respondents have not been harnessing the potentials of maize cobs. Like also previously discussed, a pig rearer had to abandon pig rearing due to inability to break even because of high cost of feeding them. This is an important where rural dwellers could be economically empowered by converting the maize cobs into livestock feed.

4.3.9 Maize shaft

Results in Table 9 show that about 31.6 per cent and 23.4 per cent held the view that maize shaft of were very valuable and somewhat valuable, respectively. Few (about 20 %) regarded it useless, while about 26 per cent were indecisive about the economic potentials of maize shaft. Furthermore, results in Table 10 reveal that about 35 per cent considered maize shaft as potential income source, while 76.9 per cent viewed it as very useful livestock feed. Furthermore, excerpts from FGD below revealed that maize shaft is rarely considered a waste item to be thrown away. But rather mostly used for feeding livestock.

We do not know of any importance of the maize shaft than using it to feed livestock...

We use it to feed our sheep and goat, and they do very well feeding on them...

The results revealed respondents' favourable perception about potentials of maize shaft. However, as a way to better harness the potentials of maize shaft as livestock feed, rural dwellers, particularly those involved in processing of maize into pap, may be encouraged to dry the maize shafts in order to preserve it for a longer period. This may then be sold as livestock feed to those rearing livestock. This is from economic view point. But for health benefit, rural dwellers may be encouraged not to sieve the grounded maize but rather consume it themselves while making pap. With several other items available that could be used as livestock feed, it seems more beneficial that rural dwellers should consume the fibre content rather than feeding the shaft to livestock.

4.3.10 Guinea corn leaves and stem

About 39 per cent and 29.1 per cent viewed guinea corn leaves as very valuable and somewhat valuable, respectively, while about 30 per cent regarded it as not useful, as shown in Table 9. These results indicated that 68.1 per cent considered guinea corn leaves as economically important. Results in Table 10 further show that about 35 per cent and 31 per cent regarded guinea corn leaves as useful food source and income generating, respectively. Also, about 63 per cent considered it to be of medicinal importance, while 11 per cent and 7.1 per cent viewed it as important feed for livestock and useful for soil fertility improvement, respectively.

As for the guinea corn stem (*poporo oka*), about 32 per cent and 22 per cent it as very valuable and somewhat valuable, while about 34 per cent regarded it worthless. About 11 per cent were uncertain about the potentials of guinea corn leaves. Results in Table 10 further show that 34.1 per cent and 32.7 per cent considered the guinea corn stem as important for food and medicine, respectively. Very few (6.9 % and 4.4 %) considered it important as livestock feed and for improving soil fertility, respectively.

The results revealed respondents' perception about guinea corn leaves and stems. They considered them as useful condiment for cooking. They are used as colouring item for turning

white beans into red while cooking. They are also considered as very useful supplement for blood when boiled in water and taken, and also useful as feeding livestock and replenishing soil nutrient. Excerpts from FGD below further corroborate the above submission

Guinea corn stem are very useful blood supplement...

The leaves and stems are very good blood tonic....

If we cut (guinea corn stem) and put them in beans we are cooking, it readily turns the colour from white to red, and also add aroma to it...

4.3.11 Guinea corn bran

About 32 per cent and 16 per cent of the respondents held the view that guinea corn bran as somewhat valuable and very valuable, respectively, while about 24 per cent viewed it worthless (see Table 9). About 29 per cent were indecisive. Results in Table 10 further show that about 48 per cent considered it as valuable livestock feed, while 23.6 per cent considered useful for soil fertility improvement. The results indicated that respondents held the view that guinea corn bran could be useful livestock feed and replenishing soil fertility. These are sustainable ways of utilising this item. However, utilising it to make livestock feed for economic advantage was not largely exploited by the respondents.

4.3.12 Cowpea and rice husk

As shown in Table 9, 55.5 per cent and 14.6 per cent considered cowpea husk as somewhat valuable and very valuable, respectively, while few (about 14 %) regarded it useless. About 17 per cent were unsure about the potentials of cowpea husk. Furthermore, results in Table 10 indicated that 67 per cent and 11.8 per cent considered it useful for livestock feed and soil fertility improvement, respectively.

Also, 26.4 per cent and 15.7 per cent viewed rice husk and bran and somewhat valuable and very valuable, respectively while about 46 per cent regarded it as worthless (see Table 9). About 12 per cent were uncertain about its potential. Furthermore, about 37.1 per cent specifically considered it as useful for feeding livestock, few (9.9 %) regarded it useful

income source (see Table 10). These results revealed respondents' perception about the potential usefulness of cowpea and rice husk as livestock feed and in replenishing soil nutrient. However, as earlier discussed, it was not common practice in the study area to gather these waste items and preserve them for longer period use. If these items are gathered, rural dwellers may derive economic benefit from selling them as livestock feed to those rearing livestock, thereby earning additional income.

4.3.13 Oil palm fronds

It is important to start the discussion on respondents' perception about the utilisation potentials of the oil palm crop with their notion that the oil palm tree is so valuable that no single part of it is without its use, except for one who does not know it. Following excerpts from key informant interviews lent credence to this assertion:

> *Nothing is useless from oil palm, even 'omi afo' (waste water obtained during oil palm processing) is used to bathe unhealthy children to cast away disease*
>
> *I don't think there is any waste from oil palm tree o,... hmmm, except for 'omi afo', even that those know its uses make use of it....*
> (Source: Key informant interviews, 2013)

Now, as regards oil palm fronds, results in Table 11 show that about 60 per cent and 20 per cent of the respondents regarded oil palm fronds as very valuable and somewhat valuable, respectively, as shown in Table 11, while about 20 per cent regarded it not useful. The results indicated that majority (80 %) perceived oil palm fronds as economically important. Result in Table 12 further show that about 76 per cent specifically identified palm fronds as potential source of income earning among rural dwellers, while very few (4.7 %) indicated it as potential feed for livestock. The fronds are used to make lot things including brooms, basket, bird cages that fetch them money. Some respondents put it as below:

> *"Oil palm fronds are very useful items...*
>
> *We use them as roofing material in shed construction...,*
>
> *We use them to make wooden bed, baskets and even cage..."*

In the excerpts below, a respondent gave an estimate of how much he used to make from sales of basket woven:

> *I made average of 8 baskets a day from 16 palm fronds, which i sell for N200 each at the Ikire market which operate every 5 days. That means i sell about 40 woven baskets each week (i.e. every 5 days) and make N8, 000 per week.*

The respondent who gave the above information was a secondary school student who engaged in basket weaving as part time activities. Yet, he was making as much as N8, 000 per week. He could make more money if he committed more time to it. But being a student, he could not do more than that. The implication of this finding is that unemployed rural youth can be gainfully engaged in utilisation of palm tree fronds. Also, as previously noted, making broom from palm tree frond was a pastime by those engaged it this act. If taken as serious job by those without job, particularly, rural youth, this might provide a sustainable means of sustenance for them.

The results also indicated that very few proportions (4.7 %) of the respondents realised the potentials of the palm frond as livestock feed. It has been reported that oil palm fronds can be processed as roughage source for ruminants such as cattle and goats. In fact, the Malaysian Agricultural Research and Development Institute (MARDI) made a new product known as oil palm frond based ruminant pellet which could be used as balanced diet for fattening beef cattle (Abdullah and Sulaiman, 2013). This has a lot of implications for reducing cost of feeding of livestock ruminants if practiced in the study area. During the process of utilising the fronds, the leafy parts useful as livestock feed are usually trimmed off with no attention paid to. Rural dwellers may be empowered by training them how to make such ruminant based pellet which could be both be used as livestock feed and sold to generate additional income for them

4.3.14 Palm kernel shell

About 60 per cent and 15 per cent of the respondents, as shown in Table 11, perceived palm kernel shell as economically valuable, respectively. Very few, less that 2 per cent,

considered it not useful. Furthermore, results in Table 12 show that 75.5 per cent of the respondents specifically identified palm kernel shell as useful income generating source. About 14.3 per cent others identified its usefulness in environmental protection for control of erosion. The later corroborated the submission of Abdullah and Sulaiman (2013) who reported that part of the ways excess shell is utilised include using them as covering of the surface of the roads within the rural environment, particularly during raining periods.

These results indicated a favourable perception of the rural dwellers perception about economic potential of palm kernel shell. The rural dwellers primarily used it as fuel for household cooking and by local blacksmith. This is of economic importance because it saves them cost of buying alternatives, such as firewood and kerosene they could have used instead. It was also reported that people from outside the rural communities come to purchase the palm kernel shell from the rural dwellers. Below are excerpts from key informants' interview in this regards:

> "*The palm kernel shell is very useful to us here, we use it to cook..., blacksmith also use to generate fire (called 'ewiri' in local parlance) they use in their business...*
>
> "*.....Of recent, some people started coming to buy the palm kernel shell using big lorries to pack them....*"

These results notwithstanding, ample proportion of this item still waste away in the rural environment. This is because; they are so much in abundance that they could not be exhausted by mere using as housing fuel. As put by the respondents' during field survey: "*how many could we use to cook?! We use as much as we need from them, and leave others wasting away*". This then means that better alternative have to be sought to effectively dispose off the excess shell rather than leaving them to waste away.

Table 11: Distribution of respondent by perception about economic potentials of identified farm wastes from some field crops

Items	Very valuable		Somewhat valuable		Indifferent/ unsure		Somewhat worthless		Extremely worthless	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Oil palm fronds	218	59.9	73	20.1	0	0.0	72	19.8	1	0.3
Oil palm stem	231	63.5	62	17.0	25	6.9	13	3.6	33	9.1
Oil palm flower	110	30.2	104	28.6	34	9.3	41	11.3	75	20.6
Palm kernel shell	225	60.4	55	15.1	80	22.0	3	0.8	1	0.3
Empty palm fruit bunch	55	15.1	67	18.4	159	43.7	27	7.4	56	15.4
Coconut shell	103	28.3	199	54.7	31	8.5	23	6.3	8	2.2
Coconut palm fronds	91	25.0	158	43.4	12	3.3	27	7.4	76	20.9
Cocoa pods	141	38.7	92	25.3	92	25.3	36	9.9	1	0.3
Cocoa bark	146	40.1	75	20.6	49	13.5	91	25.0	3	0.8
Cocoa root	88	24.2	144	39.6	85	23.4	23	6.3	24	6.6
Cocoa leaves	76	20.9	153	42.0	113	31.0	20	5.5	2	0.5
Plantain and banana leaves	104	28.6	124	34.1	37	10.2	81	22.3	18	4.9
Plantain and banana fruit peels	132	36.3	85	23.4	45	12.4	8	2.2	94	25.8
Plantain and banana tree sap	148	40.7	110	30.2	90	24.7	14	3.8	2	0.5
Africa's spice tree's pod	89	24.5	79	21.7	110	30.3	77	21.2	9	2.5
West African indigo leaves	102	28.0	103	28.3	67	18.4	88	24.2	4	1.1
Moringa's seed	37	10.2	48	13.2	255	70.0	18	4.9	6	1.6
Moringa's leaves	44	12.1	105	28.8	174	47.8	35	9.6	6	1.6

Source: Computed from field survey, 2013

Table 12: Distribution of respondents by perception about specific utilisation potentials of farm waste from field crops and other sources

Items	Food		Income		Medicinal		Livestock feed		Improving soil fertility	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Palm frond	-	-	278	76.4	-	-	17 (4.7)		-	-
Palm kernel shell	-	-	275	75.5	-	-			-	-
Empty palm fruit bunch	37	10.2	-	-	-	-	-	-	81	22.3
Coconut shell	-	-	114	31.3	152	42.3	-	-	-	-
Coconut frond	-	-	170	46.7	-	-	20	5.5	-	-
Cocoa pod husk	-	-	165	45.3	154	42.3	-	-	13	3.6
Cocoa leaves	72	19.8	133	36.6	-	-	45	12.4	110	30.2
Cocoa bark and root	28	7.7	33	9.1	170	46.7	-	-	-	-
Plantain and banana leaves	27	7.4	81	22.3	-	-	185	50.8	84	23.1
Plantain and banana peels	-	-	-	-	-	-	265	72.8	97	26.6
African spice tree	73	20.1	56	15.4	117	32.1	-	-	12	3.3
West African indigo leaves	-	-	131	36.0	99	27.2	34	9.3	80	22.0
Moringa seed	4	1.1	109	29.9	106	29.1	-	-	-	-
Moringa leaves	105	28.8	14	3.8	11	3.0	114	31.3	3	0.8

Source: Computed from field survey, 2013

Dit (2007) reported that a cement company in Malaysia had used palm shell as fuel in the boiler and they found that the the emissions of CO2 can be reduced by 366.26 thousand metric tonnes in the year 2006 alone. On the basis of this finding, Dit (2007) concluded that the emission of CO2 in Malaysia can be decreased significantly if all industries in Malaysia can replace or partially replace fossil fuel with oil palm wastes to generate energy without degrading the environment. This will invariably reduce the global warming of the atmosphere. With the results above that majority (75.5 %) of the respondents perceived palm kernel shell as income generating source, this implied that respondents would likely sell off the excess shell to willing buyers from the cities who might want to use the at industrial level.

However, it is important that the rural dwellers are not been exploited in the process. This is because as previously mentioned, they would rather prefer the excess palm kernel shell decay within the rural environment than for some alien people to pack them at outrageous prices. Excerpt of key informant interview lending credence to this is repeated below:

> "*Primarily, we use it (PKS) for cooking; of late some people started coming with vehicle to buy them, but we didn't sell to them because they are useful to us, otherwise, we won't have something to cook again. Asides, indiscriminate buying made us not to sell to them; they wanted to pay just N60 for a full 50 kg bag. We declined and told them we won't sell even if they offer N200. They came back about twice and offered to pay more (about N100), but we still declined, since we consider them of immense use to us.*
> (Source: Key informant interviews, 2013)

4.3.15 Empty Fruit Bunch (EFB)

Results in Table 11 show that few (15.1 % and 18.4 %) regarded the empty fruit bunch as very valuable and somewhat valuable, respectively. A total of 23 per cent regarded it as worthless, while about 43.7 per cent were unsure of the economic potentials of empty fruit bunch. Results in Table 12 further show that about 10.2 per cent of the respondents specifically perceived the EFB as source of food, while about 22 per cent regarded is important material for enhancing soil fertility. It was revealed during field survey that EFB could be used to produce mushroom (*olú sọsọ eyìn*) which are consumed by rural inhabitants.

Given the volume of palm oil produced several processing mill across the study area, producing mushroom from EFB could be a viable venture that unemployed rural youth may be profitably engaged.

Aside the foregoing, the EFB has lot of utilisation potentials yet to be harnessed by majority of the rural dwellers in the study area, based on the foregoing results. The empty fruit bunch can be air dried until the moisture content reaches about 40% and then used as fuel in the palm oil processing plant (Yeoh, 1999). The burnt waste is then used as fertiliser in plantations (Lim, 2000). Other than that, EFB have also been reportedly used as mulch in the plantations thereby, reducing the cost of applied and also a step towards environmental conservation by reducing dependence on fossil fuel required for the manufacture of inorganic fertilizer (Hamdan *et al.*, 1998). It is claimed that using the EFB as mulch has several advantages for the nutritional sustainability of the plantation. According to (Abdullah and Sulaiman, 2013), some plantation owners in Malaysia claimed that the benefits of EFB as a fertiliser and as a soil conditioning agent are significant, because it releases nutrients slowly to the soil via microorganisms therefore effectively recycling the plant nutrients. It improves the soil structure due to better aeration, increases the water holding capacity and increases the soil pH.

The foregoing underscored the need to sensitise the rural dwellers who are engaged in oil palm processing about the various highlighted ways that the empty fruit bunch can be utilised. This will not save them the cost of obtaining inorganic fertilisers but also ensure environmental conservation. Extension agents covering the rainforest region where oil palm processing is prominent have very important roles to play in this regards.

4.3.16 Coconut shell and frond

About 55 per cent and 29 per cent, as reflected in Table 11, considered coconut shell as somewhat valuable and very valuable, respectively, while very few (about 9 %) regarded it as worthless. Also, 43.4 per cent and 25.0 per cent viewed coconut palm fronds as somewhat

valuable and very valuable, respectively, while about 28 per cent considered it not useful. These results equally indicated that majority (83.2 % and 68.4 %) perceived coconut shell and coconut frond as economically important. Furthermore, results in Table 12 show that about 42 per cent indicated that coconut shell has medicinal benefit, while 46.7 per cent viewed coconut frond as important for income generation. The findings again implied favourable perception of the respondents about the importance of these items.

The coconut shell plus guinea corn stem is cooked in water and believed to be very useful for blood supplement, while the coconuts frond are used to make items, such as broom. Brooms made from coconut frond are stronger and last longer, than one made from oil palm frond. While respondents could earn money from sales of items made from coconut frond, drinking herbal concoction made from coconut shell could save them money that would have been used to purchase blood tonic.

4.3.17 Cocoa pods

Results in Table 11 show that about 39 per cent and 25 per cent regarded cocoa pods as very valuable and somewhat valuable, respectively. Very few (about 10 %) regarded it useless while 25 per cent were uncertain about the economic potentials of cocoa pods. The results indicated that majority (64 %) perceived cocoa pods as valuable items. Furthermore, about 45 per cent indicated cocoa pods as important source for income generation, as shown in Table 12. The cocoa pods are used with emptied palm fruit bunch to make local black soap that is traditionally very useful amongst the rural populace.

4.3.18 Bark of cocoa tree and roots and cocoa leaves

Results in Table 11 show that about 40.1 per cent and 20.6 per cent of the respondents viewed bark of cocoa tree as very valuable and somewhat valuable, respectively, while about 26 per cent regarded as waste. Similarly, 24.2 per cent and 39.6 per cent considered root of cocoa tree as very valuable and somewhat valuable, while few (about 13 %) viewed it as not useful. About 23 per cent were uncertain about the potential of root of cocoa tree. Also, about

42 per cent and 20.9 per cent considered cocoa leaves as somewhat valuable and very valuable, respectively, while about 30 per cent were indecisive about the potentials of cocoa leaves, very few (less than 6 %) regarded it useless.

Results in Table 12 further show that 46.7 per cent specifically identified cocoa bark and roots as medicinally useful items, while very few (9.1 %) indicated them as potential source of income of generation. Also, 36.6 per cent and 30.2 per cent indicated cocoa leaves as income generation source and important item for soil fertility improvement. The cocoa bark and leaves are used to make herbal concoction that are taken by rural dwellers, while the cocoa leaves are used to wrap pap.

4.3.19 Plantain and banana leaves, peels and sap

Results in Table 11 show that 28.6 per cent and 34.1 per cent regarded leaves of plantain and banana as very valuable and somewhat valuable, respectively. While about 27 per cent considered it worthless, about 9 per cent were uncertain about its potential usefulness. 36.3 per cent and 23.4 per cent viewed plantain and banana fruit peels as very valuable and somewhat valuable, respectively. While about 28 per cent regarded them useless, about 12 per cent indicated uncertainty about the potentials of banana and plantain peels. However, 40.7 per cent and 30.2 per cent viewed plantain and banana sap as very valuable and somewhat valuable, respectively. Very few (less than 5 %) regarded it as worthless, while about 25 per indicated uncertainty about its potential use. The results, which indicated that a total of 62.7 per cent, 59.7 per cent and 70.9 per cent perceived plantain and banana leaves, peels and sap as valuable items, respectively, implied favourable perception of respondents about the aforementioned items.

Results in Table 12 further show that 50.8 per cent and 22.3 per cent of the respondents specifically indicated that plantain and banana leaves are useful as livestock feed and sold to generate income. They are used to wrap pap and kola and are known to preserve the freshness and quality of the kola wrapped in them for a long period of time. Also, about 73

per cent indicated that plantain and banana leaves are useful for feeding livestock animals, while 31.9 per cent indicated them as useful items for replenishing soil fertility.

4.3.20 Africa spice tree (*aidan*) and West African indigo (*elu*) leaves

Results in Table 11 show that 24.5 per cent and 21.7 per cent regarded Africa's spice tree's leaves (*aidan*) as very valuable and somewhat valuable, respectively, while about 24 per cent considered it worthless. Similarly, 28.0 per cent and 28.3 per cent viewed young leaves of *elu* as very valuable and valuable, respectively, while about 25 per cent considered it insignificant. These results indicated that less than half (about 46 %) perceived Africa's spice tree's leaves as economically important, while a bit above half (about 56 %) perceived young leaves of *èlù* as valuable.

Results of further analysis as shown in Table 12 further show that while 32.1 per cent of the respondents specifically regarded African spice tree as having medical importance, few (15.4 %) regarded it as avenue for income generation. Also, 27.2 per cent regarded West African as medically beneficial, while 36 per cent regarded as additional means of generating income. The leaves of these plants are very useful in making dye which is economically profitable. The dye produced from the plant is of high quality and lasts longer on clothing materials it is used for than synthetic fibres. Also, the root, bark and leaves of these plants have been reported to have antimicrobial properties and have therefore been used to treat ailment such as boil and sore.

Despite, the remarkable significance of these plants their trees are cut down and burnt within the rural environment, as previously mentioned. The FGD excerpt is repeated here again:

> *They (ewe elu) are abundant in the forest; (they) are used to make dye but people do not engage in dye making again as before, so we clear them and burn the remnant in the forest...*

These findings underscore the need for extension to continually sensitise the rural dwellers about the significance of such plants, and encourage them to exploit their potentials by making use of them as useful local resources which would economically empower them.

4.3.21 Moringa seeds and leaves

Few (13.2 % and 10.2 %), as shown in Table11, considered moringa's seed as somewhat valuable and very valuable, respectively, while majority (69.2 %) were unsure about the economic potentials of moringa's seed. However, 28.8 per cent and 12.1 per cent regarded moringa's leaves as somewhat valuable and very valuable, respectively, while about 47 per cent were not sure about its potential. Also a few (total of 23.4 % and 40.9 %) of the respondents, as shown in Table 12, perceived moringa's seed and leaves as economically important, respectively, while a larger proportion as indicated above had indifference view about the economic potential of moringa seeds and leaves. It could be from these findings that respondents in the study area were, perhaps, not aware on the several potentials of moringa, hence their unfavourable disposition towards it. In fact, during field survey, experience showed that most of the respondents could not identify the moringa tree. The findings underscore the need to sensitise the rural dwellers about the moringa plant and its potentials, and also encourage them to cultivate the plant so they can benefit from its potential.

4.3.22 *Kigelia africana (pandoro)*

45.1 per cent and 25.0 per cent considered *pandoro*'s as somewhat valuable and very valuable, respectively, while about 23 per cent viewed it as not useful. This plant's fruit has insecticidal property and enhance growth of yam set as previously discussed. Also, Obata and Aigbokhan (2012) in their study of importance of ethno botanical plants mentioned that the bark and leaves of *pandoro* when boiled in water is used to treat syphilis, gonorrhoea and chest pain. Also, as earlier been reported, the fruit of *kigelia africana* has pesticidal property which enables it prevent pest attack on yam sett.

4.3.23 Poultry droppings

With respect to poultry droppings, results in Table 13 show that 56.9 per cent and 25 per cent amongst the respondents regarded it as somewhat valuable and very valuable, respectively, while very few (about 5 %) regarded it as useless. About 13 per cent were uncertain about the economic potentials of poultry droppings. The results indicated that majority of the respondents (totalling 81.9 %) as valuable economically. Results of further analysis revealed that 64 per cent considered poultry droppings as important material for making manure useful for replenishing soil nutrient. Also, while 29.9 per cent considered the poultry droppings as avenue for generation of additional income, very few (9.9 %) regarded it as useful items to feed livestock. This implied a favourable perception of the rural inhabitants about the economic potential of poultry droppings.

Poultry droppings is important farm waste that have potential to economically empower rural people, the youth particularly. Although, the results revealed favourable perception of rural dwellers about economic potentials of poultry droppings, yet not many of them have exploited this opportunity. This is partly due to the societal stigma attached to engaging in the practice of gathering the waste. While, there is need to sensitise and re-orientate the rural people in this regards, those engaged in livestock production, may also be encouraged to practice fish rearing such that they can use the poultry droppings to grow maggot to feed the fish. The maggots grown may also be sold for cash to those already involved in fish rearing.

Poultry dropping is the most common substrate cited in the literature for maggot rearing (Akpodiete *et al.*, 1997), sometimes using a fly attractant like animal offal or rotten fruit (Odesanya *et al.*, 2011). Particularly, housefly larvae grown on poultry litter have shown to be used with great benefits as a potential protein source in poultry nutrition (Pretorius, 2011). Housefly larvae are able to break up and dry out large amounts of poultry manure, and this ability makes them a potential solution to waste management in poultry farms (El Boushy

et al., 1985). Heuze (2014) cited several works where alternative substrates have been used to successfully grow maggot. Other such substrates are pig manure, cattle blood and wheat bran, cattle blood and gut contents, cattle gut and rumen contents, fish guts, amongst others.

Although, poultry rearing at the rural household level in the study area was at subsistence level which may not generate enough droppings to grow maggot, however, evidence from literature as cited above show that other substrates too which are common waste items within the rural environment could make up for this deficiency. Therefore, the rural dwellers need to be exposed to the technique of maggot growing from various waste items identified and also taught how to convert the maggot to livestock feed. This will greatly cut the production cost of livestock feed and enable them break even easier in their livestock production.

4.3.24 Sheep and goat faeces and cow dung

Results in Table 13 show that 30.5 per cent and 29.7 per cent viewed sheep and goat faeces as very valuable and somewhat valuable, respectively. While about 27 per cent regarded sheep and goat faeces as worthless, about 13 per cent indicated uncertainty about their potentials. 32.7 per cent and 34.9 per cent considered cow dung as very valuable and somewhat valuable, while about 26 per cent were unsure about its economic potential.

The results indicated that majority (total of 60.2 % and 67.6 %) perceived sheep and goat faeces and cow dung as having economic importance, respectively. The findings thus implied favourable perception of rural inhabitant in the study area towards sheep and goat faeces and cow dung. The sheep and goat faeces and cow dung are very useful to make organic manure which is healthy to both human and the environment. Although, when not properly composted, manure from these sources may be harmful, however, rural dwellers need to be educated on how to do this very well without being adversely affected.

4.3.25 Bones of slaughtered animals

Results in Table 13 show that 20.3 per cent and 26.1 per cent regarded bones of slaughtered animals as very valuable and somewhat valuable, while about 39 per cent viewed them as worthless. About 16 per cent were uncertain about the economic potentials of slaughtered animal's bones. The results indicated that less than half (46.7 % total) perceived bones of slaughtered animals as economically important. The findings thus implied unfavourable perception of rural inhabitant in the study area towards bones of slaughtered animals. The bones of slaughtered animals are of utmost economic significance. They are used to make bone meal, which are essential ingredients of poultry feed. There is need to re-orientate the rural dwellers, particularly, youth about the economic importance of the waste item. Unemployed rural youth may become gainfully employed by gathering these bones and selling to poultry feed mill in the cities and peri-urban areas.

Table 13: Distribution of respondent by perception about economic potentials of livestock waste

Items	Very valuable		Somewhat valuable		Indifferent/ unsure		Somewhat worthless		Extremely worthless	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Poultry droppings	91	25.0	207	56.9	46	12.6	18	4.9	2	0.5
Sheep and goat faeces	111	30.5	108	29.7	46	12.6	13	3.6	86	23.6
Cow dung	119	32.7	127	34.9	105	28.8	13	3.6	0	0.0
Animal bones	74	20.3	95	26.1	54	14.8	129	35.4	12	3.3

Source: Computed from field survey, 2013

4.3.26 Overall summary perception of respondent about economic potentials of farm waste items

Results in figure 12 show that about 29.4 per cent of the respondents had unfavourable perception about economic potentials of farm waste items, while 23.9 per cent had favourable perception about farm waste items. Higher proportion (46.7 %) fell in indifferent category. The implication of the findings is that there is need to continuously sensitise rural dwellers about the economic potentials of farm waste items so as to better shape their perception. By this, they will be able to regard these waste items as important local resources which they use for their economic empowerment.

4.4 Knowledge level of rural dwellers about economic potential of identified farm wastes

Results in Table 14 show that a total of 50 per cent of the respondents indicated they knew that cassava peels could be used for mushroom production, while few (13.2 %) indicated otherwise. About 37 per cent were unsure whether cassava peels could be used for mushroom production. Also, majority (total of 68.1 %) knew that yam peel is useful source of livestock feed and producing yam flour. Similarly, majority (68.9 %) recognised that potato feeds could be useful source of livestock feed. The implication of the findings is that rural dwellers' knowledge about utilisation of cassava peels for mushroom production may be enhanced through capacity building and training opportunities.

As regards knowledge about use of sheep and goat faeces as form of manure, majority (total of 90.9 %) of the respondents responded positively, while very few (2.2 %) expressed uncertainty about utilisation potential of sheep and goat faeces as manure. However, only a total of 43.4 per cent expressed certainty about the knowledge on use of poultry dropping as source of fish feed. 22.2 per cent were not sure, while about 44.3 per cent disagreed that poultry dropping could be used as livestock feed.

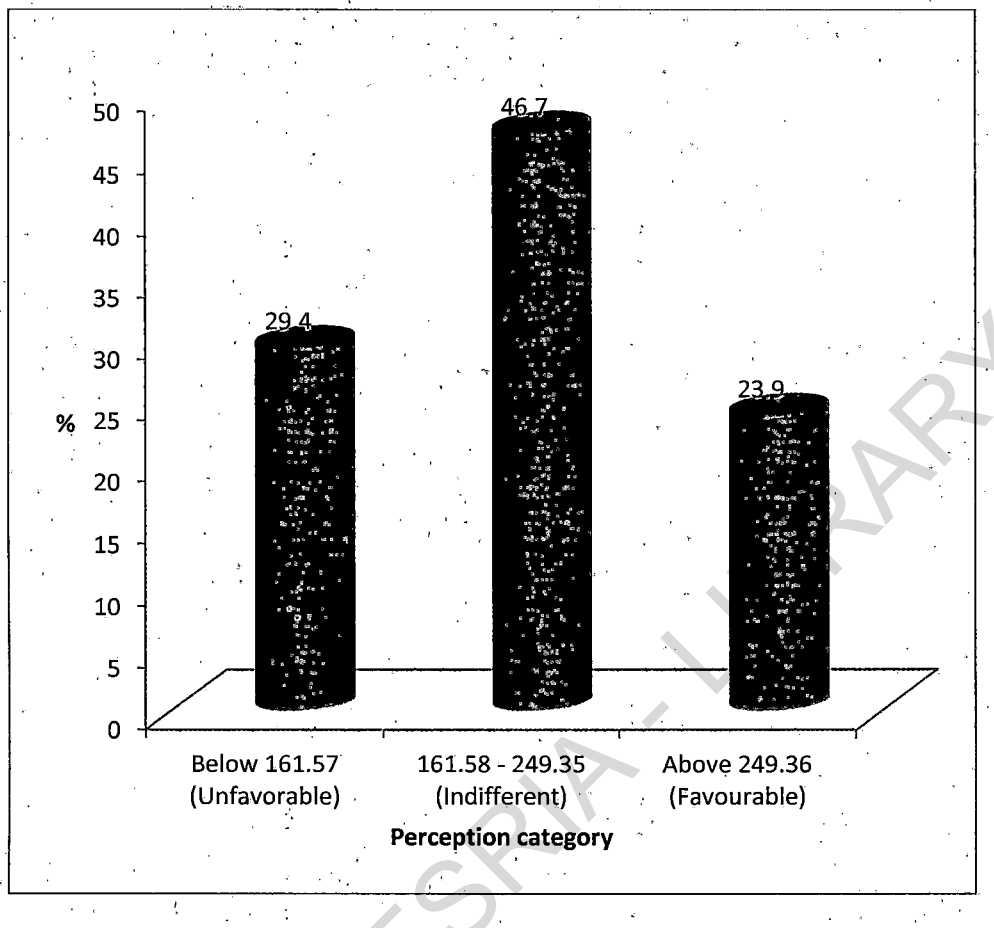

Fig. 12: Distribution of respondent by overall perception about economic potentials of farm waste items

Source: Computed from field survey, 2013

Very few (8.8 % total) indicated they knew that cow dung is useful material for biogas production, while majority (80 %) expressed uncertainty about this. Remaining 13.1 per cent thought that cow dung could not be used for biogas production.

The results in Table 14 indicated that majority of the respondents were familiar with utilisation of sheep and goat faeces as manure. However, majority (over 90 %) lacked knowledge about the utilisation potential of cow dung for biogas production. Also, a majority (over 60 %) lacked knowledge about the utilisation potential of poultry droppings as livestock feed. The implication of these is that rural dwellers' knowledge about utilisation potential of cow dung and poultry droppings may be enhanced through provision of training opportunities and capacity building workshops.

As regards carving of animal of animal bones into useful decorating materials, the results show that a total of 47.8 per cent indicated certainty about this, while 21.1 per cent were not sure, about 31 per cent regarded as untrue the use of animal bones to make useful decorating materials such as flutes, plates, cutleries, and etcetera. On the other hand, above half (53.3 % total) expressed certitude about using animal bones as component of poultry feed, while 45.1 per cent indicated uncertainty. The findings indicated that several of the respondents lacked the knowledge about utilisation potentials of slaughtered animal bones, which underscored the need for enlightenment of the rural dwellers in this regards.

Similarly, a total 66.7 per cent expressed certainty about the use of mixture of bark of plantain tree plus cocoa pods to produce local black soap, while 31.6 per cent regarded as untrue the possibility of using these items to produce black soap. The results indicated that majority of the respondents possessed the knowledge about utilisation potential of cocoa pods as item for producing local black soap. This notwithstanding, sensitisation and training opportunities if available could still enhance their knowledge given that about one-third did not know at all the cocoa pods could be so utilised.

Table 14: Distribution of respondent by their knowledge about utilisation potentials of some farm waste items

Items	Definitely true		Somewhat true		Indifferent/ unsure		Somewhat untrue		Definitely false	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Cassava peel can be used for mushroom production	88	24.2	94	25.8	134	36.8	12	3.3	36	9.9
Yam peel is useful source of livestock feed and making yam flour	214	58.8	34	9.3	32	8.8	83	22.8	1	0.3
Potato leaves can be used to feed livestock	149	40.9	102	28.0	15	4.1	7	1.9	91	25.0
Animal faeces such as sheep and goat can be used as manure	196	53.8	135	37.1	8	2.2	0	0.0	25	6.9
Potato leaves can be useful source of fish feed	99	27.2	59	16.2	81	22.2	4	1.1	121	33.2
Cow dung can be very useful for biogas production	9	2.5	23	6.3	284	80.0	26	7.1	22	6.0
Animal bones can be carve into plate, cutleries and other decorating materials	75	20.6	99	27.2	77	21.1	84	23.1	29	8.0
Animal bone can useful source of calcium content in poultry feed	75	20.6	119	32.7	163	45.1	1	0.3	7	1.9
Cow tail could be used for making *irukere*	166	45.6	77	21.2	93	25.5	25	6.9	3	0.8
Bark of plantain trees and cocoa pods can be used to make black soap (*ose dudu*)	213	58.5	30	8.2	6	1.6	84	23.1	31	8.5
Coconut shell is useful source of household cooking fuel	203	55.8	40	11.0	115	31.6	6	1.6	0	0.0
Coconut palm frond could be very useful for weaving baskets, and mats	105	28.8	114	31.3	31	9.9	104	28.6	5	1.4
Maize shaft and stalk are useful source of animal feed	148	40.7	128	35.2	57	15.6	27	7.4	4	1.1
Oil palm extract (palm kernel oil) when extracted and dried can be used as fuel, especially by blacksmith	198	54.4	38	10.4	4	1.0	38	10.4	86	23.6
Oil palm kernel can be used to make palm kernel cake which is useful component of poultry feed	159	43.7	59	16.2	34	9.3	87	23.9	25	6.9
Remains of oil palm processing (*ogunso*) is useful source of household cooking fuel	213	58.5	133	36.5	17	4.7	1	0.3	0	0.0
Oil palm fronds are very useful for weaving basket and making brooms	220	60.4	32	8.8	26	7.1	86	23.6	0	0.0

Source: Computed from field survey, 2013

Table 14 (continued): Distribution of respondent by their knowledge about utilisation potentials of farm waste items

Items	Definitely true		Somewhat true		Indifferent/ unsure		Somewhat untrue		Definitely false	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Oil palm flower when dried and burnt can be used to drive away soldier ants	185	50.8	50	13.7	98	26.9	29	8.0	2	0.5
Guinea corn stalk can be used for malaria treatment when mixed with some other herbs	147	40.4	51	14.0	127	34.8	27	7.4	12	3.3
Bark of cocoa tree and its root could be used as rich source of blood tonic	165	45.3	130	35.7	47	13.2	4	1.1	17	4.7
Liquid extract of cocoa tree is useful source of attractant for baiting bees	157	43.1	79	21.7	15	4.1	111	30.5	2	0.5
Sap of banana and plantain trees can be used to stop bleeding	208	57.1	120	33.0	33	9.0	1	0.3	2	0.5
Bamboo stems useful for making fences, ladder and pole for TV antennae	213	58.5	112	30.8	8	2.1	30	8.2	1	0.3
Bamboo leaves are useful for herbal medicine	116	31.9	37	10.2	173	47.5	19	5.2	19	5.1
Aidan's pod useful to make herbal medicine and traditional soap	88	24.2	158	43.4	51	13.8	44	12.1	23	6.3
Awin is rich source of vitamin C	63	17.3	59	16.2	106	29.1	125	34.3	11	3.0
Elu leaves can be used to make local dye useful in dying industry	92	25.3	138	37.9	71	19.5	40	11.0	23	6.3
Cactus root is very useful for termite control	58	15.9	65	17.9	207	56.8	24	6.6	10	2.7
Branches of sheer butter tree can be used as chewing sticks	61	16.8	74	20.3	64	17.5	151	41.5	14	3.8
Iyere is useful is useful as chewing stick and making herbal medicine	115	31.6	83	22.8	36	9.8	16	4.4	114	31.3

Source: Field survey, 2013

As regards of use of coconut shell as fuel for household cooking, majority (total of 66.8 %), as shown in Table 14, indicated they knew about this, while 31.6 per cent expressed uncertainty about it. Similarly, majority (total of 60.1 %) knew about the use of coconut palm fronds for weaving of baskets and mats while 29.6 per cent indicated otherwise. With respect to use of maize shafts and stover as animal feed, majority (total of 75.9 %) expressed certainty about this. The results indicated that rural dwellers were well aware about of the utilisation potentials of coconut shell and palm fronds, and maize shaft and stover.

Also, majority (about 60 % total) knew that remnant from palm kernel nut could be used to make palm kernel cake (PKC) which is a useful component of poultry feed. Similarly, majority (total of 63.2 %) expressed certainty about utilising remains from oil palm processing as useful source fuel for household cooking. In same vein, majority (total of 69.2 %) knew that oil palm fronds could be useful to make baskets and brooms. Also, majority (64.5 %) knew that oil palm flower could be used to drive away soldier ants, when dried and burnt, while 26.9 per cent expressed uncertainty about this. The results indicated that the rural dwellers knew so well about the utilisation potentials of various parts of the oil palm tree. However, with ample proportion of the respondent either indifferent or expressing uncertainty about the utilisation potentials of these items, the implication of the findings is that there is need to create more awareness about the utilisation potentials of these items amongst rural dwellers and organise training opportunities for them in order to encourage more rural inhabitants exploit the economic potentials of the farm waste items.

Results in Table 14 further show that a total of 54.4 per cent amongst the respondents knew about treatment of malaria with mixture of guinea corn stalk plus some other herbs. About 35 per cent were unsure of this. Also, majority (total of 81 %) knew that the bark and roots of cocoa tree could be used as rich source of blood tonic. Similarly, a total of 64.8 per cent knew that liquid extract from cocoa tree could be a useful source of attractant for baiting bees, while about 31 per cent regarded this as untrue. Likewise, vast majority (total of 90.1 %)

possessed the knowledge that sap of banana and plantain trees is useful for stopping external bleeding.

42.1 per cent possessed the knowledge that bamboo leaves could be used for herbal concoctions, while 47.5 per cent expressed uncertainty about utilisation of bamboo for herbal medicine. 67.6 per cent possessed the knowledge that *aidan*'s pod is useful in making herbal medicine and tradition soap, while about 18 per cent did not know. 33.5 per cent knew that *awin* is very rich of vitamin C content, while about 37 per cent did not know, and 29.1 per expressed uncertainty.

A total of 63.2 per cent indicated they knew that West African indigo (*elu*) leaves can be used to make local dye useful in local industry. 19.5 per cent were uncertain, while 17.3 per cent did not know that *elu* leaves could be used in producing local dye. The results indicated that majority of the respondents knew about utilising *elu* leaves for producing local dye. However, with the results earlier obtained about utilisation of *elu* leaves for making dye, the findings indicated that rural inhabitants did not harness the economic potentials of this item despite their knowledge. This could be as a result of their perception about the abandonment of dye nowadays, as evidenced from excerpts below obtained during FGD:

> *Dye making have been abandoned by the people, it was not popularly promoted as before, however, some areas are still popularly known for dye making, and they still make dye there*

> *They (ewe elu) are abundant in the forest; (they) are very useful to make dye but people don't use them again, we clear them and burn the remnant...*

The findings underscored the need to re-orientate the rural inhabitants on the need to preserve the local resources, rather than cutting and burning them down. And also to train them, particularly the youth and those not gainfully employed how to use the important local resource to make dye. This will not only enhance conversion of this usually wasted item into important resource, but also enable those engaging in the conversion process gainfully employed.

33.8 per cent knew that cactus root is very useful in control of termite while above half (56.8 %) expressed uncertainty about the potentials of cactus root to control termite. 37.1 per cent knew to be true that branches of shear butter tree could be used as chewing sticks and its bark as herbal medicine, while higher proportion (44.3 %) regarded this as untrue. Also, 54.4 per cent knew that branches of *iyere* tree is useful for making chewing stick and its bark can for making herbal medicine, while about 34.7 per cent did not know about this. The results indicated that while majority of the respondents did not know about the utilisation potentials of branches of shear butter tree, ample proportion did not know about the utilisation potential of branches of *iyere*. The findings implied the need to enlighten the rural dwellers about the potentials of these items, and teach them better way of packaging that could make the products (chewing sticks) appealing to people in the cities.

Results in Figure 13 further show the categorisation of respondents by knowledge level about utilisation potentials of farm waste items. About 31 per cent fell within the low knowledge boundary, that is, this proportion knew little about farm waste utilisation potentials. There were 12.4 per cent in the high knowledge boundary, which indicates only few proportion knew much about the utilisation potentials of farm waste items. Over half of the respondents (56.3 %) had average knowledge about farm wastes' utilisation potential. These findings again underscored the need for capacity building and training workshop for the rural inhabitant, in order to enhance their knowledge about the utilisation of farm waste items.

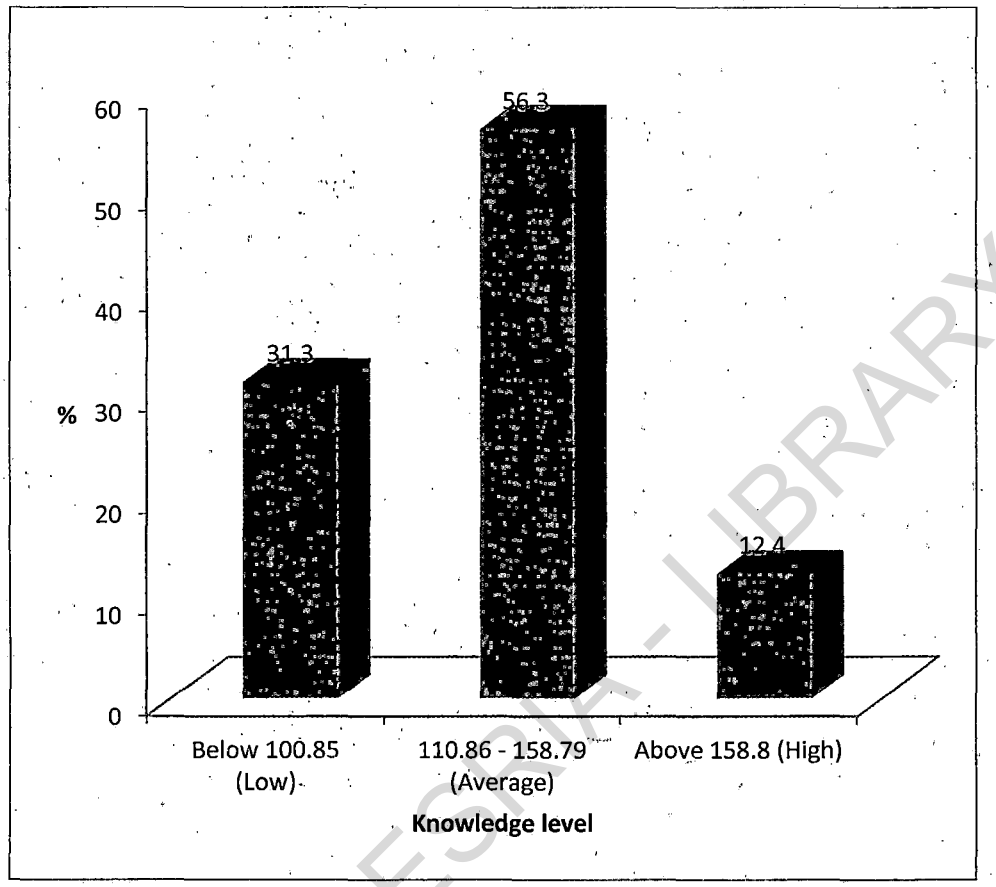

Fig. 13: Distribution of respondents by knowledge level about utilisation potentials of farm waste items.

Source: Field survey, 2013

4.5 Level of utilisation of farm wastes by rural dwellers

The results in Figure 14 show that majority (73.3 %) of the respondent fell within the average category, while few 14.3 per cent and 12.4 per cent fell within the low and high level of utilisation, respectively. The results indicated that on the overall, majority averagely utilised farm waste items, while few highly used them. The implication of this is that, with continuous sensitisation among the rural dwellers about farm waste items, and provision of capacity building and training opportunities for them, proportion of the respondents that will be involved in utilisation of farm waste items might increase.

4.6 Attitude of rural dwellers towards farm wastes utilisation

Results in Table 15 show that 17.9 per cent and 37.1 per cent amongst the respondent somewhat disagreed and strongly disagreed, respectively, that making using of farm wastes as a source of household fuel is no longer relevant today. However, 33.2 per cent and 8.0 per cent strongly agreed and somewhat agreed, respectively, with the position. The results which indicated that a total of 55 per cent were opposed to not utilising of farm wastes items as household fuel even in modern time implied that a slightly higher proportion of the respondent were favourably disposed to utilisation of farm wastes as household fuels.

As regards incorporating farm wastes as source of building materials, 13.7 per cent and 10.2 per cent strongly agreed and somewhat agreed, respectively, that the idea is archaic and should not be practiced in this modern times, while 17.9 per cent and 46.4 per cent somewhat disagreed and strongly disagreed, respectively, with this opinion. The results indicated that a majority (total of 64.3 %) of the respondents were not favourably disposed to utilisation of farm wastes items as source of building material. The finding underscored the need for more enlightenment of rural populace about utilisation of abundant waste items such as oil palm kernel shell as building material.

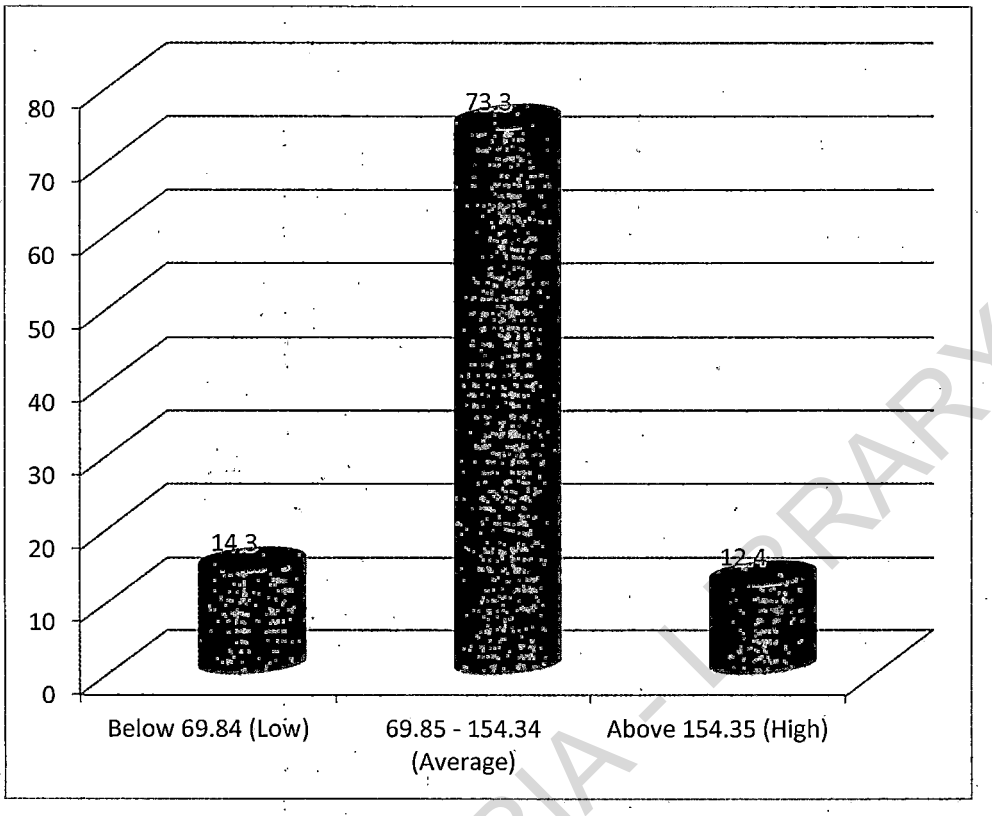

Fig. 14: Distribution of respondents by level of utilisation of farm waste items

Source: Field survey, 2013

About 22 per cent and 30 per cent strongly agreed and somewhat agreed that utilising cassava farm wastes such as cassava peelings, oil palm fruits empty bunch (*soso*), etc, could provide a good source of additional income, while 39.3 per cent and 4.4 per cent somewhat disagreed and strongly disagreed, respectively. The results indicated that while a total of 51.6 per cent were favourably disposed to utilisation of farm waste items as additional income source, about 44 per cent were unfavourably disposed to this idea. Further probing during field survey revealed that some rural dwellers viewed as waste of time, less financially rewarding and socially demeaning utilisation of some farm waste items. Excerpts of interview with a key informant lent credence to this: "*Empty bunch of oil palm fruits is a waste item here because we don't use it in this community...*" Given this response, it was further asked: 'can't someone go round oil processing plants to collect it (oil palm fruit bunch) and sell in nearby community where they value and use it?', to which the key informant responded: "*...he will feel that there are better well paid job than doing that; you see a job for N500, you are doing one that will fetch you N200, it's like a waste of time*". When another key informant was asked similar question as above with respect to cassava peels, he responded: "*if there is nothing doing, may be, but it's not so good, it's like doing job of cleaning hospital toilet; in fact, farming job is even better than it*"

The implication of the finding is that with more enlightenment about the economic potentials of utilising these abundant waste items, rural dwellers may become more favourably disposed to using them. Also, with provision of capacity building workshops and training opportunities, inhabitants of communities where certain farm waste items with economic potentials were not utilised could become encouraged to consider venturing into their utilisation as alternative income source that will augment that present earnings. On the other hand, such training opportunities would enhance the entrepreneurial skills of those already involved in utilisation of these items, thereby increasing their chances of making more money thereby.

Table 15: Distribution of respondents based on their attitudes towards farm waste utilisation

Attitudinal statements	Strongly Agree	Somewhat Agree	Not sure	Somewhat disagree	Strongly disagree
	F (%)	F (%)	F (%)	F (%)	F (%)
Making use of farm wastes as a source of household fuel is no longer relevant today	121(33.2)	29 (8.0)	14 (3.9)	65 (17.9)	135 (37.1)
Incorporating farm wastes as source of building materials is archaic and should not be practiced in this modern times	50 (13.7)	37 (10.2)	43 (11.8)	65 (17.9)	169 (46.4)
Cultivation of mushrooms from waste such as cassava peelings is a good source of additional income	79 (21.7)	109 (29.9)	17 (4.7)	143 (39.3)	16 (4.4)
Utilisation of farm wastes to make briquettes charcoal can be a good source of household fuel	120(33.0)	112(30.8)	121 (33.3)	6 (1.6)	5 (1.4)
Farm wastes such as cassava peels, etc. are indispensable feed for livestock	184(50.5)	62 (17.0)	8 (2.2)	110 (30.2)	0 (0)
Crop residues in conjunction with other nitrogen rich waste can be useful materials for biogas generation	83 (22.8)	150 (41.2)	129 (35.4)	1 (0.3)	1 (0.3)
Making bricks and walls from straw clay mixtures is an archaic techniques and no longer fashionable nowadays	60 (16.5)	107 (29.4)	39 (10.7)	73 (20.1)	85 (23.4)
Use of crop residues in mushroom production provide alternative means of converting farm waste into edible food stuff	121(33.2)	94 (25.8)	20 (5.4)	125 (34.3)	4 (1.1)
Judicious use of farm wastes can be a useful way to ameliorate the effects of excessive soil erosion which is a major threat to sustainable farming	123(33.8)	113 (31.0)	14 (3.8)	2 (0.5)	112 (30.8)
Presence of crop residues is useful to reduce surface runoff of soil particles thereby reducing the effect of soil erosion	89 (24.5)	152 (41.8)	37 (10.1)	83 (22.8)	3 (0.8)

Source: Computed from field survey, 2013

Table 15 (Continued): Attitudes of respondents towards farm waste utilisation

Attitudinal statements	Strongly Agree	Somewhat Agree	Not sure	Somewhat disagree	Strongly disagree
	F (%)	F (%)	F (%)	F (%)	F (%)
The abundance of earthworm, which presence are particularly important for enhancing soil fertility, declines sharply with removal of crop residues by burning them on the field after harvest	142(39.0)	104 (28.6)	113 (31.0)	2 (0.5)	3 (0.8)
Use of crop residues as cover crop is highly essential for replenishing soil nutrients	150(41.2)	88 (24.2)	27 (7.4)	73 (20.1)	26 (7.1)
Crop residues and other farm wastes should be treated as valuable renewable resources to be managed carefully to maintain soil fertility and promote crop productivity	153(42.0)	85 (23.4)	121 (32.2)	1 (0.3)	4 (1.1)
Burning of crop residue in order to get rid of the field of farm waste is not an environmental friendly act	150(41.2)	62 (17.0)	47 (12.9)	74 (20.3)	31 (8.5)
Appropriate or alternative farm waste disposal is better and more environmental friendly than burning these wastes	115(31.6)	120 (33.0)	102 (28.0)	12 (3.3)	15 (4.1)
Burning agricultural wastes contributes greatly to environmental degradation	102(28.0)	114 (31.3)	26 (7.1)	85 (23.4)	37 (10.2)
Burning agricultural wastes contributes greatly to climate change which is hazardous to the environment	133(36.5)	69 (19.0)	144 (39.7)	7 (1.9)	11 (3.0)
Burning of farm wastes is harmful to human health	161(44.2)	64 (17.6)	23 (6.3)	111 (30.5)	5 (1.4)
Practice of residue or farm waste utilisation gulps extra cost with small returns, and at best they should be get rid of by burning or dumping to decompose	62 (17.0)	92 (25.3)	127 (34.9)	50 (13.7)	26 (7.1)
Crop residues should not be regarded as undesired waste but rather as integral part of agricultural production for which some use must be found	156(42.9)	74 (20.3)	118 (32.4)	3 (0.8)	13 (3.6)

Source: Computed from field survey, 2013

Furthermore, 33 per cent and 30.8 per cent strongly agreed and somewhat agreed, respectively, that utilisation of farm wastes and other waste materials to make briquette charcoal could be a good source of household fuel, while very few (1.6 % and 1.4 %) somewhat disagreed and strongly disagreed, respectively, about 33 per cent remained indecisive. The results indicated that majority (totalling 63.8 %) were favourably disposed to utilisation of waste items for making briquette charcoal for household cooking. The briquette charcoals are more environmentally friendly and less harmful to users.

About 51 per cent and 17.0 per cent strongly agreed and somewhat agreed that farm waste such as cassava peels, cowpea husk, etc, are indispensable feed for livestock, while 30.2 per cent somewhat disagreed with this idea. The results indicated that majority (about 68 %) of the respondents were favourably disposed to utilisation of farm waste items as livestock feed. This finding corroborated earlier findings of the study that utilisation of farm waste items as livestock feed was a preponderant practice.

About 33 per cent and 31 per cent strongly agreed and somewhat agreed, respectively, that farm wastes can be judiciously used to ameliorate the effects of excessive soil erosion that is a threat to sustainable farming, while about 31 per cent disagreed with this view. 24.5 per cent and 41.8 per cent strongly agreed and somewhat agreed, respectively, that presence of crop residue is useful to reduce surface run off of soil particles thereby reducing the effects of soil erosion. The results indicated that higher proportions of the rural inhabitants were favourably disposed to utilisation of farm waste items as a mean of preventing soil erosion.

In addition, 39 per cent and 28.6 per cent strongly agreed and somewhat agreed, respectively, that removal of crop residues by burning sharply declines the presence of earthworm in the soil which is important for enhancing soil fertility. About 31 per cent were indecisive, while very few (less than 2 %) opposed this view. 41.2 per cent and 24.2 per cent strongly agreed and somewhat agreed, respectively, with the idea that use of crop residues as cover crop is highly essential for replenishing soil nutrients, while about 27 per cent opined

otherwise. The results indicated that majority (about 68 %) of the rural dwellers were favourably disposed to not burning of crop residues and using them as cover crop as a means of replenishing soil fertility.

Results in Table 14 further show that 42 per cent and 23.4 per cent of the respondents strongly agreed and somewhat agreed, respectively, that crop residues and other farm wastes should be treated as renewable resources that should be carefully managed to maintain soil fertility and promote crop productivity. Very few (less than 2 %) disagreed with this view, while about 32 per cent were indecisive. The results indicated that majority (totalling 65.4 per cent) were favourably disposed to utilisation of farm wastes items to enhance soil fertility and crop productivity.

In addition, 41.2 per cent and 17.0 per cent strongly agreed and agreed, respectively, with the view that burning of crop residue in order to get rid of farm waste is not environmentally friendly act, while 20.3 per cent and 8.5 per cent somewhat disagreed and strongly disagreed with this position. 31.6 per cent and 33 per cent of the respondents strongly agreed and somewhat agreed, respectively, that 'appropriate or alternative farm waste disposal is better and more environmental friendly than burning these wastes. While few (about 8 %) were opposed to this, about 28 per cent were indecisive. 28 per cent and 31.3 per cent strongly agreed and agreed, respectively, that burning agricultural wastes contributes greatly to environmental degradation, while 23.4 per cent and 10.2 per cent disagreed and strongly disagreed with this view.

These results indicated that higher proportions of the rural inhabitant were not favourably disposed to burning of farm wastes and crop residues because of its effect on the environment, but would prefer alternative ways to disposing these items. The implication of the findings is that they would gladly adopt such alternative measures if available and affordable. An example of an alternative measure is ploughing back of crop residues into the

soil during land preparation. This, however, would depend on the availability of tractor equipment to use for this purpose.

Furthermore, 36.5 per cent and 19 per cent strongly agreed and agreed, respectively, that burning agricultural wastes contribute greatly to climate change which is hazardous to the environment, while about 40 per cent were indecisive, very few (about 5 %) were opposed to this idea. Also, 44.2 per cent and 17.6 per cent amongst the respondents strongly agreed and somewhat agreed, respectively, that burning of farm waste is harmful to health, while about 32 per cent disagreed with this. The results indicated that over half of the respondents concurred that burning of farm waste items contribute to climate change and adversely affect human health. The implication of the finding is that rural inhabitants would prefer healthy and more environmental friendly means of disposal of farm waste items. Also, given the ample proportion that were either indecisive or favourable disposed to burning of farm waste, there might be need for increasing awareness amongst rural populace the potential threats of indiscriminate burning to both the human and the environment.

However, 17 per cent and 25.3 per cent strongly agreed and somewhat agreed that utilisation of farm waste or residue gulps extra money, and they should be get rid off by burning or left to decompose, about 35 per cent were indecisive while 13.7 per cent and 7.1 per cent disagreed and strongly disagreed with this view. The results indicated that about 42 per cent of the respondent opined that utilisation of farm waste would gulp extra money and therefore should be get rid off by leaving to decompose or burning. The findings underscored the need for proper re-orientation of the rural dwellers about the utilisation potentials of farm waste items, which would end up augmenting their income and diversifying their means of livelihood.

Finally, 42.9 per cent and 20.3 per cent strongly agreed and somewhat agreed that crop residues should not be regarded as undesired waste but rather as integral part of agricultural production resources for which some use must be found. 32.4 per cent remained indecisive

while very few (about 4 %) disagreed with this view. The results indicated that majority (over 60 %) opined that farm waste items should be considered as important resources and judiciously utilised, rather than regarding them as useless items.

4.7 Factors affecting farm wastes utilisation

4.7.1 Culture/Community factors

Results in Table 16 show that about 53 per cent of the respondents indicated that the community culture did not abhor utilisation of materials regarded as farm waste, while 47.3 per cent submitted that community culture affects farm waste utilisation. Also, 40.9 per cent and 25.3 per cent indicated that there were interpersonal conflict and group/political conflict within community. Few (10.7 % and 11.3 %) submitted that there were tribal/ethnic and religious conflicts, respectively, within the community, while very few (5.5 %) indicated that conflict related to resource use abound within the community. The results indicated relative presence of harmony and peace within the communities in the study area. This has implication for togetherness and fostering of cordial relationship amongst the rural inhabitants.

With regards to information sources about farm waste utilisation available to the respondents, majority (79.7 %) indicated family as prominent information which provided them information about utilisation of farm wastes materials. This was followed by neighbour (41.5 %) and radio (40.1 %). Few (16.2 %) indicated TV as information source and very few (5.5 %, 4.7 %, 0.8 % and 0.5 %) indicated extension, newspaper, internet and agricultural newsletter, respectively, as avenue where they obtained information about farm waste utilisation.

The results indicated that family and friends and radio were most prominent information source available to the respondents about farm waste utilisation. Extension was amongst the least ranked information source available to the rural dwellers. The findings underscored the necessity for active involvement of extension in enlightening rural dwellers

about farm waste utilisation potentials and enhancing their entrepreneurial capabilities through organising capacity building workshops and training opportunities for them.

4.7.2 Institutional factors

Results in Table 17 show that 59.9 per cent and 24.5 per cent strongly agreed and agreed, respectively, that extension agents and agencies have significant roles to play in promoting utilisation of farm waste materials, while very few (1.3 % and 3.3 %) disagreed and strongly agreed with this opinion. Also, 34.3 % and 33.5 % strongly agreed and agreed that extension agents did not educate them about the potentials of farm wastes items within their environment, while few (14.6 %) and very few (5.8 %) disagreed and strongly disagreed with this position.

Similarly, 34.6 per cent and 22.2 per cent strongly agreed and agreed, respectively, no extension agents or agencies ever organised any training for them about the utilisation potential of farm waste items available within the rural environment. 54.4 per cent and 11 per cent strongly agreed and agreed, respectively, that extension agencies should provide training opportunities for rural dwellers about the economic potentials of farm waste materials within the rural environment. However, 23.6 per cent and 2.5 per cent, respectively, disagreed and strongly disagreed with this position.

The results indicated that extension was rarely involved in campaigning and promoting utilisation of farm waste materials amongst rural inhabitants by way of providing training opportunities or capacity building workshops. The results furthermore indicated that rural dwellers strongly believed that extension, particularly, government extension agencies, have a prominent role to play in this regards. This is because where extension impact was felt concerning canvassing for farm waste utilisation, respondents indicated 'people from University' as extension source. The implication of the findings is that call for active involvement of extension as previously noted cannot be overemphasised

Table 16: Distribution of respondents by community/cultural factors affecting with farm waste utilisation

	Frequency	Percentage (n = 364)
Cultural/Community factors		
Culture abhors utilisation of materials regarded as waste		
Yes	172	47.3
No	192	52.7
Rival faction and dispute in the community:		
Interpersonal conflict	149	40.9
Group or political conflict	92	25.3
Tribal or ethnic conflict	39	10.7
Religious conflict	41	11.3
Resource use conflict	20	5.5
Information source about farm waste utilisation*:		
Family	290	79.7
Neighbour	151	41.5
Radio	146	40.1
TV	59	16.2
Local formal organisation	23	6.3
Extension	20	5.5
Newspaper	17	4.7
Internet	3	0.8
Agric. Newsletter	2	0.5

Source: Computed from field survey, 2013

*** Multiple responses applicable**

With respect to religious institution, results in Table 17 further show that very few (2.7 %) strongly agreed that the church is opposed to utilisation of farm waste items, while 23.4 per cent agreed with this position. However, 49.7 per cent and 16.2 per cent strongly disagreed and disagreed, respectively that the church does not encourage utilisation of farm wastes. Also, only 29.6 per cent and 6.9 per cent of the respondents strongly agreed and agreed, respectively, with the position that Islam is prohibited utilisation of wastes of animals prohibited for consumption, while 37.6 per cent and 4.7 per cent disagreed and strongly disagreed, respectively, with this position. About 19 per cent remained indecisive. Similarly, 30.2 per cent and 12.6 per cent strongly agreed and agreed, respectively, that adherents of the Islamic faith are prohibited from using products made from parts of animal prohibited for eating, while 14.8 per cent and 28.6 per cent, disagreed and strongly disagreed, respectively, with this position. About 14 per cent were indecisive.

The foregoing results indicated that religious institutions were rarely deemed as barriers to utilisation of farm waste items. However, as revealed during field survey, it may be important to note that while the church or mosque may not expressly abhor utilisation of farm waste items, individual rural dweller may express religious belief indicating otherwise. This was the case with an elderly and aged man who claimed to have lost access to cultivation of his rented land because of his refusal to allow people to pack cocoa pods from his farm because he learnt that they make local black soap with it, which he claimed he was used to using as Christian, giving the impression of it been fetish

Table 17: Distribution of respondents by institutional factors associated with farm waste utilisation

	SA F (%)	A F (%)	U F (%)	D F (%)	SD F (%)
Institutional factors					
Extension					
Extension agents and agencies have significant roles to play in promotion of utilisation of farm waste items	218(59.9)	89(24.5)	40(11.0)	5(1.3)	12(3.3)
Extension agents do not educate us on the economic potentials of various farm waste items available within our environment	125(34.3)	82(22.5)	83(22.8)	53(14.6)	21(5.8)
Extension agencies should provide training opportunities for rural dwellers on economic potentials of farm waste items available within their environment	198(54.4)	40(11.0)	31(8.5)	86(23.6)	9(2.5)
Extension agents and agencies have never organised training for us about utilisation potentials of farm waste items available within our environment	126(34.6)	81(22.2)	8(2.2)	119(32.7)	30(8.2)
Religious					
The church does not encourage utilisation of certain farm wastes items	10(2.7)	85(23.4)	29(8.0)	59(16.2)	181(49.7)
Islam prohibits making use of wastes of animals prohibited for eating	106(29.1)	25(6.9)	69(19.0)	137(37.6)	27(4.7)
Products made from parts of animal prohibited for eating are not to be used by adherents of Islamic faith	110(30.2)	46(12.6)	50(13.7)	54(14.8)	104(28.6)

F – Frequencies; % - Percentage

SA – Strongly agree; A – Agree; U – Undecided; D – Disagree; SD – Strongly disagree

Source: Computed from field survey, 2013

4.8 Results of hypotheses testing

4.8.1 Results of Chi-square analysis testing association between socio-economic characteristics of respondents and farm waste utilisation (H_{01})

Results of Chi-square analysis (see Table 18) show that there was no significant association between farm waste utilisation and religion (χ^2 = 2.146), marital status (χ^2 = 11.295) and family type (χ^2 = 0.991) of respondents at $p \leq 0.05$. However, there was significant association between gender of respondent (χ^2 = 10.38) and farm land acquisition (χ^2 = 51.00) and extent of farm waste utilisation at $p \leq 0.01$, respectively. Also, there was significant association between ethnicity (χ^2 = 19.67) and nativity (χ^2 = 10.40) at $p \leq 0.05$, respectively. The results agreed with those of Babayemi and Daudu (2009), Agwu (2012) and Adedayo (2012) whose findings indicated significant relationship between gender and ethnicity and waste management behaviour. However, with respect to religion and marital status, the findings of the current study differed from those of the previous studies cited above.

The relationship between gender of respondents and farm waste utilisation suggest that utilisation of farm waste items may be gender-specific. This is not unexpected given that respondents' engagement in various occupational pursuits, from which farm waste items are generated, is gender-specific. For instance, women are known to be more engaged in processing of agricultural produce than male rural inhabitants. Using oil palm processing as an example, utilisation of oil palm kernel shell as fuel for household cooking, and empty bunch of oil palm fruit as a constituent for local black soap production were peculiar to the female folk. Yet, when it comes to packing of the oil palm kernel shell into bags for sale, and loading them into vehicles of buyers from outside the rural environment, the male folk were at the fore-front.

Table 18: Results of Chi-square analysis establishing relationship between selected socio-economic characteristics and farm waste utilisation

Variable	χ^2 – value	d.f.	p-value
Sex	10.375**	2	0.006
Religion	2.146	4	0.709
Marital status	11.295	8	0.186
Family type	0.991	4	0.91
Farm land acquisition	51.001**	8	0.00
Ethnicity	19.670*	2	0.03
Nativity	10.397*	8	0.03

**Significant at $p \leq 0.01$ * Significant at $p \leq 0.05$

Source: Computed from field survey, 2013

The implication of the findings is that in empowering rural dwellers in rural enterprise that will facilitate judicious utilisation of farm waste items, consideration should be given to each gender based on extant extent of utilisation of these farm waste items.

As regards association between utilisation of farm waste items and farm land acquisition, nativity and ethnicity, it may be explained as follows: mode of land acquisition may determine which crop an individual cultivates; as such, those that obtained land by outright purchase or through inheritance may cultivate permanent crop, like cacao, more than others who obtained land through rent/lease. Given that it is only indigene or native of an area that may inherit farmland, then, the findings indicate that utilisation of farm waste items, such as cocoa pods, may be common with indigene of that area.

4.8.2 Results of correlation analysis establishing relationship between selected socio-economic characteristics and farm waste utilisation (H_{01})

Results of correlation analysis, as shown in Table 19, indicated that total farm size ($r = 0.135$), total herd size ($r = 0.198$) and income ($r = 0.158$) had positive and significant relationship with extent of farm waste utilisation at $p \leq 0.01$. The results further show that there was significant but negative relationship between information sources ($r = -0.262$) and presence of rivalry/dispute ($r = -0.34$) and extent of farm waste utilisation at $p \leq 0.01$. The results agreed with the findings of Adedayo (2012) who reported that income of respondent influenced poultry waste management techniques adopted by poultry farmers.

The results indicate that those who cultivate more acreage of land or have large herd size may generate more farm waste items, thus having more of them available for utilisation. With respect to information source being negatively related to farm waste utilisation, the result indicate that the fewer and better quality information rural dwellers have access to about farm waste utilisation, the higher the tendencies that they put these information to use, which may translate to increased utilisation of farm waste items. This submission is in accordance with

that of Friedman and Hechter, as cited from Heckathorn (1997), who opined that quality information is a variable that highly has profound effect on actors'.

The implication of this from rational choice perspective is that proliferation of avenue through which information are made available to rural dwellers about farm waste utilisation may not be helpful on the long run; rather, reliable and robust information source even though few, may be adequate in increasing awareness amongst rural dwellers about the economic potentials of farm waste items for utilisation.

As regards negative relationship between rivalry/dispute and farm waste utilisation, it is plausible that the chances of peaceful co-existence amongst the rural dwellers within the community are higher with lesser presence of interpersonal, group or communal conflict within the rural environment. This may have positive implication on all activities going on in the communities, which include exploiting potentials of farm waste items for livelihood pursuits of rural inhabitant.

4.8.3 Relationship between farm waste utilisation and variables of TPB and other related variables (H_{02}, H_{03} & H_{04})

Of the three key variables of TPB, results as shown in Table 20, revealed that perceived behavioural control ($r = 0.256$) and attitude towards farm waste utilisation ($r = 0.204$) had positive and significant relationship with extent of farm waste utilisation at $p \leq 0.01$. Only, subjective norm did not have significant relationship with farm waste utilisation. Results further show that there was positive and significant relationship between extent of farm waste utilisation and respondents' knowledge about farm waste utilisation potential ($r = 0.109$) and their perception about farm waste items ($r = 0.256$) at $p \leq 0.01$.

The findings agreed with the submission of previous studies (Ho, 2002; Tonglet *et al.*, 2004) that perceived behavioural control and attitude are important determinant of utilisation behaviour. The non-significance of subjective norm with farm waste utilisation was also

supported by the findings of Niaura (2013) whose study revealed that subjective norm had less impact on youth behavioural intentions compared to perceived behavioural control.

The results indicated that the respondents' knowledge and confidence in their ability to utilise a particular farm waste item (which are measures of PBC) significantly correlated with their extent of farm waste utilisation. Also, the more knowledge they possess about the utilisation potential of a particular farm waste item and the more favourably they perceive the farm waste item, the higher the likelihood that they utilise such farm waste items. The implication of these findings is that strengthening rural dwellers' PBC and influencing their perception about farm waste items could enhance their resolve to judiciously exploit the economic potentials of these farm waste items to enhance their livelihood. Here, extension agents and agencies have a paramount role to play in achieving this.

Table 19: Results of correlation analysis establishing relationship between selected socio-economic characteristics and farm waste utilisation

Variable	r – value	p-value
Age	0.041	0.442
Years spent on formal education	0.020	0.709
Total farm size	0.135**	0.010
Total herd size	0.198**	0.000
Years of farming experience	-0.052	0.324
Association membership	0.022	0.682
Household size	0.020	0.710
Income	0.158**	0.002
Length of residency	0.039	0.455
Information sources	-0.262**	0.000
Rivalry/Dispute	-0.340**	0.000

**Significant at $p \leq 0.01$

Source: Computed from field survey, 2013

Table 20: Results of correlation analysis establishing relationship between TPB and related variables and farm waste utilisation

Variable	r – value	p-value
Perceived behavioural control	0.148**	0.005
Subjective norm	0.074	0.364
Attitude	0.204**	0.000
Knowledge about farm waste Utilisation potential	0.109*	0.037
Perception about farm waste	0.256**	0.000

**Significant at $p \leq 0.01$; * Significant at $p \leq 0.05$

Source: Computed from field survey, 2013

4.8.4 Results of regression analysis establishing variables that significantly contributed to farm waste utilisation

Results in Table 21 show that total herd size (t = 2.711), income (t = 2.401), perception about farm waste items (t = 4.458), perceived behavioural control (t = 2.534) and attitude towards farm waste utilisation (t = 2.732) positively and significantly contributed to extent of farm waste utilisation at $p \leq 0.01$. Also, total farm size (t = 1.988) and years spent on formal education (t = 2.024) positively and significantly contributed to extent of farm waste utilisation at $p \leq 0.05$. However, information source (t = -2.732) and presence of rivalry/dispute (t = -4.837) significantly but negatively influenced farm waste utilisation at $p \leq 0.01$, while knowledge about farm waste utilisation potentials (t = -2.314) also significantly but negatively influenced farm waste utilisation at $p \leq 0.05$.

Since correlation does not imply causation, a regression analysis establishes whether significant relationship recorded in a correlation analysis would actually significantly contribute to variation in the dependent variable of a study. Therefore, while explanation about the significant variables above as given in the correlation analysis may still hold here, there is need to provide plausible explanation for negative contribution of 'knowledge about farm waste utilisation potential' to the regression model.

The result apparently indicates that the lesser the knowledge respondents possess about utilisation potentials of various farm waste items, the more they utilise such farm waste items. Conceivable explanation is that respondents tend to utilise more of few farm wastes they know about, since reasonably, they may not be able to effectively and efficiently utilise all these farm waste items at a time. The implication is that extension agents and agencies should make concerted efforts to concentrate on fewer farm waste items with economic potentials in order to empower rural dwellers.

Furthermore, overall regression model summary show that R^2 value of 0.575 was obtained in the analysis. Also F value of 11.002 obtained was significant at $p \leq 0.01$. This

indicated 57.5 per cent variation in the dependent variable was accounted for by the independent variables included in the regression analysis. The remaining 42.5 per cent was due to other variables not included in the analysis.

Furtherance to the above, stepwise regression model was done in order to provide more detailed information on the significant contributors, that is, percentage variation in the dependent variable explained by the independent variables at each step of the models. The models are composed of different set of variables, which are the best combination of independent variables that best explain the dependent variable.

Results of the stepwise regression model in Table 22 revealed 8 models (i.e. 8 steps) which accounted for a total of 54.6 per cent variation in the dependent variable. More importantly, the results show that at step 1 (i.e. model 1), income alone accounted for 10.8 per cent variation in the dependent variable. Income and perception about farm waste economic potential accounted for 30.3 per cent variation at step 2 (i.e. model 2). Model 3 which comprised income, perception and total herd size accounted for 35.5 per cent variation. In model 4, income, perception, total herd size and information sources accounted for 39.6 per cent variation. Detailed results as shown in Table 22 indicated that models 5 and 6 accounted for 39.6 per cent, 44.1 per cent and 48.2 per cent, respectively. Finally, model 7 and 8 accounted for 50.6 per cent and 54.6 per cent.

Stepwise regression analysis by default excludes certain variables from the result in order to avoid problem due to collinearity (i.e. a situation where there is correlation between two independent variables). However, when it is not obvious that any two variables excluded are related in real world, a researcher may be obliged to keep both of them. To allow for this, principal component analysis (i.e. factor analysis), which regroups collinear variables into single variables which can be used in techniques that require non collinear data was employed. The result obtained from the factor analysis was presented in the following subsection.

Table 21: Results of multiple regression analysis establishing relationship between selected variables and farm waste utilisation

Variable	Standardised coefficient Beta	t	p - value
Age	-0.042	-0.556	0.580
Household size	-0.006	-0.009	0.992
Residency length	0.072	0.974	0.332
Total farm size	0.267	1.988*	0.049
Total herd size	0.278	2.711**	0.008
Years spent on formal education	0.139	2.024*	0.045
Income	0.309	2.401**	0.018
Information source	-0.256	-2.732**	0.007
Rivalry/dispute	-0.435	-4.837*	0.000
Subjective norm	0.013	0.183	0.855
Perceived behavioural control	0.343	2.534**	0.013
Attitude towards farm waste Utilisation	0.395	2.732**	0.007
Knowledge about farm waste Utilisation potentials	-0.497	-2.314*	0.022
Perception about farm waste items	0.789	4.458**	0.000

**Significant at $p \leq 0.01$; * Significant at $p \leq 0.05$

Model summary: F = 11.002; sig = 0.000; $R^2 = 0.575$

Source: Computed from field survey, 2013

Table 22: Results of stepwise regression model indicating percentage variation of the significant contributors in the analysis

Step	Variable	R^2	F	B	t
	Constant				-1.44
1	Income	.108	15.44	.42	3.99
2	Perception	.303	27.32	.78	4.59
3	Total herd size	.355	22.92	.29	2.96
4	Information source	.396	20.34	-.25	-2.78
5	Rivalry/dispute	.441	19.43	-.48	-5.64
6	Perceived behavioural control	.482	18.91	-.37	2.76
7	Knowledge about farm waste utilisation	.506	17.74	-.70	-3.63
8	Attitude towards farm waste utilisation	.546	18.01	.45	3.21

R^2 coefficient of determination which indicates variation accounted for at each level in percentage when multiplied by 100;

B – Beta coefficient;

F – Indicates F test value to determine whether model is good fit for the data based on P value obtained.

Source: Computed for field survey, 2013

4.8.5 Results of factor analysis

In order to identify factors associated with farm waste utilisation amongst rural dwellers, relevant variables were inter-correlated and run with varimax factor rotation pattern. Table 23 shows the result of the varimax rotation of the variables included in the factor analysis and the principal components subsequently extracted. The results show that the inter-correlation between the independent variables yielded six factors which accounted for a total of 66.82 per cent variation in the dependent variable. The factors were labelled (see Table 24): 'psychological factor', 'residency status factor', 'educational status factor', 'family characteristic factor', 'social network factor' and 'cultural value factor'.

Table 23: Result of varimax rotated component matrix showing extracted factors with Eigen values

Independent Variables	Factor Loadings					
	1	2	3	4	5	6
Age	-.006	**.621**	-.064	.176	.089	-.296
Sex	.006	.074	-.147	**.298**	.860	.045
Religion	.005	-.138	-.204	-.203	-.086	.055
Marital status	.033	-.016	-.086	**.385**	.182	-.270
Family type	.433	.248	.054	**.529**	.017	.001
Years spent on formal education	-.101	-.157	**.854**	-.091	-.025	.087
Level of educational attainment	.414	-.017	**.640**	-.168	.144	.081
Literacy level	-.143	.108	**.765**	.277	-.025	-.098
Nativity	-.364	.199	.247	-.165	**.687**	-.193
Residency length	-.044	**.939**	-.008	.049	.054	.020
Dual residency	-.369	**.327**	.108	.159	-.217	.415
Ethnicity	.112	-.073	-.362	.281	**-.426**	-.051
Association membership	.512	.069	.017	.159	**-.450**	-.059
Extension contact	-.392	.331	.278	.031	.100	.276
Household size	.055	.279	-.006	-.041	.025	**-.723**
Total farm size	-.828	.180	-.093	-.124	.226	.010
Subjective norm	.365	.081	0.005	.025	.044	**.633**
Perceived behavioural control	**.920**	.034	-.052	.170	.030	.137
Information sources	.609	-.044	0.089	**-.542**	**-.227**	.181
Rivalry/Dispute	.335	.165	-.015	.0800	-.032	**.246**
Attitude	**.934**	.020	-.031	.170	.065	.143
Knowledge about farm waste utilisation potential	**.945**	-.056	-.129	-.130	.013	.055
Perception about farm waste items	**.923**	-.054	-.107	.012	-.146	-.033
Income	-.800	.107	-.038	-.210	.134	.078
Per cent variation	26.02	10.82	8.54	7.75	7.52	6.17
Cumulative % variation	26.02	36.84	45.38	53.13	60.65	66.82

***Variables contributing to factor naming**

Source: Computed from field survey, 2013

Table 24: Factor names and Eigen values

Factors	Name	Eigen value
I	Psychological factor	6.504
II	Residency status	2.705
III	Educational status factor	2.134
IV	Family characteristic factor	1.937
V	Social network factor	1.880
VI	Cultural value	1.534

Source: Derived from the result of factor analysis, 2013

4.8.5.1 Explanation of the identified factors associated with farm wastes utilisation

4.8.5.1.1 Factor one: 'Psychological characteristic' factor (see Table 25)

Variables that loaded very high on factor one included: Perceived behavioural control (L = 0.920), attitude towards farm waste utilisation (L = 0.934), knowledge about farm waste utilisation potential (L = 0.945) and perception about economic potential of farm waste items (L = 0.923).

The explanation is that when an individual perceives a particular waste item to be valuable and that its utilisation would yield him economic return; has knowledge about its utilisation and also has confidence in his ability to utilise it, then the tendency is high that he engages in utilisation of such farm waste item. The implication is that with continuous sensitisation of rural inhabitants about the economic potentials of farm waste items, building their confidence and enhancing their knowledge about farm waste utilisation through organisation of training and capacity building workshops for them, then, they become psychologically prepared to engage in the utilisation of such farm waste items.

4.8.5.1.2 Factor two: 'Residency status' factor (see Table 26)

Variables with high load which contributed to naming of the factor were age of respondent (L = 0.621), residency length, i.e. length of stay respondent had been residing in a community (L = 0.939) and dual residency (L = 0.327).

The explanation is that older rural inhabitants who have invariably lived for a long period of time in a particular rural environment are likely to possess knowledge about the utilisation potentials of farm waste items generated within that environment. Also, those that live in more than one location, and have considerably lived there for a long time are likely to be exposed to utilisation of farm waste items in these various locations. The implication is that, in event of organising capacity building workshops or training opportunities for rural inhabitants, inclusion of such categories of respondents as described above would be invaluable. They would be able to share certain experiences others might be unable to give.

Table 25: Variables contributory Factor one: 'psychological' factor

Variables	Loading (L)	L^2	$\sum L^2$
Perceived behavioural control	0.920	0.846	
Attitude	0.934	0.872	3.462
Knowledge about farm waste Utilisation potential	0.945	0.893	
Perception about farm waste item	0.923	0.851	

Source: Computed from results of factor analysis, 2013

Table 26: Variables contributory to factor 2: 'residency status' factor

Variables	Loading (L)	L^2	$\sum L^2$
Length of residency (stay in community)	0.939	0.882	
Age	0.621	0.386	1.375
Dual residency	0.327	0.107	

Source: Computed from results of factor analysis, 2013

4.8.5.1.3 Factor three: 'Educational status' factor (see Table 27)

Variables with highest loadings which were contributory to naming of this factor included year spent on formal education (L = 0.854), level of educational attainment (L = 0.640) and literacy level (L = 0.764). The explanation is that the better and higher educational status of the rural inhabitants, the higher the likelihood that they are receptive to new innovations introduced to them that might have to do with farm waste utilisation. The implication is that such individual if convinced about the economic benefits of utilisation of a particular waste item might be handy in encouraging some other individuals too within same environment.

4.8.5.1.4 Factor four: 'Family characteristics' factor (see Table 28)

Variables whose loadings contributed to naming this factor were: family type (L = 0.529), information sources (L = -.542), marital status (L = 0.385) and sex (L = 0.298). The explanation is that if qualitative and useful information about farm wastes economic potentials for utilisation are available to an individual member of a family, say wife, husband or co-wife, chances are that such will share knowledge about the information with other members of the family.

Table 27: Variables contributory to factor three: 'Educational status' factor

Variables	Loading (L)	L^2	$\sum L^2$
Years spent on formal Education	0.854	0.729	
Literacy level	0.765	0.585	1.724
Level of educational attainment	0.640	0.410	

Source: Computed from results of factor analysis, 2013

Table 28: Variables contributory to factor four: 'Family characteristics' factor

Variables	Loading (L)	L^2	$\sum L^2$
Family type	0.529	0.280	0.811
Information sources	-.542	0.294	
Marital status	0.385	0.148	
Sex	0.298	0.089	

Source: Computed from results of factor analysis, 2013

4.8.5.1.5 Factor five: 'Social network' factor (see Table 29)

Variables whose loadings contributed to naming this factor included: nativity (L = 0.687), association membership (L = -.450), ethnicity (L = -.426) and information sources (L = -.227). The explanation is that information available with an individual within a particular social network, say members of same ethnic group or belonging to same associations, chances are that such information would spread easily to other members of the same social network. The implication is that there is need to ensure adequate representation of various groups as much as possible in an event of holding training or capacity building workshop.

4.8.5.1.6 Factor six: 'cultural value' factor (see Table 30)

Variables whose loadings contributed to naming this factor were: Household size (L = -0.723), subjective norm (L = 0.633) and rivalry/dispute (L = 0.246). Subject norm refers to effect of consideration for what other people, (such as family members, relatives, or friends) feel about what an individual wants to do. While this was not found to significantly influence farm waste utilisation, the result here suggests that when such pressures are mounted by large number of people, the individual may tend to give in.

Table 29: Variables contributory to factor five: 'Social network' factor

Variables	Loading (L)	L^2	$\sum L^2$
Nativity	0.687	0.472	0.908
Association membership	-.450	0.203	
Ethnicity	-.426	0.181	
Information sources	-.227	0.052	

Source: Computed from results of factor analysis, 2013

Table 30: Variables contributory to factor six: 'Cultural value' factor

Variables	Loading (L)	L^2	$\sum L^2$
Household size	0.723	0.523	
Subjective norm	0.633	0.401	0.985
Rivalry/dispute	0.246	0.061	

Source: Computed from results of factor analysis, 2013

4.9 General discussion on findings of the study

The strength of an intellectual work lies in its originality and how it advances knowledge in the discipline of the study. Hence this section discusses some of the crucial findings of the study which distinguishes it from other studies. The following sub-themes are discussed, delineating the roles of extension in each.

- Attainment of sustainable livelihoods among rural dwellers through judicious farm waste utilisation
- Economic empowerment of the rural dwellers through farm wastes' utilisation
- Model for utilisation of farm waste items among rural dwellers (model of the study)

4.9.1 Attainment of sustainable livelihoods among rural dwellers through judicious farm waste utilisation

Sustainable livelihood among rural dwellers is characterised by their ability to cope with shocks and risks, while at same time the livelihood activities they engage in do not undermine natural resource base. Livelihood diversification, which has been defined as 'the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living' (Ellis, 2000), is an inevitable option to attainment of sustainable livelihood by the rural populace. Also, the ability of rural inhabitants to effectively undertake any livelihood activity is dependent on livelihood assets at their disposal, that is, their resource base. These are: natural, physical, social, financial and human capitals often referred to as livelihood pentagon in livelihood's literature.

This study emphasised the need for recognition of farm waste items emanating from various livelihood pursuits of the rural dwellers as part of the natural assets which should be judiciously harnessed and utilised as important local resources. This is in addition to available natural resource stock in the rural environment which potential that have not been fully exploited, moringa for example. The findings also emphasised the need to explore and exploit

the multi task ability of rural inhabitants to their advantage through encouraging them to add more portfolios to their conventional livelihood activities by utilising hitherto unutilised or less utilised farm waste items.

The study's findings also stressed the need for intensification, whereby rural inhabitants increase their scale of production, livestock production, for example; using intensive management system. This will ensure both increase in availability of waste items, like poultry droppings and sheep and goat faeces for use as manure and fish feed, respectively, and also facilitate their easy collection. While recognising the high cost associated with livestock feeding, the study encouraged judicious utilisation of farm wastes (such as maize stalk, cowpea husk, rice husk and bran, maize cob, etc) as livestock feed. Also, growing of maggots on waste such as poultry droppings, blood of slaughtered animals, etc, could be useful supplement to costly fish feeds. So it is like a cycle: crop residues used as feed for livestock, and animal wastes in turn converted into manure for crop's use.

These submissions, therefore, emphasise 'reuse' and 'recycling' of farm waste items, which represent two of the 3 r's that are important in waste management. The third is 'reduce', that is, to reduce waste generation as much as possible. However, this study would not subscribe to that. Rather, it canvasses for generation of more farm waste as earlier asserted which should shrewdly harnessed as important local resources. The reason is because the 3 r's are proposed in solid waste management where wastes include non-biodegradable items. On the other hand, farm waste items are biodegradable and where they are not utilised, they readily decompose. So in a typical farm-family farm, it is the submission of this study that such cycle for recycling and reuse of farm waste be encouraged and practiced. This will help to help rural dwellers to spread their risks better, thereby better assured of sustainable rural livelihoods.

Another important asset of the livelihood pentagon is social assets. It refers to the social resources which rural people draw upon in pursuit of their livelihood objectives. It is

dependent on the quality of relationships among rural people and the extent to which one can count on support by the family or mutual assistance. These include networks, membership of groups, relationships of trust, access to wider institutions of society (Carney, 1998). The study's findings revealed low membership of rural dwellers in various associations in the study area and that considerable proportion amongst them did not contact with extension, an example of wider institution of the society. Giving the foregoing, it was not out of place that one of the crucial factors identified to be associated with farm waste utilisation was 'social network' factor. These findings underscored the need for extension to improve coverage of the rural clientele and encourage them to form themselves into associations whereby they will mutually benefit.

Human assets represent the skills, knowledge, creativity, experience, ability to labour and good health that, together, that enable people to pursue different livelihood strategies and achieve their livelihood objectives (Carney, 1998). The findings of the study again revealed that years spent on formal education and knowledge about farm waste utilisation potentials were amongst variables that significantly contributed to extent of farm waste utilisation among rural dwellers in the study area. Also, perceived behavioural control, which includes measure an individual's knowledge and confidence in his ability to utilise farm waste items. Similarly 'educational status' factor was amongst the crucial factors identified to be associated with farm wastes utilisation. These findings underscored germane roles for extension in facilitating organisation of capacity building and training workshops for rural dwellers in Osun state in order to improve their knowledge level and skills which will better equip them for effective utilisation of farm waste items.

4.9.2 Economic empowerment of the rural dwellers through farm wastes' utilisation

The bane of the research problem of the study was that rural dwellers have conventionally limited their quest for livelihood to production of certain crops, raising of few livestock, and engaging in non-farm activities, such as petty trading and agro-processing. While this is a form of livelihood diversification, the full potentials of several waste items emanating from their livelihood choices have not been well harnessed to their advantage.

It is the submission of this study that there are several enterprises which primarily depend on utilisation of farm waste items through which the rural inhabitants can be economically empowered. Although, these enterprises are not entirely new, however, there is need for revitalisation, intensification and introduction of value addition to make the final products more acceptable and more economically rewarding for the rural people. Such enterprise include mushroom production, dye production, intensification in livestock production, black soap production, intensive broom production, fish feed production, maggot culturing, bone meal production, intensive broom production, snailery production, organic manure production, and establishment of apiary around cocoa and moringa plantation.

The foregoing are areas rural dwellers may be economically empowered, and extension, both government, private and university outreach have roles to play. The roles include continuous creation awareness about the utilisation potentials of various farm waste items and organisation of capacity building and training workshops for rural dwellers in Osun state in order to improve their knowledge level and skills which will better equip them for effective utilisation of farm waste items.

4.9.3 Model for utilisation of farm waste items among rural dwellers (model of the study)

Using only the significant variables that influenced or contributed to extent of farm waste utilisation by the rural dwellers in the study area amongst host of independent variables included in the study, a model of farm waste utilisation (see figure 14) among rural dwellers in Osun state, Nigeria, was developed, which may be regarded as 'model of the study'. It has four major components like the hypothetical model earlier one developed as guide for the study, vis: the antecedents, set of independent variables, intervening variables and the dependent variable. It however differs from the hypothetical model in that, while the later was developed from conceptual and theoretical frameworks of the study, and therefore encompassed all independent variables included in the study, this model of the study only contained significant variables that had association with and contributed to extent of farm waste utilisation including as well factors identified to be associated with farm waste utilisation as independent variables.

MODEL OF THE STUDY

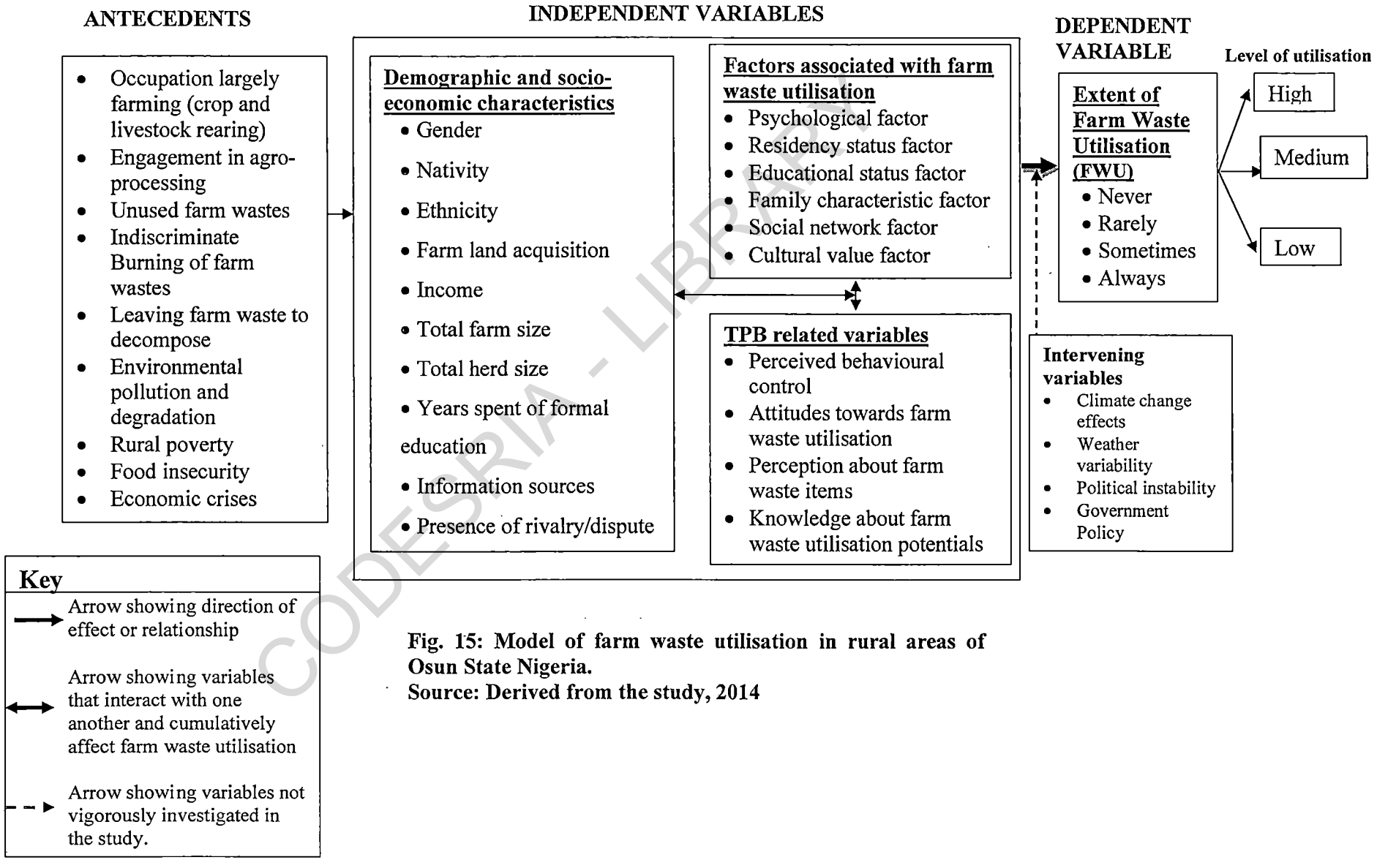

Fig. 15: Model of farm waste utilisation in rural areas of Osun State Nigeria.
Source: Derived from the study, 2014

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter presents in brief, the research problem investigated and the contributions of the study to the body of knowledge in rural sociology and extension. Followed these were summary of findings, conclusion, recommendations and suggestions for further studies.

5.1 Summary

5.1.1 Statement of research problem investigated

The need to exploit potentials of waste materials for wealth generation is increasingly emerging globally. However, while much attention has been paid to the urban cities, there is dearth of empirical evidence pertaining to farm wastes generation and utilisation in the rural areas. The study, therefore, sought to document the farm waste items available within the rural environment of the study area and document their economic potentials, examine rural dwellers' perception about identified farm waste items, determine their knowledge level of the utilisation potential of these wastes and identify factors associated with farm waste utilisation.

5.1.2 Contributions to knowledge

The study contributed to the body of knowledge in rural sociology and extension as follows:

1. It identified several farm waste items available in rural environment of the study area with their economic potentials, which could serve as compendium for governmental and non governmental agencies involved in rural development efforts.
2. It documented specific examples of entrepreneurial activities or enterprises rural inhabitants may engage in order to diversify their livelihood choices and increase their income through judicious utilisation of identified farm waste items available in the rural environment.
3. It outlined specific roles which extension agents and state ADP would have to perform towards enhancing utilisation of farm waste items by the rural clientele for their economic development.

4. It generated an evidence-based perception of rural dwellers about farm waste items' economic potentials.

5. It identified six composite factors associated with farm waste utilisation by the rural inhabitants. These were: 'psychological factor', 'residency-status factor', 'educational status factor', 'family characteristics factor', 'social network factor' and 'cultural value factor'

6. It developed a model of farm waste utilisation which depict, at a glance, germane variables associated with utilisation of farm waste items by rural dwellers in a typical rural environment.

5.1.3 Methodology of the study

The study was carried out in Osun State, using the three agricultural zones of the state. The zones namely: Osogbo, Ife/Ijesha and Iwo zones contain 13 Local Government Areas (LGAs), 10 LGAs and 7 LGAs, respectively. A multistage sampling procedure was used to select the respondents sampled for the study.

At first stage, 20 per cent of the total number of LGAs in each zone was used to select three, two and one rural LGAs, respectively, from the three zones. These were: Odo-otin, Egbedore, Orolu LGAs, from Osogbo zone; Atakumosa west and Ife south LGAs from Ife/Ijesha zone and Ayedade LGA from Iwo zone. At second stage, using proportionate sampling, five per cent of the total number of communities in each LGA was used to select 28 communities. Finally, 13 respondents were purposively chosen from each of the selected communities giving a sample size of 364 respondents.

Semi structured interview schedule was used for data collection from the identified respondents. In addition, one FGD session, comprising 7 – 10 participants, and two key informant interviews were conducted in each zone. Also, frequency counts and percentages, mean, standard deviation and weighted mean scores were used to describe the data collected while Chi-square, correlation and regression analyses were used to make inferential deductions. Also, factor analysis was used to identify factors associated with farm waste utilisation among rural dwellers.

5.1.4 Summary of findings

5.1.4.1 Demographic and socio-economic characteristics of respondents

Mean age of respondent was 52.73 years with a standard deviation of 14.74. About half (50.8 %) of them were male while 49.2 per cent were female. They were predominantly Christians (57 %) and Muslims (41 %). Majority (82.1 %) of them were married, while very few were widowed (9 %) and single (7 %). Majority (69.8 %) came from monogamous family while 26.4 per cent came from polygynous family, and mean household was approximately 7 with standard deviation of 3.2. Also, 65.4 per cent could read and write, and 30.8 per cent and 11.5 per cent completed primary and senior secondary education, respectively, with average number of year spent on attaining formal education being approximately 7 years.

About 55 per cent were indigenes of various communities sampled within the study area, and 45 per cent were non-indigene; majority (77.7 %) of who belonged to Yoruba ethnic group while about 6 per and 5 per cent belonged to Hausa/Fulani and Igbo ethnic group, respectively. Also, majority (61 %) had lived for between 20 – 40 years, and mean length of stay of respondent in the study area was 25.75 years.

Farming was major occupation amongst the respondents although they engaged in variety of other activities as minor occupations. They cultivated a variety of arable crops, amongst which cassava (88.5 %) and maize (84.1 %) were most prominent. Others included vegetable (64 %), yam (72 %) and cocoyam (59.1%). Also, oil palm (71.2 %) and cocoa (67 %) were prominent field crop cultivated. Asides, respondents also engaged in rearing of livestock too, although, on a low scale of production; and poultry birds (58.5 %) and goats (50.0 %) were most prominent amongst these livestock. Others included sheep (28.8 %) and cow (22.5) fish (21.4 %) and rabbit (21.2 %). In addition, majority (61.3 %) of the respondents owned their farmlands, which were acquired through lease (41.5 %), inheritance (30.4 %) and outright purchase (30.2 %). Mean annual income earned by respondent from crop cultivation

(arable and permanent crops), livestock rearing and agro-processing all pulled together was ₦ 382,500 which translated to ₦ 31,875 monthly.

Furthermore, 47.8 per cent belonged to various associations, while 52.2 per cent did not belong to any association. Of those who belonged to associations, 28.6 per cent and 18.1 per cent were members of religious association and farmers group, respectively. Very few belonged to other groups such as cooperative societies (6.4 %), social club (5.8 %), social club (5.8 %) and community development association (4.7 %), amongst others. Although, over half of the respondents had extension contact with state ADP as prominent source of contact, however considerable proportion (over 40 %) of the respondents lacked extension contact.

5.1.4.2 Identified farm waste items from arable crop and extent of utilisation

Respondents utilised cassava peels for livestock feeding, mushroom and flour (*elubo*) production, with varying degree of extent of utilisation. Utilising it as livestock feed (WMS = 2.45) was more preponderant, while utilising it for mushroom production (WMS = 1.07) and for producing flour (WMS = 0.79) were rarely practiced. While utilising young cassava leaves (*omunu ege*) as vegetable had low WMS (1.4), utilising young cocoa yam leaves (*omunu koko*) as vegetable (WMS = 1.85) was a more prevalent practice. Also, utilisation of cassava stem as firewood was not so common (WMS = 0.98).

Utilising yam peels for flour production recorded second highest weighted mean score of 2.24, which pointed to the preponderance of the practice. Utilisation of maize leaves as herbal concoction (WMS = 1.03) and maize stalk for yam staking (WMS = 1.19) recorded low extent of utilisation. Utilising maize cobs as household fuel for cooking (WMS = 2.22) was more prevalent than using it for feeding livestock (1.28) which was less practiced. Utilising maize shaft for livestock feeding recorded a high weighted mean score (1.71).

Utilising guinea corn leaves as food colorant and condiment (WMS = 1.85) recorded high weighted mean score. Utilising guinea corn stem as blood tonic (WMS = 2.05) was more prevalent than utilising it for yam staking (1.46), while there was low utilisation of guinea corn

bran (WMS = 1.06), cowpea husk (WMS = 1.37), and rice husk and bran (WMS = 1.24) as livestock feed.

5.1.4.3 Identified farm waste items from field crops and other sources and extent of utilisation

Utilisation of oil palm fronds for broom production recorded a very high weighted mean score (2.23) which pointed to the preponderance of the practice. Yet, people only engaged in broom making as pastime, as respondents gave preference to their farming work instead. It was only when the children were on holiday that they engaged actively in broom production. On the contrary, utilisation of coconut tree fronds for broom production recorded low extent of utilisation (WMS = 1.39). In addition, utilising oil palm frond for basket weaving recorded low weighted mean score (1.19), which indicated that utilising oil palm fronds for basket was less preponderant, compared to utilising it for broom making.

Also, using oil palm stem as wooden material for roof construction (WMS = 2.34) was often practiced, while using oil palm flower (*aran ope*) for soldier repellant (WMS = 1.9) was also common practice. Oil palm kernel shell was very much in abundance in the study area and most commonly used as household fuel for cooking. Utilisation of oil palm kernel shell as household fuel for cooking recorded very high weighted mean score (2.43). Whereas, utilisation of oil palm kernel nut for PKC production (WMS = 1.45), which is a very important ingredient in poultry feed, was not commonly practiced.

Furthermore, utilising coconut shell for household cooking (WMS = 1.88), utilisation of cocoa exudates for baiting bees (WMS = 1.74) and utilisation of oil palm fruit bunch (*soso*) plus cocoa pad (*paadi koko*) for local black soap production (WMS = 1.77) were common practices. Utilisation of bark of cocoa tree for drinking as blood supplement (WMS = 1.87) recorded high extent of utilisation, as well.

Utilising plantain and banana leaves as fish feeds recorded very low weighted mean score (0.60) which pointed to the rarity of the practice. Contrarily, utilising plantain and

banana leaves as livestock feed (WMS = 2.17) was preponderant practice. Also, utilising plantain and banana sap to stop bleeding (WMS = 1.80) was not uncommon. In addition, utilising bamboo stem for making 'go to hell' for harvesting recorded high weighted mean score (1.91), while utilising it for shed construction (2.27) and as pole for raising TV antennae (2.15) recorded very high weighted mean score; findings which pointed to the preponderant utilisation of bamboo stem. However, utilising leaves of african spice tree (*aidan*) (WMS = 0.73), wall nut (*awusa*) shell (WMS = 1.18) and west African indogo leaves (*ewe elu*) (WMS = 1.24) for dye production were rarely practiced by the respondents.

Agbayun was commonly utilised as sweetener (WMS = 1.62) while its roots (WMS = 1.45) and leaves (WMS = 1.13) were not often utilised for herbal concoction. Also, utilisation of moringa seeds as water purifier (WMS = 0.83), its leaves as livestock feed (WMS = 0.59) and fruits as bee forage (WMS = 0.91) were rarely practiced. Similarly, utlisation of *pandoro* as pesticide for yam sett protection (WMS = 1.49), branches of shear butter tree as chewing stick (WMS = 1.05) and bark as treatment for malaria (WMS = 1.09) recorded low extent of utilisation. However, utilisation of black pepper tree branches as chewing sticks (WMS = 1.52), seed of bush mango fruit for soup cooking (WMS = 1.82) and unripe fruit for treating measles (WMS = 1.27) had high extent of utilisation. Finally, there was low extent of utilisation of poultry droppings as fish feed (WMS = 1.19) and animal bones for bone meal production (WMS = 1.43), while utilising sheep and goat faeces as manure (WMS = 1.61) had high extent of utilisation.

5.1.4.4 Perception about economic potentials of farm waste items

Majority (totalling 69 % each) perceived cassava peels and young cassava leaves as valuable economically, respectively. Also, a majority (totalling 62.3 %) opined that cassava stems were valuable. Also, majority (totalling 68.4 % and 61.3 %) perceived yam peels and young cocoyam leaves, respectively, as of important value, while a total of 50 per cent held the view that young cocoyam leaves were valuable items. Similarly, majority (totalling 63.2 %

and 62.1 %) perceived maize stalk and maize cob as economically valuable, respectively. In same vein, maize shaft was perceived as valuable item by over half (totalling 55 %) of the respondents. The results implied favourable perception of the respondents about cassava peels, leaves and stems, yam peels, cocoyam leaves, maize stalk, cob and shaft.

Furthermore, majority (68.1 %) perceived guinea corn leaves as economically important, while a total of 53.5 per cent and 47.8 per cent held the view that guinea corn stem and guinea corn bran were valuable items. Majority (totalling 70.1 %), as well, perceived cowpea husk as economically important item, while only about 42.1 per cent and 33.5 per cent perceived rice husk and bran and cotton seed coat as valuable items, respectively. The findings implied favourable perception of the respondents about the economic potentials of guinea corn leaves, stem and bran, and cowpea husk, while there was unfavourable perception of rice husk and bran and cotton seed coat.

With respect to field crop, majority (totalling 80 % and 80.5 %) perceived oil palm fronds and oil palm stem as economically important, respectively. Similarly, majority (totalling 65.9 %) perceived oil palm kernel shell as valuable economically while a total of 58.8 per cent perceived oil palm flower as valuable. Also, majority (totalling 83.2 % and 68.4 %) perceived coconut shell and coconut palm frond as economically important. Similarly, majority (totalling 64 % and 60.7 %) perceived cocoa pods and bark of cocoa tree as valuable items, while total of 63.8 per cent and 62.9 per cent perceived roots of cocoa tree and cocoa leaves as valuable items. The results implied favourable perception of the rural inhabitants about various parts of the oil palm tree.

In addition, a total of 62.7 per cent, 59.7 per cent and 70.9 per cent perceived plantain and banana leaves, peels and sap as valuable items, respectively. While, majority (totaling 83.3 %) perceived bamboo stem as economically important, a bit above half (about 56 %) perceived young leaves of *elu* as valuable and about 55.5 per cent perceived *agbayun* as economically valuable. Conversely, while few (totaling 31.6 % and 36 %) perceived bamboo

leaves and fruit of *Dialium guineensis* (*awin*) as economically important, close to half (about 46 %) perceived Africa's spice tree's pod as economically important. Also, few (totalling 23.4 % and 40.9 %) perceived moringa's seed and leaves as economically important, while a larger proportion had indifference view about the economic potential of moringa seeds and leaves. The findings implied that rural inhabitants had favourable perception about sap of banana and plantain leaves, leaves and peels, west African indigo (*elu*) leaves and bamboo stem, while they had unfavorable perception about the economic potentials of bamboo leaves, African spice tree's pod, moringa's seeds and leaves.

5.1.4.5 Knowledge about utilisation potentials of farm waste items

Majority (totalling 90.9 %) of the respondents were familiar about utilisation of sheep and goat faeces as manure. Also, majority (totalling 66.8 % and 60 %) knew about utilisation of maize shafts and stover as animal feed, and oil palm kernel for make palm kernel cake (PKC) production, respectively. Likewise, total of 66.7 per cent expressed certainty about the use cocoa pods to produce local black soap, while total of 63.2 per cent indicated they knew that *elu* leaves can be used to make local dye useful in local industry.

On the other hand, about half of the respondents lacked the knowledge about utilisation potential of cassava peels for mushroom production, while majority (over 90 %) lacked knowledge about the utilisation potential of cow dung for biogas production. Also, a majority (over 60 %) lacked knowledge about the utilisation potential of poultry droppings as livestock feed. Similarly, several (about 45.1 %) of the respondents lacked the knowledge about utilisation potentials of slaughtered animal bones. In same vein, less than half (totalling 43.4 %) expressed certainty about the knowledge on use of poultry dropping as source of fish feed.

5.1.4.6 Attitudes towards farm waste utilisation

While a total of 55 per cent of the respondents were favourably disposed to utilisation of farm wastes as household fuel even in this modern time, majority (totalling 63.8 %) were favourably disposed to utilisation of waste items for making briquette charcoal for household cooking. Similarly, majority (about 68 %, 64 % and 65.4 %) were favourably disposed to utilisation of farm waste items as livestock feed, as a mean of preventing soil erosion and as a means of enhancing soil fertility and improving crop productivity. Majority (about 68 %) were favourably disposed to 'not burning of crop residues and using them as cover crop as a means of replenishing soil fertility'.

Furthermore, majority (totalling 64.3 %) of the respondents were not favourably disposed to utilisation of farm wastes items as source of building material. While a total of 51.6 per cent were favourably disposed to utilisation of farm waste items as additional income source, about 44 per cent were unfavourably disposed to this idea. They considered as waste of time, less financially rewarding and socially demeaning utilisation of some farm waste items.

In addition, over half (56 %) of the respondents concurred that burning of farm waste items contribute to climate change and adversely affect human health. Similarly, over half (58 %) of the rural inhabitant were not favourably disposed to burning of farm wastes and crop residues because of its effect on the environment, but would prefer alternative ways to disposing these items. Although, about 42 per cent of the respondent opined that 'utilisation of farm waste would gulp extra money and therefore should be get rid off by leaving to decompose or burning', majority (over 60 %), however, opined that farm waste items should be considered as important resources and judiciously utilised, rather than regarding them as useless items.

5.1.4.7 Factors affecting farm waste utilisation

53 per cent of the respondents indicated that the community culture did not abhor utilisation of materials regarded as farm waste. Also, 40.9 per cent and 25.3 per cent indicated

that there were interpersonal conflict and group/political conflict within community, while few (10.7 % and 11.3 %) submitted that there were tribal/ethnic and religious conflicts, respectively, within the community. Very few (5.5 %) reported presence of conflict related to resource use within the community.

Family members (79.7 %), friends (41.5 %) and radio (40.1 %) ranked highest amongst information source available to the respondents about farm waste utilisation within the communities sampled in the study area. Extension (5.5 %) was amongst the least ranked information source available to the rural dwellers. Furthermore, findings indicated that majority (over 60 %) opined extension did not offer any training opportunities for them in this regards. Also, over 60 per cent affirmed that extension had significant roles to play and should provide training opportunities (over 80 %) for rural inhabitants about farm waste utilisation potentials.

As regards religious institutions (church and mosque), they were rarely deemed as barriers to utilisation of farm waste items. However, as revealed during field survey, it may be important to note that while the church or mosque may not expressly abhor utilisation of farm waste items, individual rural dweller may express religious belief indicating otherwise.

5.1.4.8 Results of hypotheses testing

As regards relationship between farm waste utilisation and socioeconomic characteristics of respondents, results of chi-square analysis indicated that there was no significant association between farm waste utilisation and religion ($\chi^2 = 2.146$), marital status ($\chi^2 = 11.295$) and family type ($\chi^2 = 0.991$) of respondents at $p \leq 0.05$. However, there was significant association between sex of respondent ($\chi^2 = 10.38$) and farm land acquisition ($\chi^2 = 51.00$) and extent of farm waste utilisation at $p \leq 0.01$. Also, there was significant association between ethnicity ($\chi^2 = 19.67$) and nativity ($\chi^2 = 10.40$) at $p \leq 0.05$, respectively. Furthermore, correlation analysis results showed there was significant and positive relationship between

extent of farm waste utilisation and total farm size (r = 0.135), total herd size (r = 0.198) and income (r = 0.158) and significant and negative relationship with information sources (r = -0.262) and presence of rivalry/dispute (r = -0.34) and extent of farm waste utilisation at $p \leq 0.01$

Amongst TPB variables, perceived behavioural control (r = 0.256) and attitude towards farm waste utilisation (r = 0.204) had positive and significant relationship with extent of farm waste utilisation at $p \leq 0.01$, while subjective norm did not have significant relationship with farm waste utilisation. Also there was positive and significant relationship between extent of farm waste utilisation and respondents' knowledge about farm waste utilisation potential (r = 0.109) and their perception about farm waste items (r = 0.256) at $p \leq 0.01$.

Furthermore, regression analysis results indicated that total herd size (t = 2.711), income (t = 2.401), perception about farm waste items (t = 4.458), perceived behavioural control (t = 2.534) and attitude towards farm waste utilisation (t = 2.732) positively and significantly contributed to extent of farm waste utilisation at $p \leq 0.01$. Also, total farm size (t = 1.988) and years spent on formal education (t = 2.024) positively and significantly contributed to extent of farm waste utilisation at $p \leq 0.05$. However, information source (t = -2.732) and presence of rivalry/dispute (t = -4.837) significantly but negatively influenced farm waste utilisation at $p \leq 0.01$, while knowledge about farm waste utilisation potentials also significantly but negatively influenced farm waste utilisation at $p \leq 0.05$.

5.1.4.9 Results of factor analysis

With varimax rotation, inter-correlation between the independent variables indicated that the factor analysis yielded six principal components (factors) which accounted for a total of 66.82 per cent variation in the dependent variable. The factors were labeled: 'psychological factor', 'residency status factor', 'educational status factor', 'family characteristic factor', 'social network factor' and 'cultural value factor'.

5.2 Conclusion

Based on the major findings of the study, it was concluded that there were several farm waste items that have economic potentials for utilisation in the study area. These waste items, this researcher opines, should be considered as part of the natural asset base within the rural environment, which if utilised by rural dwellers as important local resources can engender sustainable livelihood diversification and economic empowerment of the rural populace. Some of these farm waste items include cassava peels and stems, yam peels, maize stalks, cobs and shafts, guinea corn stalks and leaves, cowpea husk, and rice husk and bran. Others were oil palm kernel shell, empty oil palm fruit bunch, cocoa pods, plantain and banana peels and leaves, poultry droppings, sheep and goat faeces, cow dungs, amongst others.

Also findings of the study showed that perception of rural dwellers about economic potentials of these farm waste items differed from one person to another across different locations. As such, an item discarded by an individual in one location may be a by-product for another individual within the same locality or beyond. In addition, rural dwellers had knowledge about utilisation potentials of some waste items and lacked knowledge about utilisation potentials of others. For instance, while majority of the respondent knew that sheep and goat faeces could be used as manure, they were unaware of the utilisation potentials of cow dung for biogas production. Finally, six crucial factors associated with farm waste utilisation were identified. They are 'psychological factor', 'residency status factor', 'educational status factor', 'family characteristic factor', 'social network factor' and 'cultural value factor'.

5.3 Recommendations

The following recommendations were proffered as way forward:

1. The state ADP, Non Governmental Organisations (NGOs), Community Based Organisations (CBOs) and media outfit should explore and exploit the multitask ability of the rural inhabitants through sensitising them and drawing their attention to vast

potentials and opportunities that abound in utilisation of farm waste items available within the rural environment as useful local resources.

2. There is need for state ADP to increase its coverage so that higher proportion of rural inhabitants would benefit from extension activities. Also, the study's findings underscored the need for University and NGOs to engage more in extension activities, thereby complementing government's efforts.
3. The need to strengthen social network amongst rural inhabitants cannot be overemphasised. There is the need to encourage rural inhabitant to relate with one another through membership in various associations which might enhance social network amongst them.
4. There is need to encourage rural dwellers to increase their scale of livestock production and practice intensive management system. This will increase amount of waste items available for their use and also increase collation. With adequate training opportunities they could be empowered on various ways of converting the livestock wastes into useful resources that can generate wealth and translate to addition income for them.
5. Given the abundance of oil palm plantation in the study area, production of PKC is a viable economic venture rural inhabitants could be empowered to undertake.
6. The study's findings underscored the necessity for active involvement of extension in enlightening rural dwellers about farm waste utilisation potentials and enhancing their entrepreneurial capabilities through organising capacity building workshops and training opportunities for them.
7. With adequate capacity building workshop and training opportunities, rural dwellers already involved in mushroom production may be empowered to acquire skills in modern mushroom production, while others that had never utilised cassava peels for mushroom production might become interested in considering it as alternative and additional income source.

8. Rural inhabitants need to be sensitised on the need to engage more intensively in broom production and not considering only as amusement or hobby. By doing this, there will be increase in broom production, which will not only increase rural inhabitants' earnings but also serve as diversified income source for them.
9. Rural inhabitants, particularly, women and youth, should be empowered to revive local dye production by utilising available local resources available within the rural environment at their disposal.

5.4 Suggestions for further studies

This study established the presence of several farm waste items that could be considered as part of natural assets base of the rural dwellers in Osun state. These wastes have great potentials for utilisation as important local resource and the study had identified extension playing a major role in the process. However, the study did not assess extension agents' (both government and private) capacity to effectively engage and involve in the farm waste utilisation process. An important starting point is determination of extension agents' skills, capabilities and prowess in playing a major role of promoting farm waste utilisation among rural dwellers.

Further study could therefore be carried out on evaluation of training needs of agricultural extension agents with respect to farm waste utilisation in order to determine the gap between their present ability (i.e. what is) and what ought to be. Outcome of such study would document specific areas where extension personnel might require training and establish the need for training them (i.e. training of trainers). Also, this study examined holistically wide range of farm waste items' potential for utilisation; other studies may further probe into how each farm waste item's identified potentials may be further judiciously harnessed through value addition. Further studies may also be conducted to evaluate the commercial viability and marketability of farm wastes.

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APPENDIX I

OBAFEMI AWOLOWO UNIVERSITY, ILE – IFE

FACULTY OF AGRICULTURE

DEPARTMENT OF AGRICULTURAL EXTENSIONAND RURAL DEVELOPMENT

INTERVIEW SCHEDULE FOR DATA COLLECTION ON '**ASSESSMENT OF FARM WASTE UTILISATION AMONG RURAL DWELLERS IN OSUN STATE, NIGERIA**'

DATE:_____ **INTERVIEW SCHEDULE NO:** ____

LGA: _____ **COMMUNITY:**_____

Section A: Personal and Socio-economic characteristics

1. **Age:** Please give your age in years .....
2. **Sex:** Indicate your sex i. Male [ ] ii. Female [ ]
3. **Religion:** What is your religion? i. Christianity [ ] ii. Islam [ ]
   iii. Traditional religion [ ]
4. **Marital status:** Please, indicate your marital status i. Single [ ] ii. Married [ ]
   iii. Divorce [ ] iv. Separated [ ] v. Widowed [ ]
5. If married, do you live with your spouse? i. Yes [ ] ii. No [ ]
6. If No, why do you not live with your spouse
   i. Occupation [ ] ii. Educational Pursuit [ ]
   iii. Better accommodation [ ]
7. **Household size:** How many people are in your household?
   Number of male children ..... Number of female children.....
   Number of wives..... Number of other dependents.....
   Total .....

8. **Family type:** Indicate your family type i. Monogamy [ ] ii. Polygamy [ ]

9. **Literacy**: Can you read and write? i. Yes [ ] ii. No [ ]

10. **Years spent on formal education:** If yes, to Question 14 above, how many years of formal schooling did you have? .....

11. **Level of education:** Please, indicate the level of education attained.

i. Koranic education [ ] ii. Adult education [ ]

iii. Primary school incomplete [ ] iv. Primary school complete [ ]

iv. Secondary school incomplete [ ] v. Secondary school complete [ ] vi. Tertiary education [ ]

12. **Nativity:** Are you a native of this area? i. Yes [ ] ii. No [ ]

13. If no, how long have you been living in this area? .....

14. **Nature of residency:** Do you also reside in any other place apart from this community? i. Yes [ ] ii. No

15. **If yes,** Give reason: i. My family reside there [ ] ii. I have some business outfit there [ ] iii. For leisure [ ]

iv. Other reasons (Please specify).....

16. **Ethnicity:** Which ethnic group do you belong? i. Yoruba [ ] ii. Hausa [ ]

iii. Ibo [ ] iv. Fulani [ ] v. Others (specify) .....

17. **Occupation:** Major and minor occupation, please check (√).

S/N	OCCUPATION	MAJOR	MINOR
1	Farming		
2	Agro-processing		
3	Petty Trading		
4	Livestock rearing		
5	Hunting		
6	Civil servant		

7	Others (Please specify)		

18. (a) **Farm size and crop cultivated.** Please indicate which of the following crops do you grow, and size of acreage cultivated (3,000 heaps = 1 acre; 2.5 acres or 7,500 heaps = 1 ha)

S/N	Types of crop	Tick, if cultivated	Size (Acre)
1	Maize		
2	Cassava		
3	Yam		
4	Cocoyam		
5	Soybean		
6	Rice		
7	Vegetable		
8	Cocoa		
9	Oil palm		
10	Citrus		
11	Cashew		
12.	Others (please specify)		

18. **(b) Animal raised and size.** Please, indicate which of the animal you keep and size

SN	Type of animal kept	Tick, if raised	Size (Number)
1	Poultry birds		
2	Sheep		
3	Goat		
4	Cattle		
5	Fish		
6	Rabbit		

7	Others (please specify)		

19. **Income:** What is the approximate annual income you realized from the following sources

S/N		Amount (N) per year		
		2010	2011	2012
1	Farming (Any from 18a above)			
2	Livestock (Any from 18b above)			
3	Agro-processing			

20. **Farmland tenancy:** Do you own the land you cultivate? i. Yes [ ] ii. No [ ]

21. **Farmland acquisition:** If no, how did you get the land?

i. Illegal occupant [ ] ii. Pledge [ ] iii. Lease [ ] iv. Gift [ ] v. Inheritance [ ] vi. Outright purchase [ ]

22. **Years of farming experience:** How long have been you engaged in farming _____ Years

23. **Association membership:** Do you belong to any formal association?

i. Yes [ ] ii. No [ ]

24. **Membership status:** If yes, please which association and indicate your membership status

Association	Tick, if member	Tick where applicable		
		Ordinary member	Committee member	Executive member
i. Farmers' cooperative				
ii. Religious association				
iii. Credit and Thrift cooperative society (CTCS)				
iv. Social club				
v. Descendant union				
vi. vigilante group				
vii. Community Development Association (CDA)				
viii. Others, please specify				

25. **Benefits derived from association membership.** Please, check which of the following benefits derived from the associations you belong to

i. Increase in my farm size [ ] ii. Improvement in standard of living [ ]

iii. Timely access to loan [ ]iv. Low interest rate on loan [ ]

v. Share experience and learn from other farmers [ ]

vi. Protection from aggressors within the community [ ]

26. **Extension contact:** Have you ever had extension visits within the past three (3) years?

i. Yes [ ] ii. No [ ]

27. **Source of extension contact and frequency of visit** If yes, indicate from the following, your source of extension contact and frequency of visit?

S/N	**Sources**	**Tick, whichever is applicable**	**Frequency of visit**			
			Weekly	Fortnightly	Monthly	During problem situation
1	Government: (OSSADEP)Extension workers					
2	Non-Governmental Organization (NGOs)					
3	University based Extension personnel					
4	Others (please specify)					

Cocoa stem for building house construction					
Plantain and banana leaves used as fish feed					
Plantain and banana fruit peels used as livestock feed					
Plantain and banana sap used to stop external bleeding					
Pseudo stem of banana and plantain used for production of organic fertiliser					
Bamboo stem for construction of fences					
Bamboo stem for construction of shed					
Bamboo stem for making 'go to hell' used in crop harvesting					
Bamboo stem for construction of TV pole					
Africa spice tree (*Aidan)* for dye production					
Wall nut (*Awusa*) *Tetracarpidium conophorium* for dye production					
Young leaves of *Elu* for dye production					
Awin (Dialium guineensis) used as vitamin C supplement					
Agbayun used as sweeteners/stimulants					
Agbayun roots for herbal usage					
Agbayun leaves medicinal for treatment of malaria					
Horse radish tree (*Moringa oleifera*) *Ewe Igbale:* Seed as water purifier					
Moringa leaves as livestock feed					
Moringa fruits for bee forage					
African pear (*pia*): stem as wood for furniture and building purpose					
African pear: Leaves and fruits for feeding snails					
Isin (*Blighia sapida*): split fruit for consumption					
Isin : stem used to obtain timber for construction					
Isin: stem used as fuel for cooking					
Pandoro fruit used as yam sett pesticide					
*Vittellaria paradoxa (*shear butter*)* tree branches as chewing stick					
Shear butter bark medicinal for treatment of malaria					
Black pepper *Iyere (piper guineensis)*for making chewing stick					
Eeru (Xylopia aethiopcia) dried and burnt fruits for driving away soldier ants and mosquitoes					
Cactus root used for biological control of termite					
Cactus planted as fence against large mammalian pests					
Oro: seed for making *apon* soup					
Oro: stem used as fuel					
Oro: unripe but mature fruit medicinal: chewed against measles					
Poultry droppings for fish feed					
Sheep and goat faeces for organic manure production					
Cow dung for biogas production					

Section B: Farm waste utilisation

Please indicate (by ticking wherever applicable) which of the following materials/items you make use or have ever made use of for purpose indicated and indicate how often (i.e. the extent of utilisation)

0-Never; 1 – Rarely; 2 – Sometimes; 3 – Always

	Tick if ever utilised	0	1	2	3
Cassava peels for livestock feeding					
Cassava peels for mushroom production					
Cassava peels for flour (*elubo*) production					
Young cassava leaves (*omunu ege*) for vegetable soup					
Cassava stem as firewood					
Yam peels for flour (*elubo*)					
Young cocoyam leaves for vegetable soup					
Potato leaves as livestock feed					
Oil palm fronds for broom production					
Oil palm fronds for shed construction					
Oil palm stem to obtain wood for building construction					
Dried and burnt oil palm flower to drive away soldier ants					
Oil palm kernel for prevention of soil erosion					
Palm kernel nut for palm kernel cake (PKC) production					
Oil palm kernel as household fuel for cooking					
Maize leaves for herbal concoction					
Maize stalk used for yam staking					
Maize cob for livestock feeding (i.e. pig)					
Maize cob as household fuel					
Maize shaft for livestock feed					
Guinea corn when dried leaves as food colorant and condiment					
Guinea corn (*poporo oka*) stem for yam staking					
Guinea corn stem as blood tonic (by cutting into small pieces and cooking in water for drinking)					
Guinea corn bran for livestock feed					
Cowpea husk as livestock feed					
Rice husk and bran for livestock feed					
Cotton lint case for insecticide					
Coconut shell for household fuel					
Coconut leaves for broom production					
Coconut stem for building					
Cocoa extracts (*omije koko*) used as attractant for bee					
Cocoa pods + *soso (remnant from oil palm processing)* for production of black soap					
Cocoa bark and root used as blood tonic when cooked					
Cocoa leaves for wrapping pap					

Section C: Benefits (potentials for utilisation) of identified farm waste items

Please, indicate the areas from the following options where you consider the itemised farm waste items could be utilised

Items	Food/nutritional (spice)	Income	Medicinal	Livestock feed	Soil improvement fertility	Others
Cassava peels						
Young cassava leaves						
Cassava stem						
Yam peels						
Young cocoyam leaves						
Young potato leaves						
Oil palm fronds						
Oil palm stem						
Oil palm flower						
Oil palm kernel						
Maize stalk						
Maize cob						
Maize shaft						
Guinea corn leaves						
Guinea corn stem (*poporo oka*)						
Guinea corn bran						
Cowpea husk						
Rice husk and bran						
Cotton lint case						
Coconut shell						
Coconut leaves						
Cocoa pods						
Cocoa bark and root						
Cocoa leaves						
Plantain and banana leaves						
Plantain and banana fruit peels						
Plantain and banana sap						
Bark of plantain and banana trees						
Bamboo stem						
Bamboo leaves						
Aidan African spice tree						
Elu (Xylopia						

aethiopica)						
Awin (Dialium guineensis)						
Agbayun roots						
Agbayun leaves						
(*Moringa oleifera*) *Ewe Igbale*: seed						
Moringa leaves						
Moringa fruits						
African pear (*pia*): leaves and fruits						
Isin (Blighia sapida): fruit						
Isin: stem						
Pandoro fruit						
*Vittellaria paradoxa (*shear butter*)*						
Iyere (piper guineensis)						
Eeru(Xylopia aethiopica): fruits						
Cactus root						
Cactus stem						
Cactus seed						
Oro seed						
Oro stem						
Oro: unripe fruit						
Poultry droppings						
Sheep and goat faeces						
Cow dung						
Animal bones						
Animal horn						
Cow tail						

Section D: Perception about farm wastes economic potentials

Please check which of the following options best describe your perception about the economic potentials of the identified materials listed below

1 – Extremely worthless; 2 – Somewhat worthless; 3 – Not sure; 4 – Somewhat valuable; 5 – Very valuable

Items	**1**	**2**	**3**	**4**	**5**
Cassava peels					
Young cassava leaves					
Cassava stem					

Yam peels					
Young cocoyam leaves					
Young potato leaves					
Oil palm frond					
Oil palm stem					
Oil palm flower					
Oil palm kernel					
Maize stalk					
Maize cob					
Maize shaft					
Guinea corn leaves					
Guinea corn stem					
Guinea corn bran					
Cowpea husk					
Rice husk and bran					
Cotton lint case					
Coconut shell					
Coconut leaves					
Cocoa pods					
Cocoa bark					
Cocoa root					
Cocoa leaves					
Plantain and banana leaves					
Plantain and banana fruit peels					
Plantain and banana sap					
Bamboo stem					
Bamboo leaves					
Aidan African spice tree's pod					
Elu young leaves					
Awin (Dialium guineensis) fruits					
Agbayun					
(*Moringa oleifera*) *Ewe Igbale* seed					
Moringa leaves					
Moriga stem					
African pear (*pia*)					
Isin (Blighia sapida) Split fruits					
Isin (Blighia sapida) stem					
Pandoro fruit					
*Vittellaria paradoxa (*shear butter*)* tree branches					
Vittelaria paradoxia (shea butter) tree bark					
Iyere (piper guineensis) tree branches					
Iyere (piper guineensis) seed					
Iyere (piper guineensis) stem					
Eeru (Xylopia aethiopica)					
Cactus root					
Cactus stem					
Cactus seed					
Oro: unripe fruits					
Oro: root					
Oro: stem					

Poultry droppings					
Sheep and goat faeces					
Cow dung					
Animal bones					
Animal horn					
Cow tail					

Section E: Knowledge about utilisation of identified farm wastes materials

Please react to the following statements by picking any of the options you find most suitable to depict your knowledge about the identified farm wastes.

1 – Definitely false; 2 - somewhat untrue; 3 – Not sure; 4 – somewhat true; 5 – Definitely true

	1	2	3	4	5
Cassava peels can be useful for mushroom production					
Cassava peels and dried and grinded to make flour (elubo)					
Yam peel is useful source of livestock and yam flour					
Potato leaves can be useful as livestock feeds					
Animal faeces, such as sheep and goat dung can be collected, dried and spread on farm land as a form of manure					
Poultry droppings can be useful source of fish feed					
Cow dung is very useful material for biogas production					
Animal bones can be carved into plate, cutleries, flutes and other decorating materials					
Animal bones can be useful source of calcium content in poultry feed					
Cow tail could be a very useful material for making *irukere*, used by traditional to distinguish themselves from others					
Bark of plantain trees and cocoa pods can be used to prepare black soap (*ose dudu*)					
Coconut shell is useful source of household cooking fuel					
Coconut leaves can be very useful for weaving of mats					
Maize shafts and stalks are useful source of animal feed					
Oil production extract (palm kernel oil) when extracted and dried can be used as fuel, especially by the blacksmith					
Oil palm kernel can be used to make Palm kernel cake useful component of poultry feed					

Remains of oil processing (*ogunso*) is a useful source of household cooking fuel					
Oil palm fronds are very useful for weaving baskets and making brooms					
Oil palm flower when dried and burnt can be used to drive away soldier ants					
Stem of Palm trees can be used to make benches for sitting down to play *ayo*					
Guinea corn stalk can be used to treat malaria when mixed with some other herbs					
Bark of cocoa tree and its roots are rich source of blood tonic and useful for herbal medicine					
Liquid extract from cocoa tree is useful source of attractant for baiting of bees					
Sap of banana and plantain tree can be used to stop external bleeding					
Bamboo stem useful for construction of fences, ladder and TV pole					
Bamboo leaves are useful for herbal medicine					
Aidan's pod useful to make herbal medicine and traditional soap					
Awin is very rich source of vitamin C content					
Elu can be used to make local dye useful in dyeing industry					
Cactus root is very useful for control of termite					
Branches of Shea butter tree can be used as chewing sticks and bark is useful for herbal medicine					
Iyere useful as chewing stick and making herbal medicine					
Iyere's seed useful condiment/spice for cooking					
Pandoro fruit when cut with cutlass can be used for treatment of yam sett against viral attack when same cutlass is used to cut the yam sett before planting					
Eeru's dried fruit when burnt is useful as insecticide to drive away mosquitoes and soldier ants					

Section F: Attitude towards farm waste utilisation

Please react to the following attitudinal statements by picking most suitable option

1 – Strongly disagree; somewhat disagree; 3 – not sure; 4 – somewhat agree; 5 – strongly agree

Statements	1	2	3	4	5
Making use farm wastes as source of household fuel is no longer relevant today					
Incorporating farm wastes as source of building materials is archaic and should not be practiced in this modern times					
Cultivation of mushrooms from waste such as cassava peelings is a good source of additional income					

Utilisation of farm wastes to make briquettes charcoal can be a good source of household fuel					
Farm wastes such as cassava peels, etc are indispensable feed for livestock					
Crop residues in conjunction with other nitrogen rich waste can be useful materials for biogas generation					
Making bricks and walls from straw clay mixtures is an archaic techniques and no longer fashionable nowadays					
Use of crop residues in mushroom production provide alternative means of converting farm waste into edible food stuff					
Judicious use of farm wastes can be a useful way to ameliorate the effects of excessive soil erosion which is a major threat to sustainable farming					
Presence of crop residues is useful to reduce surface runoff of soil particles thereby reducing the effect of soil erosion					
The abundance of earthworm, which presence are particularly important for enhancing soil fertility, declines sharply with removal of crop residues by burning them on the field after harvest					
Use of crop residues as cover crop is highly essential for replenishing soil nutrients					
Crop residues and other farm wastes should be treated as valuable renewable resource to be managed carefully to maintain soil fertility and promote crop productivity					
Burning of crop residue in order to get rid of the field of farm waste is not an environmentally friendly act					
Appropriate or alternative farm waste disposal is better and more environmental friendly that burning these wastes					
Burning agricultural wastes contributes greatly to environmental degradation					
Burning of agricultural waste contributes greatly to climate change which is hazardous to the environment					
Burning of farm wastes is harmful to human health					
Practice of residue or farm waste utilisation gulps extra cost with small returns, and at best they should be get rid of by burning or dumping to decompose					
Crop residues should not be regarded as undesired waste but rather as integral part of agricultural production for which some use must be found					

Section G: Perceived Behavioural Control (PBC)

Please complete the following statements with any of the options that best described you with regards to the confidence in your ability to perform the task in question and perception of how ease or difficult it is for you to perform it

1- Extremely difficult; 2 – Somewhat difficult; 3 – Not sure; 4 - somewhat easy; 5 – extremely easy

Statements	1	2	3	4	5
Collection of animal dropping, soaking them in water and spraying them on my crop as protection from sheep and goats to feed on them is ----------					

task					
Production of mushroom from cassava peels is ---------- task for me					
Collection of animal faeces, such as sheep and goat dung, drying and spreading them on farm land as a form of manure is ---------- task I would be unwilling to undertake					
Collection of poultry droppings and supplying it as fish feed for those engaging in fish production is ----------					
Collection of cow dung for biogas production is ---------- task I can never undertake					
Carving animal bones into plate, cutleries, flutes and other decorating materials is ----------					
Collection of animal bones from slaughter slabs, drying and grinding them into powdery form as a source of protein content in poultry feed is ----------					
Making of *irukere* from cow tail is ----------					
Preparation of black soap (*osedudu*) from grounded mixtures of bark of plantain trees and cocoa pods is ----------					
Collection of coconut shell as a source of household cooking fuel is ----------					
Weaving of mats from coconut leaves is ----------					
Collection of maize shafts and stalks as source of animal feed is ----------					
Making *ogunso* from remains of oil palm processing for household cooking fuel is ----------					
Weaving of basket from palm fronds is ---------- task					
Making of brooms from palm leaves is ---------- task					
Making of benches from stem of palm trees for sitting is ----------					
Preparation of concoction for treating malaria using mixture of guinea corn stalk and some other herbs is ----------					

Section H: Subjective norms

Please indicate extent of how likely or unlikely the opinion/view discouragement from parents, friends and peer may influence your choice to engage in farm waste utilisation behavior/act indicated in the following statements

1 – Extremely unlikely; 2 – most unlikely; 3 – not sure; 4- most likely; 5 – extremely likely

Statements	1	2	3	4	5
Collection of animal dropping, soaking them in water and spraying them on my crop as protection from sheep and goats to feed on them					
Collection and piling of cassava peels for mushroom production					
Collection of animal faeces, such as sheep and goat dung, drying and spreading them on farm land as a form of manure					
Collection of poultry droppings and supplying it as fish feed for those engaging in fish production					
Collection of cow dung for biogas production					
Carving animal bones into plate, cutleries, flutes and other decorating materials					
Collection of animal bones from slaughter slabs, drying and grinding them into					

powdery form as a source of protein content in poultry feed					
Making of *irukere* from cow tail					
Preparation of black soap (*ose dudu*) from grounded mixtures of bark of plantain trees and cocoa pods					
Collection of coconut shell as a source of household cooking fuel					
Weaving of mats from coconut leaves					
Collection of maize shafts and stalks as source of animal feed					
Making *ogunso* from remains of oil palm processing for household cooking fuel					
Weaving of basket from palm leaves					
Making of brooms from palm leaves					
Making of benches from stem of palm trees for sitting					
Preparation of concoction for treating malaria using mixture of guinea corn stalk and some other herbs					

APPENDIX II

FOCUS GROUP DISCUSSION AND KEY INFORMANT GUIDE

1. What are waste materials generated in course of your livelihood pursuits?
2. What are other waste materials available in this community not made mention of above?
3. Do you attach any importance to any of these materials, i.e. do you regard them as useful or worthless?
4. Which of these waste materials do you make use of?
5. Give reason for your choice and why do you not make use of the other ones?
6. Are there any taboos, whether religious, cultural, or any other one associated with utilisation of farm wastes in this community?
7. Are you aware you can generate enormous wealth/aware of wealth generating potentials of these farm wastes?
8. Has extension ever played any role towards enhancing your use farm waste materials?
9. Have you ever attended any training/seminar programme that focussed on farm waste utilisation?
10. What are constraints inhibiting you towards utilisation of farm wastes?

APPENDIX III

PICTURES OF SOME IDENTIFIED FARM WASTE ITEMS

Plate 1: Slaughtered animal bones

Plate 2: Empty palm fruit bunch being burnt

Plate 3: Palm kernel shell (PKS)

Plate 4: PKS bagged for sale

Plate 5: Cocoa pod discarded after removal of the bean to decay

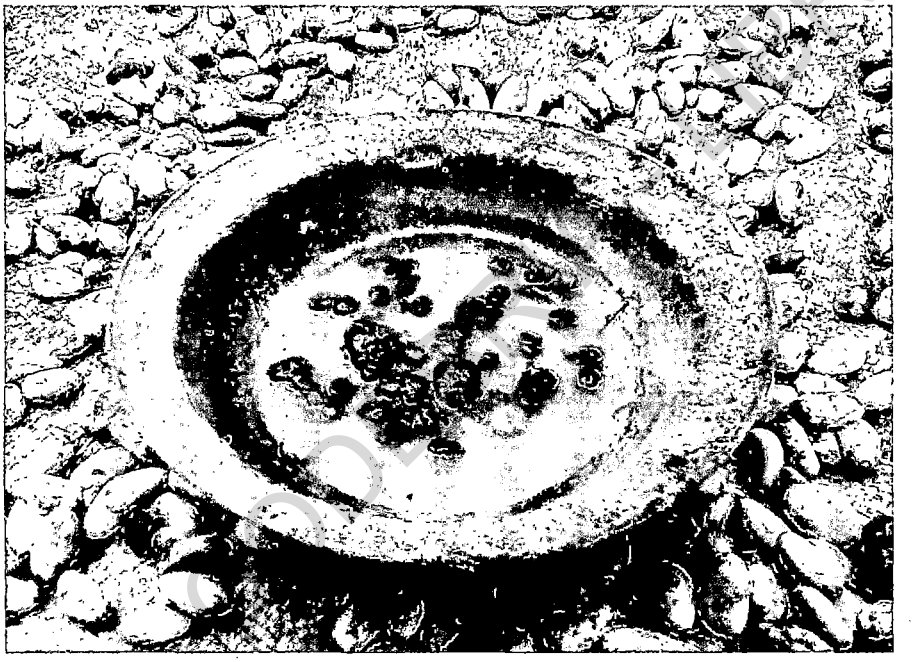

Plate 6: Goat faeces spread over cocoa beans as protection measure from sheep and goat

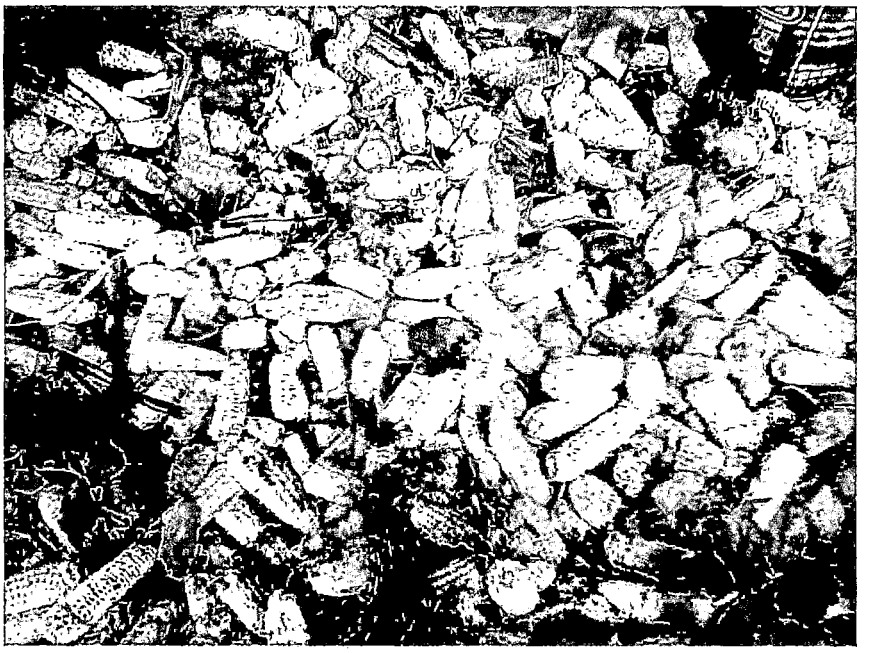

Plate 7: Decaying maize cobs

Plate 8: Cassava peels

Plate 9: Maize stover littering the rural environment

Plate 10: Empty palm fruit bunches