Walking the sweet orange chain: Agri-food geographies of citrus losses

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Statement about Joint Authorship

The authors of the journal articles (chapter 6-10) and extent of contribution are below:

- Sarem Ugoh was responsible for the conception, design, collection, analysis, and interpretation of data. She drafted various versions of the articles and made final revisions based on feedback received.
- Michele Clarke provided guidance on all the steps involved in data collection, analysis and interpretation. Also provided feedback on each of the draft papers.
- Sarah Jewitt - Provided guidance on all the steps involved in data collection, analysis and interpretation. Also provided feedback on each of the draft papers.

The Joint authors agree with the description of the extent of their contributions as detailed above.

Abstract

Food waste in recent years has become an international priority because of the large amounts of food wasted from farm to fork. In low-income countries like Nigeria, losses are significantly higher along the food chain from production to retail. There is a dearth of research that considers various crop value chains in different geographical regions and the prevailing conditions that influence these losses. Nigeria produces 3.9 million metric tonnes of citrus annually and it estimated that 30-70% is lost to postharvest losses.

This study investigated the causes of losses from farm to fork along the citrus value chain in Nigeria. It adopted the 'follow the thing' framework to trace the journey of an orange from the farm to the consumers' home. A multi-method methodological strategy was employed to capture the causes and impacts of losses from the perspective of core actors with the use of questionnaires, interviews and field observations.

Empirical findings suggest that citrus postharvest losses are between 10-100%. Losses were found to result from an absence of processing facilities to provide a ready market for fruits. Other causes include improper postharvest handling in the form of poor harvesting techniques, inadequate storage, packaging and transportation facilities. These losses had negative impacts on the livelihood of the actors, as they directly reduced the income they obtained. The most important cause of losses identified was the lack of political willpower due to bad governance in the provision of processing facilities. This further provided a disabling environment for the citrus market to thrive. The thesis recommends 'follow the thing' as an adequate framework to study and understand postharvest losses.

Chapter 1: Introduction

1.0 Overview of Food Losses

In many countries there is a knowledge gap and/or [physical] distance between producers and consumers of food. People are oblivious to the path travelled by food to get to their plates because the food production system functions properly (Clapp, 2012), or so we think. Tracing the journey of food from points of production to consumption has revealed inefficiencies in the global food system (Watson, 2013c). This is because about 4 billion metric tonnes (MT) of food are produced yearly but approximately 1.3 billion tonnes are wasted, that is 30-50% of global production (Lundqvist *et al*., 2008, Gustavsson, *et al.* 2011). This indicates that a third of what is produced is not consumed; rather it is lost at various points along The Food Supply Chain (FSC). The volume of waste (1.3 billion tonnes) is equivalent to the total amount of food produced in Sub-Saharan Africa (SSA) (Gustavsson *et al*., 2011). Estimates on the magnitude of losses are critiqued due to the lack of actual measurements and a standard postharvest methodology (Parfitt *et al*., 2010, Affognon *et al*., 2015). They however reveal an inefficient food system that has prompted wide spread research to understand why food that was intended for consumption turned to waste (Watson, 2013c). With an increasing population and high levels of food insecurity, the management of losses has become a global concern and priority; there is a need to manage the food crisis sooner than later (Parfitt *et al*., 2010, BSR, 2011).

Losses occur at different points along the supply chain, postharvest losses (PHL) take place from production to retail and consumption losses are known as post-consumer waste. As a result, postharvest losses are prevalent in low-income countries, while consumption waste is higher in middle and high-income countries (Grolleaud, 2000, Gustavsson *et al*., 2011). Postharvest losses are crop and region specific due to the various biological, cultural, social, economic and political factors that influence

losses (Kader, 2005, Hodges *et al*., 2010). Therefore, the quantity of losses will vary amongst grains, roots, tubers, fruits and vegetables, and occur at different stages of the FSC, which is a complex system to analyse (Lundqvist *et al*., 2008). The paucity of postharvest research in most low-income countries is due to the absence of adequate postharvest data collection systems (Parfitt *et al*., 2010), with available studies revealing questionable methodologies (Kitinoja and Kader, 2015). Nevertheless, postharvest losses generally occur as a result of inefficient harvesting and processing technologies, early harvesting (because of the bad weather or food deficiency), poor storage, inadequate/lack of transportation, improper handling leading to physical damage, microbial deterioration, attack from pests and diseases, high temperatures, hot and humid climate and lack of market chains/ networks (Spurgeon, 1976, Lundqvist *et al*., 2008, Hodges *et al*., 2010, Gustavsson *et al*., 2011, Bond *et al*., 2013)

The history of postharvest research has focused more on staple foods despite fruits and vegetables experiencing more losses (Parfitt *et al*., 2010). Various figures for the quantitative losses of fruits and vegetables are cited: the National Academy of Sciences report in 1979 claimed that between 20-95% of fruits were lost in low-income countries (FAO, 1981); Mrema and Rolle (2002) estimate 25%; while Kitinoja and Kader (2015) suggest 45% of fruits are lost in Sub-Saharan Africa. The magnitude of losses has created a gradual shift towards the management of PHL in horticulture (Choudhury, 2006). However, crops like citrus are seen as less perishable than tomatoes and thus not studied with the same intensity (Kader and Arpaia, 2002).

Post-consumer waste results from consumer preferences and behaviours in regards to their diets and a "*careless attitude*" towards managing food (Gustavsson *et al*., 2011:v, Watson, 2013c). Cosmetic standards set by retailers result in perfectly edible food being disposed of as waste because they do not meet requirements on size, shape and colour (Hodges *et al*., 2010, Gille, 2012). The various wordings of date labels: 'use by', 'best before', 'best by' and 'sell by' result in losses, as some consumers throw

food away that is still in date because they do not understand what the labels mean (Ventour, 2008, Milne, 2012). Research on post-consumer waste is focused on middle and high-income countries, with data for low-income countries almost non-existent. Food waste research is limited by the absence of a uniform definition that creates room for contentious issues such as over nutrition to be considered as food waste (Parfitt *et al*., 2010). This goes on to reveal broad political issues surrounding inequalities in the global food system (Watson, 2013c).

The analysis of several crop value chains in different countries by *Gustavsson et al*. (2011) and Affognon *et al*. (2015) revealed the dearth of data on the causes of postharvest losses specific to individual crops and the necessity for more applied postharvest research. Postharvest losses occur on the farm and beyond the farm gate where postharvest activities such as sorting, packaging and retail take place (Parfitt *et al*., 2010, Affognon *et al*., 2015). A limited understanding of crop value chains makes the management of losses difficult (Affognon *et al*., 2015). The social aspects of postharvest losses are mainly absent from the study of losses, when in reality socio-economic, cultural and political factors have significant impacts since PHL do not occur in a vacuum (FAO, 1981, Affognon *et al*., 2015). In order for food waste to be understood and managed effectively, studies need to go beyond quantification and answer questions on how much is wasted, what is wasted and where, how is it wasted and when? These will begin to provide answers and give an understanding of the factors involved in food waste generation (Eriksson *et al*., 2012).

1.1 Background to the study

Nigeria produces 3.9 million metric tonnes of citrus annually (FAO, 2012). In 2012, Nigeria was the 9th highest producer of citrus in the world providing 3% of global production (UNCTAD, 2010, FAOSTAT, 2012). FAOSTAT (2012) estimated the production value of Nigeria's citrus production at 1.76bn USD. Citrus production contributes to the income of small-scale farmers. The tree crop is economical as it has the ability to

produce high yields and can be sold at high prices so farmers receive a good income (Onwualu *et al.* 2013, Ibeawuchi *et al.* 2015). As a result, citrus is the second largest fruit crop grown in Nigeria (FMARD, 2014), however, it is one of the crops significantly affected by postharvest losses. Estimates for citrus PHL range from 30-70% and limited progress has been made by the Nigerian Government to manage the losses (NIHORT, 2002, Jolaoso *et al*., 2011b, Okigbo, 2012, Olife *et al*., 2015). Horticultural losses are difficult to measure and can be as high as 100% when the fruits are not harvested. This happens when the cost of transportation to markets is extremely high and farmers decide to leave their fruits on the trees to be used as future manure (Onwualu *et al*., 2013). The wide range of loss estimates highlights the main problems with postharvest research – the need for a standardised methodology for the measurement of losses, as well as the absence of baseline surveys on citrus losses in Nigeria.

The study of citrus postharvest losses has been relatively neglected in Nigeria when compared to other fruits such as tomatoes. Thus, postharvest research on citrus is lacking; library, internet and database searches revealed limited information on the subject. Available studies have addressed different aspects of the citrus chain, such as demographic features of citrus producers, health benefits, pests and diseases (Umeh *et al*., 2004, Ezeibekwe, 2011, Ortese *et al*., 2012). Other authors have attempted to review the causes and level of losses at different stages of the chain. Adebamji (2011) evaluated the impact of postharvest losses on the income of small-scale citrus farmers. He noted that farmers incurred the most losses during transit when they transported their fruits to market and this resulted in the generation of relatively low revenue. Similarly, Idah *et al*. (2007) identified how the lack of proper packaging and poor transportation facilities caused major losses during transportation. Idah *et al*. (2007) also indicated citrus was the main fruit transported from southern to northern states in Nigeria.

Ekefan *et al*. (2004) reviewed postharvest handling of citrus in six wholesale markets in Benue State. The study concluded that losses were

incurred because of the lack of temperature control, mechanical damage during harvesting, packaging and transportation, and the process of storage in the markets. These factors greatly contributed to the marketers experiencing about 21.6% losses. The losses suffered were estimated to be over 50% when fruits were transported to other states in the country due to low sales (ibid.).

An analysis of the risks farmers perceived posed threats to their rates of production was undertaken by Fakayode *et al*. (2012). Farmers in Osun State identified damage by pests, diseases, traditional farming methods, dependence on weather, expensive inputs and high postharvest losses as production risks. Surprisingly the farmers did not regard a lack of technical knowledge in production and processing and infrastructural bottlenecks as important risks. At the market however, the low price of produce, perishability of produce, exploitation by intermediaries, poor handling and packaging and high market costs were the main risks (Fakayode *et al*., 2012). In 2015, Olife *et al*. (2015) provided an overview of the challenges facing value addition along the citrus value chain and identified that postharvest losses were significant. A few studies have surveyed how often fruits are consumed in south-western states (Adebamji and Omotola, 2009, Layade and Adeoye, 2014).

The above review shows that there is no research on the entire value chain from farm to consumer in Nigeria. Studies have aimed at identifying causes of losses at different points along the chain without considering the impact of socioeconomic and cultural factors influencing the losses. In Benue State, the hub of citrus production, there is an alarming paucity of citrus postharvest research. As stated earlier, research on consumption is almost non-existent in low-income countries and this is evident in Nigeria. Accordingly, there is very limited research on the consumption of citrus in Nigeria.

1.2 Research problem

There is a dearth of agricultural research in Nigeria and this involves food system research. Despite the importance of managing postharvest losses in low-income countries, research studying different crop value chains is lacking. A majority of the available research comprises of recycled generalised data on Africa not Nigeria. In Nigeria, more emphasis is placed on the study of grains, roots and tubers over fruits and vegetables (Atanda *et al*., 2011). Most of these studies are focused on production, on the farm, not after the farm gate (ibid.). Nigerian agricultural policies have favoured production over post-farm activities (Adepoju, 2014). The bulk of intervention programmes led by international organisations have been concentrated on grains and perishables such as tomatoes and peppers (ibid.) Before 2011, the Nigerian Government had barely tried to manage PHL; the Agricultural Transformation Agenda in 2011 was dedicated to adding value to food crops from farm to fork with the management of PHL as one of its objectives. However, the emphasis was on staple food crops with fruits and vegetables omitted, because Nigeria had a comparative advantage in the former (FMARD, 2011, Adesina, 2012).

There is inadequate commodity-specific research in Nigeria. More importantly, applied research is lacking in Nigeria on the citrus value chain. Undergraduate theses were identified in the University of Agriculture in Benue State, most of which simply described the socioeconomic characteristics of citrus farmers and marketing channels. No study was identified on citrus postharvest losses. The unavailability of research in this area means that there is a lack of awareness and low understanding of citrus postharvest losses. The scarcity of research on the consumer reflects deep-rooted preconceptions of consumer waste not being a problem, because of the view that consumers in low-income countries do not have the luxury to waste food. At the same time, solid waste management research identifies organic matter (food waste) as contributing a significant amount of wastage (Sha'ato *et al*., 2007, Nahman *et al*., 2012, Ogwueleka, 2013).

Despite the high levels of citrus production in Nigeria and the increasing level of losses, citrus fruits are not regarded with as much attention as tomatoes. This is because orange waste is viewed as a 'normal thing' in Nigeria, where rotten oranges during the seasonal glut are not seen as a problem, because that is how things have always been. During seasonal gluts, the management of oranges in markets is problematic (Onwualu *et al.* 2013). With the absence of storage and processing facilities fruits rapidly decay and cause a disposal problem, as they end up in heaps around the market and in gutters, producing bad odours, attracting flies and insects and acting as a breeding ground for disease vectors (see figure 1.1). Oranges also end up in large quantities in open dumpsites (Ibrahim, 2017). However, more efforts in research and intervention programs have been placed on tomatoes and peppers rather than oranges, even though oranges are the second largest crop produced in the country. The seasonal glut results in high wastage levels in markets. This failure to see citrus as important revealed a knowledge gap, prompting questions on why importance cannot be placed on fruits like citrus that experience high postharvest losses and contribute greatly to the income and livelihoods of small-scale farmers (Onwualu *et al.* 2013, Ibeawuchi *et al.* 2015)?







Figure 1.1 Orange waste in open dumpsites in Makurdi markets.
Author's photographs. 23rd November 2014.

This neglect of the citrus industry is also evident in the continued importation of concentrates against the use of domestic fruits for fruit juice production and the management of postharvest losses. When the production value of 1.76bn USD is viewed against the annual cost of imported concentrates (200MN USD) it is incomprehensible. Nigeria's conservative production value estimate shows that the Nigerian economy will benefit positively from developing the citrus industry. The level of losses experienced have been suggested to be as a result of the lack of ready markets for the fruits, in the form of processing facilities, therefore investing in an enabling environment for fruits has enormous benefits (Olife *et al*., 2015). LaGra (1990) contends that countries will not invest in the management of PHL if there are no significant foreign exchange benefits. However, the above figures clearly point out the potential value of the horticultural industry. It is apparent that Nigeria is unaware of the benefits accrued to managing citrus postharvest losses even though it has been identified as a fruit crop with comparative advantage (Adelaja *et al*., 2005).

The literature reveals a gap in the aspects of postharvest losses that are studied; namely the socioeconomic, cultural and political factors that influence losses are largely ignored. Likewise, postharvest research is focused on farmers while other key actors (intermediaries and traders) are side lined, even though the losses that occur from farm to fork have negative consequences on all the actors in the chain. The consumer is usually not considered in the study of the supply chain. The absence of consumer waste research as stated earlier reflects broader views of consumer waste as more important in western countries; therefore, local consumers in low-income countries are excluded from value chain studies (Raghuram, 2004, Hodges *et al*., 2010, Gregson *et al*., 2010).

1.3 Geographical research on the food system

Food waste research has become increasingly political because of issues of food insecurity and famine in the global south, alongside topics of excess and obesity in the global north (Patel, 2012, Alexander *et al*. 2013). At the

same time, food waste has been noticeably absent from geographical literature (Alexander *et al*. 2013, Evans, 2014). Food research scholarship has not really attended to food waste because the 'waste' is viewed as "*the last point on the line of production, distribution, and consumption*" making it "*an afterthought in mainstream food research*" (Alexander *et al*., 2013:472). However, in recent years things have begun to change. The Economic and Social Research Council from (2006-2011) funded 'The Waste of the World project' (ESRC, 2014) and addressed the issue of food and waste from a social sciences perspective. It avoided looking at waste as the end product of an object that is useless, focusing instead on the processes that objects or commodities pass through before becoming waste (the transitions). Likewise, Evans (2012, 2014), Watson and Meah (2012) explored the processes that result in the characterisation of food as waste in ethnographic studies; borrowing themes from waste scholarship, material culture, consumer culture, practice theory and geographies of commodities (Watson, 2013c). Alexander *et al*. (2013) also identify that food waste occurs at different points along the value chain and suggest that future research should take this into consideration because decisions that result in the actual production of waste in the home may have resulted at earlier points along the chain. Similarly, Evans (2014) and Alexander *et al.* (2013) have called for the study of entire food systems. These suggestions are however in reference to consumer waste; these processes and transitions are not explored for postharvest losses, neither are entire value chains in geographical literature.

Political economy derived approaches such as commodity chains have explored food systems in various ways (Hughes and Reimer, 2004). Geographical literature uses commodity chains or 'follow the thing' as an approach to explore inefficiencies in the food system, from areas of production to consumption, commonly known as farm to fork, to investigate the various processes that food goes through before it gets to our table (Cook *et al.*, 2006, Jackson, 2014). With the globalisation of agriculture, the food system has become more complex including multiple actors, extended along geographical spaces and places, that shape the food

system and is in turn shaped by them (Jackson, 2014; Marsden, 2013). Production and consumption have been viewed as "*geographically distant*" (Hughes and Reimer, 2004:7), but with the use of case studies, commodity chain studies have aimed to capture relations between consumers and producers, not viewing them as separate but as various sites within the system. Here, an analysis of a commodities system captures the political, economic, social, environmental, ethical and legal dimensions of the agri-food system and the way the entire system impacts the consumers' everyday life (Pritchard, 2013, Jackson, 2014). They have also been used for the reduction of waste along food chains (Jackson, 2013b).

Geographical study of food waste has not explored entire value chains in particular spaces; production to retail is analysed in low-income countries to provide more quantitative data on the level of losses (Lundqvist, 2008, Gustavsson, *et al*., 2011, IMECHE, 2013), while in middle and high-income countries research usually focuses on the consumer, with a growing shift to everyday practices that influence waste patterns (Evans, 2011, 2014, Watson, 2013c, Watson and Meah, 2014). Commodity chain studies, on the other hand, follow the movement of commodities consumed in the global north and produced in the global south to reveal the hidden story of the chain (Brandt, 2002, Cook *et al*., 2006). Both food waste and 'follow the thing' research have neglected the transitions that result in PHLs in low-income countries and the local consumer. In 2004, Hughes and Reimer suggested that commodity chains be used as a methodological approach to study production and consumption at different spatial scales that are not globalised in nature. Similarly, Affognon *et al*. (2015) recommended that postharvest losses be explored within the context of value chains to capture socio-economic, cultural, political and environmental factors that resulted in losses.

1.4 Aim and Objectives

In light of the problems, gaps and suggestions detailed above, this research adopts a commodity centred approach to critically explore the typical citrus chain in Nigeria. With an emphasis on postharvest losses, it aims to

understand the processes that result in the production of losses along the chain, by identifying the immediate actors, exploring their relationships, determining the causes of losses and revealing social, political, cultural, environmental and economic factors that drive citrus losses in Nigeria, from the perspective of the immediate actors. The research objectives are:

1. To provide a critical analysis of the citrus value chain in Nigeria with particular emphasis on the roles played by key actors and how these roles are gendered;
2. To identify the key causes and entry points of orange losses along the chain, and explore the economic impacts on actors' livelihoods;
3. To identify external institutional factors and constraints to the management of postharvest losses;
4. To explore the concept of post-consumer waste in Nigeria and identify consumer preferences and everyday behaviours that result in the disposal of oranges in the home;
5. To recommend a framework for the study and understanding of postharvest losses.

This thesis is aimed at understanding the causes of citrus postharvest losses from the perspective of chain actors. It identifies hotspots within the chain and explores what the actors view as the impacts of the losses.

1.5 Justification of the study

The management of postharvest losses in low-income countries has received significant attention in recent years. This awareness was furthered by the Malabo Declaration in 2014 and the Sustainable Development Goals (SDGs) in 2015 (AUC, 2014, United Nations, 2015). These declarations highlighted the importance of managing postharvest losses in the face of an increasing population and food insecurity. Local newspaper articles such as 'Apathy is the bane of horticulture industry in Nigeria' (Agbo, 2014); 'Despite juice factory, Benue fruits rot away' (Kajo, 2012) and 'Nigeria: Wasting fruits at home, importing juice from abroad' (Yusuf, 2014) condemn the high level of citrus losses, ignorance and lack

of political will of the Nigerian Government. They also show an increasing awareness of the problem of postharvest losses. Intervention programmes sponsored by international organisations mainly the FAO and World Bank have been focused on staple crops in Nigeria and tomatoes, revealing notable exclusions – horticultural crops including citrus fruits. The Nigerian Government has not shown significant interest in the management of citrus losses. With renewed interest on PHL, this research is timely, because it draws attention to the magnitude of losses and their resulting social consequences.

This study adopts a commodity centred approach that involves following the fruit from when it is harvested to the consumers' home. The use of a 'follow the thing' (Cook *et al*., 2006) framework with a focus on postharvest losses provides a different perspective to understanding and analysing this phenomenon locally. A geographical 'follow the thing approach' allows the 'technical value chain' to be followed but views the commodity chain as a system and thus engages with the various actors and explores different stakeholders within a community of the fruit from farm to consumers' home (Spurgeon, 1976, Grolleaud, 2000). The specificity of 'follow the thing' makes it possible for a particular crop to be followed within a geographical region, providing applied research that is lacking in literature on postharvest losses.

The supply chain is simple in Nigeria and the immediate actors are farmers, intermediaries, traders and consumers. Most of the fruits are purchased and sold in local fruit markets. The simplicity of the value chain does not reveal the relationships and operations that occur simultaneously. While my research adopts the backbone of walking the citrus chain, it studies the chain as a complete system to reveal the areas where postharvest losses occur and includes the underlying operational dynamics and the social interactions between the actors. The dynamics of the value chain are critical in understanding postharvest losses along the chain.

In addition, this approach fits appropriately with the use of key spaces including the farm, transit market and the home, as themes to delineate the chain and explain the transfer of fruits from one actor to the other and their social relationships. This study does not go beyond the initial consumer of the fruit to study its end life and death, but walks the chain up until the consumer to propose that consumers in low-income countries should be included in commodity chain and food waste research.

This research is unique in its approach to studying postharvest losses in Nigeria; it will bridge a gap in the literature by providing applied research that is specific to a crop and geographical region. It will present a better understanding of the relationships between the immediate actors, and reveal socio-economic and cultural issues that may be important to policy making. This research will highlight the realities of citrus losses in Nigeria, their impacts on actors and draw attention to problems that are largely ignored in the global south while contributing to the geographical pool of knowledge on postharvest losses. Walking the chain up to the consumer moves beyond the norm in commodity chain and food waste research that has failed to address consumers in low-income countries and entire supply chains within a country. This indicates a need for the burgeoning food waste literature to capture these two elements.

1.6 Structure of thesis

This thesis does not follow the conventional PhD style, but is set out as a PhD by published works. The main difference in structure is evidenced in the results chapters that are presented as individual articles of publishable quality – with some already submitted for publication and others in draft form for publication. The results chapters are divided into key spaces as stated earlier.

Chapter 2: The food waste conundrum: exploring losses within food supply chains

This chapter builds on the overview of postharvest losses and post-consumer waste in chapter 1. A history of postharvest losses from the

1970s to date is provided. This includes the expansion of the focus of PHL from grains to include roots, tubers and horticultural crops. Then it discusses the methodological debates and gaps available in literature relating to the lack of a standardised methodology for PHL.

Chapter 3: Theoretical framework

This chapter provides the theoretical framework of the thesis. It explores further the commodity chains approach that is introduced in chapter 1 and discusses its applicability to study postharvest losses and consumer waste.

Chapter 4: Setting the scene: Background information on Nigeria

This chapter provides background information on Nigeria, setting the context for the thesis. It discusses the introduction of citrus into Nigeria, citrus production and consumption and presents available information on postharvest losses in citrus and other crops.

Chapter 5: Methodology

This chapter discusses methods employed in the process of gathering and analysing data by providing a detailed account of the fieldwork. It concludes with a discussion of the limitations of the research, positionality and ethical issues.

Chapter 6: On-farm citrus postharvest losses: A case study of Benue State, Nigeria

As stated earlier, the thesis explores losses in key spaces. The empirical chapters reflect these spaces. This is the first results chapter and examines the causes of citrus losses on the farm, from the perspective of citrus farmers. This chapter has been submitted for consideration for publication to the *American Journal of Agricultural Economics*.

Chapter 7: Distance decay

This article focuses on transit and market spaces and explores the movement of fruits from the farm to the market. It captures the causes of losses from intermediaries and market traders. This chapter is in draft form for publication.

Chapter 8: Tale of an orange

This paper was presented at the 3rd All Africa Horticultural Congress in Nigeria on the 9th of August 2016. It has been accepted for publication and will be published as part of the conference proceedings. It provides an account of an orange from farm to market and pulls together chapters 6 and 7. The paper also discusses the gender divide among the value chain actors and the high cost of inputs for production.

Chapter 9: Commodity chain analysis as an approach to studying postharvest losses

This article provides a comprehensive review of the literature on the Nigerian agricultural sector focusing on the lack of policies to manage postharvest losses. This opens up a discussion on the political economy of agriculture in Nigeria. It proposes the use of commodity chain analysis as a methodological approach for the study of postharvest losses. This chapter analyses results from chapters 6, 7 and 8 to develop a market map that explores higher-level factors influencing postharvest losses. This paper has been submitted to *The Journal of Development Studies* for consideration for publication.

Chapter 10: Geographies of consumption: Rethinking consumer preferences and post-consumer waste within low-income countries using Nigeria as a case study

This article focuses on the home space and discusses the absence of low-income country consumers from commodity chain and food waste research. It provides results of citrus consumers in Nigeria to explore their behaviours and preferences. The article has been submitted to *Applied Geography* for consideration for publication.

Chapter 11: Connecting the dots: postharvest losses, post-consumer waste, citrus and Nigeria

This chapter provides a discussion and summary of the main findings of the thesis. It also discusses the contribution to knowledge, provides policy recommendations and rounds off with limitations and areas for further research.

Chapter 2: The food waste conundrum: exploring losses within food supply chains

2.0 Introduction

This chapter explores food losses that were introduced in chapter 1 in-depth. The concepts are defined and a history of postharvest losses and food waste is provided along with major themes underscoring research on these topics. Global statistics, the causes of losses in various locations and the gaps in food loss methodology research are discussed. As stated in Chapter 1, there is limited reliable data available on global losses, as well as in Nigeria, which limits the scope of this review.

2.1 Definitions

Food research is laden with different definitions for food that was intended for human consumption and not consumed. In 1981 the FAO defined food waste as "*wholesome edible material intended for human consumption, arising at any point in the Food Supply Chain that is instead discarded, lost, degraded or consumed by pests*" (no pagination). This definition has been subject to interpretation due to the causes and entry points of losses along supply chains. Research from the 1970s t0 date has referred to losses before the consumer as postharvest losses (Bourne, 1977, FAO, 1981, Grolleaud, 2000, Atanda *et al.*, 2011). Postharvest losses are the qualitative (distorted physical condition) and quantitative (weight or volume) reduction in the value of food. These occur earlier on along the FSC, during production and postharvest stages before the food gets to the consumer (Lundqvist *et al.*, 2008). These losses are also referred to as 'spoilage', or 'food losses'. Postharvest losses are prevalent in low-income countries (LICs). In recent years, the concept of food waste has expanded to include the consumer and the losses that occur during retail and processing. This type of loss is referred to as 'food waste' or 'post-consumer waste', resulting from processing, retailers, consumer behaviours' and preferences (Parfitt *et al.*, 2010) and occurs in homes or

commercial institutions (Lundqvist *et al.*, 2008). Post–consumer waste occurs more in middle and high-income countries (MICs and HICs).

HLPE (2014) claim that the study of food waste has been approached from two different angles, a food perspective that focuses on food security challenges and a waste perspective that addresses environmental concerns. They assert that the definition of food loss and waste result from these distinctions. On the other hand, Gille (2012) argues that the definitions are driven by social inequalities that spatially distinguish the cause of waste. Economic and development differences underline the study of food waste, available statistics and biased viewpoints categorise and relate postharvest losses largely to low-income countries and food waste to middle/high income countries. As Hodges *et al.* (2010:38) state, consumer waste in LICs is not a "*reported concern*" while postharvest losses are "*not significant*" in HICs (Parfitt *et al.*, 2010:3069). These differences in the study of postharvest losses and post-consumer waste reveal broader insecurities about the global food system that revolve around 'want' in some areas and 'excess' in others. This is associated with postharvest losses and issues of food insecurity/undernourishment at one end of the spectrum and post-consumer waste and issues of obesity/over nourishment at the other end; a situation that Raj Patel addresses extensively in his book '*Stuffed and Starved*'(Patel, 2007).

The causes of losses and waste along FSCs reveal inefficiencies and inadequacies from farm to fork, in the global north and south (Exodus, 2007a, Lundqvist *et al.*, 2008, Gustavsson *et al.*, 2011, Nahman *et al.*, 2012, Eriksson *et al.*, 2012). Bond *et al.* (2013) suggest that the entire FSC has to be taken into consideration to reduce the amount of waste produced. The entire chain has to be managed in every country with respect to its needs, even if more attention should be paid to the areas with more losses and waste.

The ambiguity and lack of a uniform definition is a significant problem for food waste research because it causes uncertainty in food loss/waste management (Watson, 2013c). It also restricts the understanding and

comparison of data (HLPE, 2014). For this thesis, the distinctions of losses before the consumer and after are applied and referred to as 'postharvest losses' and 'food/post-consumer waste'.

2.2 History of Postharvest Losses

In 1974 and 1975, the World Food Conference and 7th Special Session of the United Nations (UN) General Assembly respectively drew special attention to the importance of managing postharvest losses (Grolleaud, 2000, FAO, 1989). This was driven by the fact that African Sahel countries were beginning to suffer from famine and drought, thus the management of PHL seemed appropriate if drought and nutrition were to be alleviated (FAO, 1981). The loss of a large proportion of their grains resulted in lowered nutritional standards and the economy of affected countries were destabilized (FAO, 1980). At the time the FAO quoted 15% as the level of losses in low-income countries (Grolleaud, 2000). The awareness of postharvest losses was increased by Spurgeon (1976) and Bourne (1977). Spurgeon's (1976) '*Hidden Harvest*' booklet underlined the fact that the postharvest phase (from production to the consumers table) was one aspect of the chain that had received much less attention. In 1977, Bourne recognised that the production of more food in low-income countries was not the solution to inadequate food supply but rather suggested the management of postharvest losses was more effective. He referred to PHL as a "*neglected avenue*" (p. 2) that failed to get food produced for consumption to the ultimate consumer for whom it was intended. These two studies were influential in increasing awareness on postharvest losses and the concern for its management was regarded as a high priority (Grolleaud, 2000).

In 1975, the UN General Assembly resolved to reduce the level of losses by 50% in the year 1985. Boxall *et al.* (1979) criticised the lack of context by the UN resolution to reduce PHL by 50% claiming that there was no uniform definition of losses and reliable estimates to support the resolution were scarce. The UN called on international organisations and relevant countries to make loss prevention a priority (Bourne, 1977, FAO,

1981). Accordingly, in 1978, the Food and Agriculture Organization (FAO) of the UN launched the *Special Action Programme for the Prevention of Food Losses*. This prompted in-depth surveys and extensive research to understand postharvest losses, refine its definition, concepts and methodologies and recommend appropriate solutions (Spurgeon, 1976, Grolleaud, 2000). There were programmes created and existing ones expanded to accommodate the reduction of PHL (FAO, 1981). There was a general reflection on the lack of awareness of the causes of losses and their magnitude in low-income countries. Three major causes of PHL and limitations to its prevention were identified: the lack of information on the magnitude and causes of losses, the lack of infrastructure and the lack of investment (De Las Casas, 1982). The FAO embarked on diverse projects to provide manuals, field reports, surveys and observations on the management of food crops after harvest (Grolleaud, 2000). As a result, a majority of the material on PHL in Africa to date are products of FAO and World Bank led projects.

The programmes were initially focused on staple foods (grains, legumes, oilseeds, cereals) because of their prominence in the diet of low-income countries (FAO, 1989). Postharvest reduction of perishables received little attention for several years. Bourne (1977) identified the need to expand the commodities under the program, highlighting that roots and tubers were widely consumed in LICs. In 1989, the program was expanded to include roots, tubers, fruits and vegetables. This was after a 1978 report by the United States National Academy of Science emphasised the importance of including perishables (FAO, 1989).

In December 1982, the total number of Prevention of Food Loss projects by the FAO was a hundred and eight amounting to 30.2 million USD. Of the total amount, 30% were in Africa, 29% in Asia, 19% in Latin America and the Caribbean and 14% in the Near East and North Africa (De Las Casas, 1982). After the Special Action Programme for the Prevention of Food Losses ended in the early 1990s, over 250 programmes had been implemented to reduce PHL (FAO, 2011). These programmes and others

implemented have recorded minimal success. Most of the interventions directed towards LICs in the 1970s and 1980s were technological but the adoption rate by host countries was relatively poor (World Bank, 2011). There are no accounts of the progress made to reduce PHL by 50% in 1985 (Affognon *et al.*, 2015). After the stabilization of food prices, focus on postharvest losses dwindled (World Bank, 2011).

2.3 The Current State of Postharvest Losses

The increase in food prices in 2006, 2008 and 2011 ignited renewed interest in postharvest losses (Affognon *et al.*, 2015). Similar to what occurred in 1974 and 1975, PHL become an international concern. In 2014, African Heads of State gathered for the African Union (AU) Summit in Equatorial Guinea where they developed agricultural goals (Malabo Declaration) against 2025. A significant outcome of the summit was an agreement on the necessity for agriculture to be a high priority on government agendas for economic growth and poverty management. One of the aforementioned goals is "*to halve the current levels of Post-Harvest Losses, by the year 2025*". The AU appealed to governments, institutions and development partners to support the goals by providing technical and economic support (AUC, 2014). Similarly, the United Nations in 2015 produced the Sustainable Development Goals (SDGs). Goal 12 states "*Ensure sustainable consumption and production practices*" and the UN calls for the reduction of postharvest losses by half in 2030 (United Nations, 2015). These declarations reveal the importance and significance of postharvest losses in low-income countries.

Critiques of the 1975 UN resolution by Boxall *et al.* (1979) were made on the grounds that the objective lacked context, food loss definitions were ambiguous and available losses estimates were unreliable. These concerns are still applicable to the 2014 and 2015 declarations above. Satterthwaite *et al*. (2015) critique the lack of context for the SDGs in sanitation and the same logic is applicable for postharvest losses. They assert that sanitation needs vary greatly within communities and these differences have been neglected in development literature. This is true for PHL that vary by

country and associated socioeconomic and cultural and political factors. These differences have been neglected in food waste research. As a result, for these targets to be achieved Satterthwaite *et al*. (2015) suggest that data that provides context is required for adequate solutions to be provided.

The above declarations do not provide "*a well-defined objective*" to direct the 'goals' of intervention programmes and research (Sheahan and Barrett, 2016:2) within various geographies. As a result, agendas and goals are interpreted to fit local context targets by policy makers, experts and scientists (Baginetas, 2008, Fish *et al*., 2008). Postharvest research over the years has been unable to standardise its definition and methodology and for this reason, loss estimates are referred to as unreliable. Without reliable statistics on the level of losses experienced it is unclear how the progress of targets will be measured (Affognon *et al.*, 2015). Furthermore, the difference in time frames (2025 and 2030) creates uncertainty; are programmes and interventions geared towards the Malabo Declaration or the SDGs? With this is mind Jewitt and Mahanta (2016) conclude that "*geographically informed approaches that enhance understandings of wider political, socio-economic, cultural and environmental contexts*" (p. 7) are required to gather quality data in order for the SDGs and Malabo declaration to be achieved.

Various themes prompted this renewed interest in PHL despite the increase in food prices. The three main drivers are an increasing population, high levels of food insecurity and a shift towards sustainable agriculture (FAO, 2009, Parfitt *et al.*, 2010, Gille, 2012, IMECHE, 2013). World population is set to increase to 9 billion by 2050 and most of this growth will be in low-income countries. Projected population growth will create a surge in food demand by 50-70% (FAO, 2009). The increase in population growth is projected to be highest in Sub-Saharan Africa, and will intensify the food security challenges in the region. This has prompted research to determine how future populations will be fed, with a reduction

of PHL seen as a significant option for addressing food shortages in future (Hodges *et al.*, 2010, IMECHE, 2013).

The rise in population, income and urbanisation will increase the demand for food, as well as pose several economic, social and political challenges (IMECHE, 2013). With more people moving out of agriculture and into urban areas it will have an effect on the food supply chain, making it more complex (Lundqvist *et al.*, 2008). Likewise, there will be immense pressure on agricultural production and its associated input resources. The increase in population will open up more land for infrastructure and growing cities, hence it will compete with land for food production (Parfitt *et al.*, 2010). Then the reliance on finite resources to meet food needs will be problematic because they will be required for other purposes. One of the most sustainable ways of increasing food availability with a growing population is the reduction of losses along the FSC (Nellemann *et al.*, 2009). If postharvest losses are not managed, population growth will increase food production and intensify the pressure on finite resources (IMECHE, 2013).

There are approximately 876 million people in the world that are undernourished and do not have access to good food that meets their dietary requirements (CFS, 2013). It is estimated that 98% of the undernourished live in low-income countries (Bond *et al.*, 2013). These statistics create anxiety in the global south when viewed against the backdrop of increasing population (Jackson, 2013a). The World Food Summit in 1996 defined food security to exist "*when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life*" (FAO, 2006:1). The loss of food along the chain reduces the access individuals have to food, increasing their vulnerability to food insecurity (HLPE, 2014). Postharvest losses have significant impacts on the livelihood of immediate actors, by reducing their income and ability to purchase available food (Obayelu, n.d). The default position for food security will be to increase the production of food to meet current and

future food needs, however it needs to go beyond growing more food to include the management of what is already produced so that it is accessible and affordable (Shende and Liefter, 2017). The reduction of PHL will directly increase the amount of food available for consumption, as well as reduce food prices (Sheahan and Barrett, 2016), although the literature does not indicate the extent to which reducing postharvest losses will improve food security cost effectively (Rosegrant *et al.*, 2015). Looking ahead, the unsustainable use of natural resources will limit food production for future generations (HLPE, 2014).

The food system is influenced and shaped by economic, social, cultural, health, political and environmental factors that can be "*identified at multiple scales from a household kitchen, to a city, county, state or nation*" (Chase and Grubinger, 2014:2). Negative externalities of the technological focus of the current food system are captured when losses are directly translated to the waste of resources that were used for its production: fertilizers, pesticides, water, land, energy, labour and human input (time and money) (Lang and Heasman, 2004, IMECHE, 2013). These losses are an inefficient use of natural resources and have negative impacts on the environment (FAO, 1981, FAO, 1989, Obayelu, n.d). For instance, the Institution of Mechanical Engineers (IMECHE, 2013) estimate 550 billion m^3 of water is lost due to postharvest losses and by 2050 about 10-10.3 trillion m^3 of water will be required for agriculture. This may be difficult due to the threats climate change is posing to environment and society (Scientific Advisory Board, 2016). The production of more food will involve the intensification of agricultural practices. The reduction of PHL is therefore seen as a means of restricting increased food production and reducing its environmental impact (FAO, 1981).

The Sustainable Development Goals are a product of the wave of 'sustainability' or 'sustainable agriculture' agendas flooding various discourses, especially agricultural and geographical literature on the externalities of the food system. This is because the food system and agriculture are technologically intensive, resulting in the production of

large amounts of green house emissions, environmental pollution and degradation (Lang and Heasman, 2004). This affects the food system that is equally vulnerable to climate change and resource depletion (Watson, 2013b). This era of sustainability is also shaping agricultural agendas because the price paid for food does not cover the real costs of production (Lang and Heasman, 2004, Baginetas, 2008, Carolan, 2016). Sustainability is a "*vague notion*" (Watson, 2013b: 210) where "*almost everyone seems ready to agree with the goal of sustainable development, but unanimity over the value of the concept by no means implies agreement over what precisely is to be done*" (Ward *et al*., 1998:1167). Accordingly, sustainability means "*different thing to different people*" (Gliessman 1998:13), resulting in the provision of various sustainability agendas with varying goals and priorities (Fish *et al*., 2008).

The high levels of postharvest losses raise questions over the efficiency and sustainability of the food system. The losses promote economic, social and environmental concerns (HLPE, 2014). Sustainable development subsumes food security; this means that the food system has to expand to incorporate the following:

- "*from a pure production perspective to a more holistic food system approach;*
- *from an environmental perspective to a perspective encompassing also the economic and social dimensions;*
- *from a "global availability" perspective of food security to integrate the accessibility, nutrition and stability dimensions of food security, down to household and individual level*" (HLPE 2014:30).

Food losses have economic, environmental and social consequences that influence all aspects of life especially food insecurity, therefore the management of the food system is highly important (ibid.). According to Lang and Barling (2012) if the food system is not sustainable it cannot be secure.

2.4 Estimation and Causes of Postharvest Losses

Postharvest losses are viewed as quantitative or qualitative. Qualitative losses are harder to measure and impact the overall quantity of losses

(Sheahan and Barrett, 2016), whereas there are other kinds of losses like time, labour, seed loss, loss of goodwill or reputation (FAO, 1980, Grolleaud, 2000) and economic losses will vary by commodity and location (Tomlin *et al*., 2016). Data on PHL are more concerned with the measurement of the quantity of losses than quality and economic losses (Kitinoja and Kader, 2015). Postharvest losses depend on the crop in question, the country and the prevailing conditions in which the crop is handled and stored. As a result, there will be differences in the amount of losses experienced in different geographical areas (Bourne, 1977). The deterioration of a living product after harvest is a constant phenomenon (Grolleaud, 2000). The nature of food products determines the level and causes of losses, with fruits and vegetables experiencing more losses than grains (Parfitt *et al.*, 2010).

Although the lack of an agreed method for measuring losses contributes to a large degree of uncertainty surrounding PHL statistics (Yahia, 2008, Parfitt *et al.*, 2010), Tyler (1982) states that:

> "*post-harvest losses may be due to a variety of factors, the importance of which varies from commodity to commodity, from season to season, and to the enormous variety of circumstances under which commodities are grown, harvested, stored, processed and marketed*".

As a result, national and international estimates should be dealt with carefully estimates should be realistic at the time of use and it should also be noted that "*at other times and situations the figures will differ*" (Hodges *et al*., p. 40).

Research on postharvest losses is "*geographically scattered*" (Tomlin *et* al., 2016:3) as there is more available data on commodities like maize and tomatoes with limited data on crops like bananas (ibid.). The initial focus of postharvest loss research was on grains; as a result there have been more studies of PHL related to grains than fruits and vegetables around the world. There is considerably more research available on the quantification of grain losses than on qualitative losses (Parfitt *et al.*, 2010). Grain losses are estimated to be about 15% in Asia and occur

mainly as a result of spillage during storage (Grolleaud, 2000). In West Africa the losses range from 6-24% occurring more during storage and milling (Parfitt *et al.*, 2010). Estimates of rice losses in South-East Asia are 37-80%. Due to the inadequacy of storage and distribution facilities in India about 21 million tonnes of wheat are lost (IMECHE, 2013). African grain losses are 25% of the harvested crops (Lundqvist *et al.*, 2008). There are one off individual cases where losses can be 100% (FAO, 1981).

An important cause of PHL in developing countries is the tropical climate, as the combination of high temperatures and humidity increases respiration rates of food crops and hampers their preservation and shelf life. This increases the ability of certain devastating pests and diseases to multiply, the appearance of mould and rot and qualitative losses in colour, flavour and nutrients (Grolleaud, 2000, Olayemi *et al.*, 2012, Kitinoja and Kader, 2015). In Ethiopia, most losses are incurred during harvesting due to the use of poor tools and equipment that cause mechanical damage to fruits (Kasso and Bekele, 2016). The losses of grains in SSA were grouped into technical (postharvest handling and moisture levels) and governance related causes (procurement, marketing policies) (World Bank, 2011). Postharvest losses result from technical, cultural and economic functions of the food system (HLPE, 2014).

The quantification of fruit and vegetable losses is difficult to provide because of the "*complexity and heterogeneity within…marketing systems*" (Tomlin *et al*., 2016:38). Gustavsson *et al.* (2011) provided estimates of food losses in their FAO *Global Food Losses and Waste Report* that are widely cited. They estimate packing and processing losses of fruits and vegetables in SSA to be 25%, higher than losses during production (10%), postharvest handling and storage (9%), and distribution (17%). These are as a result of inadequate storage and processing infrastructure, as well as the hot climate. In India and Africa postharvest losses of fruits and vegetables are estimated at 35-50% annually (IMECHE, 2013). Parfitt *et al.* (2010) note that there is an overestimation of grain, fruit and vegetable losses in low-income countries. Losses of fruits and vegetables in Asia and

the Pacific region range from 10-40% because of infrastructural constraints (Choudhury, 2006). The seasonality of fruits results in market gluts making the production of fruits and vegetables in the tropics a risky business (FAO, 1981), as the losses incurred significantly impact the livelihoods of actors (Tomlin *et al*., 2016). These conditions play a major role in the level of PHL incurred in low-income countries. The quality of fruits and vegetables depend on the processes involved from harvest, handling, marketing and distribution. Procedures before harvest are also significant, for instance, if a fruit is attacked by pests and diseases before harvest, the quality of the fruit cannot be improved after harvest (ibid.). Fruits and vegetables incur the highest rates of on-farm losses (Rosegrant *et al.*, 2015). The inadequacy of packaging material and proper transportation facilities causes losses during transit from farm to market (Kereth *et al.*, 2013). The lack of information farmers have on the market conditions cannot be understated. The absence of a cold chain, effective temperature management and distribution networks influence the losses incurred by actors (Bond *et al.*, 2013).

HLPE (2014) provided a comprehensive three-part report disentangling the causes of losses. This report viewed the food system from three perspectives – systemic, sustainability (social, economic and environmental), food security and nutrition. The causes of losses and waste (the authors do not differentiate between food loss and waste) along the chain are due to micro-level (e.g. postharvest handling and temperature), meso-level (e.g. lack of adequate infrastructure and communication) and macro-level (e.g. institutional and policy) constraints that are interrelated.

In 2007, the Indian Ministry of Food Processing estimated the worth of its food losses at 580 billion Rupees. In Kenya, the worth of milk lost was 22.4 million USD in 2008 (Lundqvist *et al.*, 2008). The weight loss of cereals in Sub-Saharan Africa is valued at 4 billion annually USD (World Bank, 2011). These estimates on the value of losses and their magnitude reveal the

importance and necessity of the management of postharvest losses in the global south.

Postharvest losses also occur in middle and high-income countries, contrary to what the literature posits albeit for different reasons than in LICs (Gustavsson *et al.*, 2011). Consumer preferences (referred to in detail in next section) and the retail sector set standards on the expectations of food quality that ensure most of the food produced is not harvested, or harvested and left in the fields (IMECHE, 2013). In the United Kingdom (UK), it is estimated that 46% of potatoes produced are not sold to markets (34% are discarded after sorting) and 30% of vegetables are not harvested because of these expectations (ibid.). In the United States, farm losses are estimated to be between 15-35% depending on the crop, with fruits and vegetables experiencing more losses (Lundqvist *et al.*, 2008). In Germany, postharvest losses are about 18% (Eriksson *et al.*, 2012).

In middle and high-income countries, a case of production exceeding demand occurs, where farmers set out to protect themselves. Overproduction occurs when they try to ensure they are on "*safe side*" (Gustavsson *et al.*, 2011:10) in-case of unfavourable weather conditions or pest and disease infestation. Sometimes the farmers end up selling about half of what they produce (Gille, 2012). Other times when market prices are low, produce may not be harvested by farmers because selling the crops may not cover the cost of production (Eriksson *et al.*, 2012).

According to Lundqvist *et al.* (2008) postharvest losses should not be considered as waste because they are used for "*feed, bioenergy and soil amelioration*" (p. 5). This suggestion opens up another debate beyond the scope of the thesis; however, from the FAO definition provided earlier, food that was produced and intended for human consumption and not consumed is regarded as waste. No matter how food is lost, whether as a result of the lack of adequate postharvest technology or retail standards, it is a waste of natural resources, which has negative impacts on the environment and the actors.

2.5 Estimation and Causes of Post-consumer Waste

The above themes on population growth, food insecurity and sustainability, played a major role in raising awareness of the levels of consumer waste and promoting research to identify its causes and management in middle/high-income countries (Parfitt *et al.*, 2010, IMECHE, 2013). Campaigns such as 'love food hate waste' are underlining the importance of reducing household food waste and placing it high on the priority list of local and national authorities (Lebersorger and Schneider, 2011). Addressing post-consumer waste is gaining more ground in areas of environmental debates, cultural politics, in policy and regulation (Evans *et al.*, 2012). There is more research on the quantification of post-consumer waste than there is on the determinants and behaviours that cause the waste (Stancu *et al.*, 2016). The study of food waste in the social sciences is relatively new and aims to go beyond quantification to understand the social relations and processes that contribute to its generation (Evans *et al.*, 2012, Watson and Meah, 2012, Watson, 2013c).

About 30-50% of food purchased by consumers is not eaten. In the UK this amounts to seven million tonnes of food worth £10.2 billion pounds (DEFRA, 2013). In the United States (U.S.), the estimate stands at 30% of food worth 48.3 billion USD yearly and in Sweden about one million tonnes (Lundqvist *et al.*, 2008, BCFN, 2012). In 2005, it was reported that food waste in Australia amounted to 5.3 billion USD (Hamilton *et al.*, 2005). A report by Gustavsson *et al.* (2011) highlighted that per capita food loss in Europe and North America is between 280-300kg/year. Food waste in middle/high-income countries amounts to 222 million tonnes almost parallel to the net food production for low-income countries at 230 million tonnes (ibid.) These estimates like those for PHL are alarming and debated based on their methodologies, but they reveal huge amounts of waste between retail and consumption.

The causes of food waste in middle/high–income countries has been spread amongst three areas: retailers, labelling systems and consumers

(Milne, 2012). Cosmetic standards set by retailers on the conditions of fruits and vegetables such as the shape, size, curvature and length increase the amount of food that is wasted during processing and retail. This is because food that does not meet the set requirements and standards is disposed of (Hodges *et al.*, 2010, Gille, 2012). A Swedish study recorded 65% of its food waste as rejections from supermarkets due to cosmetic and quality requirements (products not being sold before their sell by dates), mainly of fruit and vegetables (Eriksson *et al.*, 2012). The literature debates the relative power of the retail sector in exerting these standards on consumers and consumer expectations of what their food should look like (Gustavsson *et al.*, 2011). Discount vouchers and coupons offered by retailers persuade consumers to purchase more than they need (Hodges *et al.*, 2010), resulting in a situation where more often than not consumers end up buying more food that gets wasted (Exodus, 2007a).

In the UK and across the EU as well as in most middle/high-income countries, expiration dates are compulsory on 'pre-packed food' and are a significant instrument of food policy. Watson and Meah (2012:110) describe date labels as "*innovations to fill gaps of trust…and control in increasingly extended food production chains*". These dates are to provide consumers with knowledge about the quality and safety of food (Milne, 2012), even though they deprive them of the power to make decisions about the deterioration of their food (Watson, 2013c). However, in the wake of food scandals and food safety concerns, most individuals and shop keepers are cautious about expiry dates (Gille, 2012). Food labels have come under criticism for the role they play in consumer behaviours and the disposal of edible food (Ventour, 2008, Milne, 2012). This comes after WRAP revealed from its report in 2008 that about a quarter of food thrown away was because it was past its expiry date but also noted that some food had been thrown away while still 'in date'. The expiry dates on food products have caused consumers to throw away food that could have still been eaten if managed properly (Ventour, 2008). The confusion associated with expiry dates partly comes from the various wordings - 'best by', 'use by', 'best before' and 'sell by' dates and also the possibility of

consumers not understanding the meaning of the food labels (Ventour, 2008, Gille, 2012). Although the reduction of food waste is advocated through measures like people storing food appropriately to last a few days or weeks after expiry dates, public concerns on food safety encourage individuals to obey expiry dates by the letter in order to avoid food borne diseases (Watson and Meah, 2012). Nevertheless, Watson and Meah (2012) discovered that the 'boundaries' of food safety varied across individuals and was closely associated with disgust rather than bacterial risk.

Consumer preferences are a significant cause of wastage because of preferences in diets, expectations and the desire for variety. These are the factors retailers have to consider to stay in business and satisfy their consumers (BCFN, 2012, Bond *et al.*, 2013). Various reports by WRAP (Exodus, 2007a, 2007b, WRAP *et al*. 2011) have provided a robust number of reasons why consumers waste food in their homes in the UK. Some of them included buying too much food, buying more perishables in order to eat healthily, leftovers from cooking, large portion sizes, not using food before the expiry dates, the food tasted/looked/smelt bad and or went mouldy, change of mind about food, not liking the food cooked and the failure to plan subsequent meals. Some people failed to take an inventory of their food cupboards and write down lists before they went shopping, so they fell prey to in-store promotions and impulse buying. Others did not store food properly after it was purchased. Inexperience in managing food and careless attitudes towards the disposal of food play important roles in increasing food waste in households (Exodus, 2007a, 2007b, Lyndhurst, 2007, Gustavsson *et al.*, 2011). Foods like fresh fruits, vegetables, bakery products, pre-prepared foods, meat and fish – items with short shelf lives are prone to the most wastage, with fresh products topping the list (Parfitt *et al.*, 2010, WRAP *et al.*, 2011, BCFN, 2012).

At the other end of the spectrum is post-consumer waste in low-income countries; this is one area that has received relatively little attention from researchers. A report by Gustavsson *et al.* (2011) estimated waste in Sub-

Saharan Africa and Southeast/South Asia to be between 120-170kg/year revealing low occurrences of post-consumer waste. However, reports on solid waste management reveal that in low-income countries, their waste streams have high amounts of organic waste: about 64% compared to 28% in high-income countries (Hoornweg and Bhada-Tata, 2012). The other reports identified on food waste in SSA were from South Africa, which made use of the figures provided by Gustavsson *et al.* (2011). Their resulting estimates suggested that about 1.4 million tonnes of waste is generated in South Africa, and food waste made up 15% of household waste (Nahman *et al.*, 2012, Oelofse and Nahman, 2013). Reports do not state the components of the type of food disposed but they show that household waste is largely organic ranging from 36-70% (Sha'ato *et al.*, 2007, Olukanni and Mnenga, 2015, Wei *et al*., 2017).

2.6 Methodological Gaps

The data collection system in most low-income countries is inefficient. The Indian Agricultural Statistics Research Institute report noted that postharvest methodology variations and definition concepts were a major constraint to understanding the magnitude, causes and management of PHL (FAO, 1980). Different training manuals by FAO criticised the lack of an adequate methodology for the study and measurement of PHL revealing a larger problem with its management (Grolleaud, 2000). This was because the methodologies did not take into consideration the various factors affecting PHL (FAO, 1980, FAO, 1989). For this reason, estimates provided of the level of losses were referred to as unreliable (Bourne, 1977, FAO, 1980, Grolleaud, 2000) and incomplete, with their quality questioned (HLPE, 2014). Recent comprehensive reviews by Affognon *et al.* (2015), Kitinoja and Kader (2015) disclose major methodological gaps in the literature as well as the necessity for more research across food chains (HLPE, 2014). Different postharvest studies adopt varying methodological approaches for the measurement and assessment of losses and the main data gathering tools used are surveys and interviews.

Available research on postharvest losses is composed of unpublished student theses. The timeline of postharvest research reveals more research in the 1970s, 1980s and 2000s, with less data available between the 1990s and early 2000 (Affognon *et al.*, 2015, Kitinoja and Kader, 2015). Affognon *et al.* (2015) report that only one third of the data they found on PHL had suitable methodologies. A majority of available literature discloses methodological approaches that are not reliable; as some studies recycle old data sets, do not collect primary data and make use of questionable secondary sources, as well as the differences in scope (HLPE, 2014, Affognon *et al.*, 2015). For research that collects primary data the sampling strategies are inconsistent, chosen at the discretion of the author. These variabilities along with the absence of a uniform definition hinders the comparison of results within and between countries (FAO, 1980, Schneider, 2013) especially when detailed sampling procedures are not provided by authors. The lack of standardisation makes the evaluation of available data unfeasible (HLPE, 2014).

The provision of reasonable estimates on the level of losses is difficult to provide (FAO, 1980, Gustavsson *et al.*, 2011), because no one really knows how much food is lost and wasted from farm to fork (Bourne, 1977). According to Hodges *et al.* (2010) in order to determine how much was lost, one must have known how much was produced in the first place. Statistics from various organisations attempt to quantify the amount of food that is wasted globally, usually to relate and compare with the number of hungry people in the world (Parfitt *et al.*, 2010). Bourne (1977:15) critiques postharvest loss estimates claiming that they have not been collected by actual measurements and the worst figures are usually quoted to "*dramatize the problem*". Loss figures can be over exaggerated if it will increase financial aid received or reduced due to social, political or financial reasons (ibid.). Parfitt *et al.* (2010) echo the above view of estimates dramatizing the problem. They are of the opinion that most of these estimates do not provide a real picture and the methodologies cannot truly estimate the extent of these losses.

The range of factors that contribute to the occurrence of PHL also impact their measurement (BCFN, 2012). The variations in loss estimates do not consider the different geographical and cultural factors influencing losses that makes PHL specific to crop and region (FAO, 1980, Kader, 2005). The causes of losses are also dependent on local production conditions of countries (Gustavsson *et al.*, 2011). According to Bourne (1977:15) the extrapolation of results from small samples to large populations is "*an unsound procedure*". Nevertheless, the estimates emphasise the necessity for better management and efficiency of the FSC. Thorough research of the food supply chain will provide information on the stages where losses should be reduced efficiently (Hodges *et al.*, 2010). Differences in estimates or causative agents of losses may be as a result of the methods used, the available team and financial capacity as well as the aim of the analysis (Grolleaud, 2000).

The history of postharvest research has targeted storage, because it is believed that most losses occur during storage, with less research on harvesting, marketing and other aspects of the supply chain (Affognon *et al.*, 2015). With earlier postharvest research on grains this is quite understandable, however, the perishability of a crop determines the stage at which losses occur and the resulting quantity (Kitinoja and Kader, 2015). There is less data on fruits and vegetables as well as minimal focus on harvesting and marketing. The interpretation of losses is another problem as some authors cumulatively add losses experienced at different stages to offer an overall value, whereas, others individually state the losses experienced at different stages (ibid.).

The critique of the dearth of adequate data and materials on PHL draws a defensive argument from Grolleaud (2000). He acknowledges that the whole postharvest system is poorly understood but posits that the gap in available knowledge, materials and methodology is affected by social, political, cultural, economic, climatic and biological factors in low-income countries. These aspects are largely ignored in postharvest research. The measurement of qualitative and quantitative losses requires a multi-

disciplinary approach; the country's practices and technological status should influence the methods adopted for problem inquiry (FAO, 1980).

The lack of objectivity and inaccuracy of PHL surveys is a limitation to their use for the measurement of PHL. This is because surveys rely on the respondent to recall events that occurred in the past (Boxall *et al.*, 1979). Most actors do not keep records of how much is lost at harvest, during transportation or in storage (FAO, 1980), therefore recollection of such events and figures is unreliable. Estimates provided in such situations may underestimate or overestimate the scale of the problem (Parfitt *et al.*, 2010). The use of subjective measuring techniques like interviews and surveys do not elicit the required information for the measurement of losses as the figures obtained may not represent the entire FSC (Morris and Kamarulzaman, 2014).

Post-consumer research suffers from most of the postharvest research critiques discussed earlier. The bulk of the research here has aimed to quantify the waste, focusing on the retail sector and households (Evans, 2012, Watson and Meah, 2012). Internet searches for studies in the global south proved unsuccessful. There are noticeable gaps in food waste estimates that restrict their comparison based on their sample sizes (for household studies) or the lack and inconsistency of a definitive terminology (Lebersorger and Schneider, 2011). The data collection methods adopted have included food diaries, interviews, video and photographic recording, observations, focus groups, weighing wasted food, and questionnaires (Lebersorger and Schneider, 2011, Watson and Meah, 2012, Evans, 2012, Hallam, 2013). Due to the absence of detailed methodologies the data is not reproducible. These methods are subjective and rely on the viewpoint of participants, accordingly, Lebersorger and Schneider (2011) call for a standard food waste methodology that will be objective such as the household waste composition analysis.

The widely cited report by Gustavsson *et al.* (2011) relied on secondary data sets that had been collated over the years and because of the scarcity of data along various points along the chain, some of the figures were

estimated. Under these circumstances, a true picture of the scale of the problem may be overemphasized or underestimated (Parfitt *et al.*, 2010). WRAP in 2012 conducted an online survey to determine the factors that influenced consumer waste and the attitudes associated with wastage. For Evans' (2012) ethnographic study he concluded that interviews and observations were not sufficient to identify and understand the "*processes, practices and dynamics that turned food to waste*" (p. 42).

It was noticed from the food waste literature that the study of post-consumer waste has not really begun to discuss methodological approaches compared to postharvest research. The methodological gap in the literature clearly shows the need for the standardisation of assessment methods (Kitinoja and Kader, 2015). The FAO (1980:2) proposed that whatever methodology is adopted for the study of PHL should take into account "*all possible factors involved simultaneously*". This is applicable to post-consumer waste as well.

2.7 Conclusion

This chapter has reviewed the main literature surrounding food losses: the concepts, themes, causes and methodology. The lack of a uniform definition and standardised methodology have been identified as weaknesses of existing postharvest and food waste research that limit the understanding and comparison of available data. It has been established that there is an array of factors that affect PHL that are somewhat specific to the food product studied, its postharvest operations and the geographical location. These losses are a waste of natural and human resources and they have negative impacts on the livelihoods of immediate actors. Despite the importance of losses on an international scale, the lack of context-specificity within policies or declarations cripples their effectiveness. With all the propaganda around postharvest losses, there is a lack of applied research within low-income countries that considers a crop's postharvest system, in relation to its specific socioeconomic, cultural and political context. Post-consumer waste has been studied in middle and high-income countries, with the main causes of waste

attributed to retail, processing and consumer behaviours. Chapter 3 provides the theoretical framework of the study.

Chapter 3: Theoretical framework

3.0 Introduction

This chapter discusses the commodity chain approach that was introduced in chapter 1. Its application is explored in detail to the research of postharvest losses and food waste.

3.1 Conceptualising Commodity Chains

> "*I often ask beginning geography students to consider where their last meal came from. Tracing back all the items used in the production of that meal reveals relations of dependence upon a whole world of social labour conducted in many different places under very different social relations and conditions of production. That dependency expands even further if we consider the materials and goods used in the production of the goods we directly consume. Yet we can in practice consume our meal without the slightest knowledge of the intricate geography of production and the myriad social relationships embedded in the system that puts it upon our table…we cannot tell from looking at the commodity whether it has been produced by happy labourers working in a cooperative in Italy, grossly exploited labourers working under conditions of apartheid in South Africa, or wage labourers protected by adequate labour legislation and wage agreements in Sweden. The grapes that sit upon supermarket shelves are mute; we cannot see the fingerprints of exploitation upon them or tell immediately what part of the world they come from. We can, by further enquiry, lift the veil on this geographical and social ignorance and make ourselves aware of these issues…but in doing so we find we have to go behind and beyond what the market itself reveals in order to understand how society is working…we have to get behind the veil, the fetishism of the market and the commodity, in order to tell the full story of social reproduction*" (Harvey, 1990:422-423).

This quote by Harvey and the call to lift the veil of commodities revived the story telling of commodities followed from production to consumption. This idea of 'following' commodities dates back to the 1970s. Jackson *et al.* (2006) identify two distinct sources for the emergence of commodity chain approaches. The first source is Hopkins and Wallerstein (1977) who write:

> "*Let us conceive of something we shall call, for want of a better conventional term, 'commodity chains'. What we mean by such chains is the following: take an ultimate consumable item and trace back the sets of inputs culminated in this item, including prior transformations, the raw materials, the transportation mechanisms, the labour input into each of these material processes, the food inputs into the labour. This linked set of processes we call a commodity chain*" (Hopkins and Wallerstein, 1977:128).

Commodity chains have their roots in world systems theory and were developed in the era of globalisation to link activities and actors involved in the production of goods and services (Bair, 2008, Raikes *et al.*, 2000). Global Commodity Chains (GCCs) first introduced by Gereffi and Korzeniewicz (1994) to study industrial commodity chains are characterized by four dimensions: "*an input-output structure, the territory covered, their governance structures and institutional framework*" (Raikes *et al.*, 2000:4). GCCs identify consumption as the starting point of analysis and trace – backwards - the movement of the commodity, with a focus on global production and consumption dynamics. This approach portrays production by the periphery regions to meet consumer needs and feed the core of the world economy (Leslie and Reimer, 1999, Hughes and Reimer, 2004). GCCs reveal global inequality as most products are produced in the global south for markets in the north, as a result it is used in conjunction with dependency theories (Raikes *et al.*, 2000, Bair, 2008). This approach is critiqued for its productionist bias because it excludes localities and people in its study of the food system and focuses on the process of globalisation and the relations between institutions (Cook and Crang, 1996).

The second source, traced to Friedland in 1984, is 'commodity systems analysis' under what was referred to as the 'new political economy of food and agriculture', which studies the relationships from production to marketing, distribution and beyond the farm gate. Commodity systems analysis stems from social or empirical problems (Friedland, 2001), and was developed to explore agricultural marketing chains to determine how local production is affected by institutions, investments and public bodies

(Bockel and Tallec, 2005). Friedland's work has influenced research on the globalisation of food chains. Most of the agri-food studies in the literature are influenced by these two traditions/approaches, however, the authors do not cite each other in their work (Jackson *et al.*, 2006).

Over time, various approaches have emerged to the study of commodity chains in agri-food research. The concept of the 'chain' is critiqued for its linearity that belittles the importance of the complexity of commodity systems, as well as horizontal aspects that are ignored in the chain construct. As a result, commodity circuits and networks were born (Bair, 2008). In addition, these variations have aimed to go beyond the productionist bias that ignores consumption and consumption practices (Cook and Crang, 1996). Commodity circuits view the various stages between production and consumption as circuits rather than a linear chain. The cultural dynamics of the commodity are studied to understand the meanings attached to its movement between space and time (Hughes and Reimer, 2004). Commodity circuits are criticised for abandoning the concepts of tracing the trajectory of the commodity to reveal areas of exploitation (Leslie and Reimer, 1999), an integral aspect of commodity chain research (Bair, 2008). Commodity networks conceptualise the movement of commodities at different nodes as a complex web of interactions and interdependence. The network can be explained via actor-network theory approaches, and trace the connections between human and non-human actors to reveal sources of power and exploitation sites (Hughes and Reimer, 2004).

Fine and Leopold (1993) challenged the focus of commodity chains on horizontal aspects of the chain and argued for a vertical chain of activities or 'systems of provision' (SoP) linking production to consumption for individual commodities. This framework placed consumption at each SoP as the focal point of analysis. Leslie and Reimer (1999) argue that the focus on vertical nodes of the chain excludes horizontal concepts like gender, which is a major factor that determines dynamics and relationships across the chain. They further claim that production

activities identify men as the actors, which has implications on the chain. This horizontal orientation explores commodity relationships in the spatial movements (Jackson, 2013b). Fine's work is criticised for its exclusion of consumption practices and emphasis on the dynamics of production, like GCCs (Leslie and Reimer, 1999).

The Francophone Filière (chain) approach was developed by Institute National de la Recherche Agronomique por le Développement (CIRAD) born out of French Colonial and Post-Colonial commodity centred development policies (Bair, 2008). Filière refers to the activities that occur along the 'chain' as a product is followed from production to consumer, to map out the movement of the commodity, its activities, agents and transformations (Raikes, 2011). This approach is underpinned with different theories and has focused on national chains. The above perspectives have been merged in the literature by some authors or used interchangeably (Bair, 2008) because they "*refer to the methodology for studying a specific commodity from its origins in production to consumption*" (Friedland 2004:5).

3.2 'Follow the thing'

Appadurai (1986) proposes that humans in their daily use of commodities in space and time bestow attributes on commodities that constitute their social lives. He goes on to argue that irrespective of the accolades humans bestow on commodities they have lives on their own; and this can only be understood when they are *followed*. Appadurai (1986) further reveals that their meaning is discovered in their "*forms, uses and trajectories*". The following process also uncovers the "*human transactions and calculations that enliven things….and illuminates their human and social context*" (ibid., p. 5).

The study of commodities will unveil different things and meanings to anthropologists, social scientists and economists. The social relationships revealed in commodity chains are complex and complicated if the commodity is broadly produced and consumed (Friedland, 2001). The

study of commodities provides insights on material culture and as the exchange of commodities exists in a wider society, not in a vacuum, they are not void of political and social influence (Appadurai, 1986).

Harvey's (1990) call to get behind the veil and the growing interests of consumers in the origin of the goods they purchase, have prompted widespread commodity chain analysis, connecting individuals (producers and consumers) and commodities (Hughes and Reimer, 2004). The following of commodities or 'follow the thing' approach merges sites of production and consumption. In the process of following, actors, processes, places, relationships, cultures, communities are revealed and this allows for the revelation of a complex reality, that would otherwise have been ignored (Cook and Crang, 1996, Cook *et al*., 2004, Cook *et al.*, 2006). According to Gregson *et al*. (2010) the following:

> "*is conducted either literally along the supply chains, to the point of realisation of the commodity in its final form through acquisition at the point of sale, or is distributed over a web of supply chains connecting networks of producers, buyers, technicians, product designers, retailers and consumers*" (p. 847).

A commodity chain consists "*of a series of operations or transformations, a set of agents and a system of markets…as well as the behaviour of agents as guided by their economic interests*" (Bockel and Tallec, 2005:3). The chain therefore, surpasses the operations involving the physical movement of food from production to consumption. This vertical flow of commodities can be narrowed down to study an individual commodity system and its community (Fine and Leopold, 1993, Friedland, 2001). Therefore, commodity chains are spatial, shaped "*by space and place*" (Leslie and Reimer, 1999:402), consequently, commodity chains vary across national contexts. The commodity system is dynamic; influenced by patterns of production, consumption, distribution and regulations (McGinity, 1979). Therefore, the filière's activities determine the scope of commodity chain analysis (CCA) (Bair, 2008).

Busch (1990:14) views commodity chains as social networks that are held together by "*negotiations, persuasion and coercion*". He further revealed

that these social networks are guarded by structures in the form of external rules/laws, buildings, organisations, informal rules and technology, which are constantly changing by negotiations that keep these networks alive. Certain actors in the chain have the ability to use science, technology and bureaucratic decisions (regulations and laws) to modify the structure of commodity chains to suit their preferences. Regulations such as marketing boards and tax exemptions shape and rearrange the market (ibid.).

The study of commodity chains moves away from development theories that focus on production by encompassing socioeconomic and political change (Collins, 2005). One of the benefits of commodity systems analysis is its specificity. This allows for case and context dynamics of a commodity to be analysed (Dixon, 1999, Collins, 2005). The combination of various discourses in commodity chain analysis promotes interdisciplinary research (Busch, 1990). The commodities are analysed beyond the boundaries that restrict the production and consumption of food (Sayer, 1999). Thus, food is given the ability to reveal anything about its "*molecular, bodily, social, economic, cultural, global, political, environmental, physical and human geography*" (Cook *et al.*, 2006:656). Food stories then answer the following questions: Where does food come from? What is the connection of food from politics to economics? What is the hidden story from the value chain about our food? What would food have to say if it could talk about all the processes it had gone through to get to our plate? (ibid.).

'Follow the thing' engages with the complex journey of commodities as they travel from farm to plate and beyond, and "*how, why, where and between whom these values get unequally exchanged internationally – the political economy of globalised agriculture*" (Cook *et al.*, 2006:658). Food systems are impacted by various involvements of government regulations and programmes and thus are politically sensitive (McGinity, 1979). Food stories reconnect the production and consumption of food and have the ability to expose hidden exploitation along the chain (Winter, 2003). The

unveiling of these hidden aspects of production underline commodity chain analysis (Harvey, 1990, Hartwick, 1998). This way, the tomato chain has been 'walked' by Barndt (2002) from Mexico where they are produced to the United States. Likewise, Ian Cook followed the papaya produced in Jamaica and consumed in the United Kingdom (Cook *et al*., 2004).

These kinds of food stories should not be mapped out beforehand but develop reflexively as the research progresses "*as a function of the fractured, discontinuous plane of movement and discovery among sites as (s/he) maps an object of study and needs to posit logics of relationship, translation, and association among these sites*", (Cook and Crang, 1996:11). Themes and arguments that emerge from these stories will be specific to the food and context (ibid.). Therefore:

> "*this concentration on foodstuffs as things-in-motion must, as a matter of course, involve the integration of 'different' types of geographies, where following a commodity through its circuits can never be reduced to a 'political economy' of that thing, or a 'new political economy' of that thing, or a 'cultural politics' of that thing, or any other discrete academic lens on that thing, but a study of the combined geographies of that thing which are encountered along the way*" (Cook and Crang, 1996:13).

Commodity chain analysis is referred to as a method without a theory. According to Raikes *et al.* (2000:404) it is an "*empirical category*" and "*a neutral, practical tool of analysis for use in 'down-to-earth' applied research*". There are debates on how different discourses (qualitative research, quantitative methods, poststructuralism, cultural food literature, political economy and agricultural geography) involved in food production and consumption literature can be bridged (Cook *et al.*, 2006). Critiques refer to CCA as a framework, whereas Collins (2005:2) views it as a "*haven*" for the combination of various discourses. The analysis of various commodity chain studies show that indeed CCA is not void of theory as it has been combined with development theory, actor network theory, neomarxism, political economy, economic policy and analysis amongst others (Bockel and Tallec, 2005, Collins, 2005).

Commodity chain analysis was born out of the globalisation of agriculture. Therefore, before the 1980s, it was used in conjunction with dependency and underdevelopment theories. According to Raghuram (2004:121) "*a commodity chain traces the entire trajectory of the product, usually within a political economy of development perspective derived from world systems theory*". Political economy and actor network theories have been adopted to understand and explain the changing trends in agriculture (Friedland, 2001, Cook *et al.*, 2006). Combining actor network theory with commodity chain analysis enables the inclusion and analysis of the influence of human and nonhuman elements on the chain (Hopkins and Wallerstein, 1977; Busch, 1997). In the 1980s things began to change and commodity chains were seen as a methodological strategy. It was argued that they were:

> "*well suited to capturing the complex transactions of an era of globalisation and corporate domination of agriculture…others held that… [it] provided a way to encompass the array of actors and institutions involved…grasp the evolving organizational aspects of international trade, the linkages that animate it, the coordination that makes it possible, and the new global bodies that regulate it*" (Collins, 2005:2).

One widely cited example of commodity chain analysis is Amos Gitai's documentary on pineapples (Ananas) that followed their production in Hawaii and the Philippines to consumer markets in the United States. His documentary revealed the "*relationships between exploration, colonialism and export agriculture….that forces Third world governments to produce export crops to earn foreign exchange to service its debts*" and the community of people involved in the commodities system, their everyday lives, cultures and social relations that make the system function (Cook and Crang, 1996:34). Ananas however, did not explore the realm of consumption and this is highlighted as a critique. Friedland (1984) proposed commodity system analysis should stop at the farm gate and exclude consumption. Studies by Dixon (1999) and Wright (1999) recommend and show the importance of including consumption in commodity chain analysis. The evolution of food practices has included the power of consumption in food systems (Dixon, 1999).

Warde (2012) recognises that commodity chain studies have rarely focused on consumption. This ignores how consumers interact with and handle commodities in their everyday lives (Leslie and Reimer, 1999). Another commonly cited following paper is Ian Cook's story of the papaya, which he followed from sites of production in Jamaica to the United Kingdom's retail shelves and the home of a consumer (Cook *et al*., 2004). Although the consumer in question did not actually consume the papaya as a fruit, the by-product (papain) is an ingredient in various products. This aspect of consumption revealed that the concerns conveyed during the papaya's journey – poverty and exploitation – were not the concerns the consumer thought about when she imagined where her food came from. It could be argued that following the papaya to a consumer who actually consumed the fruit would have provided a slightly different account than one who was probably unaware of the presence of papain in her products. Leslie and Reimer (1999) claim that the activities of the home have a way of shaping dynamics along the chain; as a result, commodity chains should be followed to sites of consumption. Research has studied the purchase of commodities, forgetting that the act of shopping is a single act of consumption but not necessarily where final consumption occurs (ibid.). Commodity chain analysis benefits from its ability to connect production and consumption so they are viewed as a continuous whole rather than two separate events. One of the benefits of food stories is to enable producers, politicians and consumers to walk the chain to reveal their wasteful practices, challenge their morality, which could eventually improve efficiency across the chain. On the other hand, this challenge on morality may produce little or no change, because consumers may not be interested in the realities of the producers of their food, or see the responsibility to lie with governments and politicians (Cook *et al.*, 2006).

Ian Cook identifies another aspect of consumption that does not include the consumer of the commodity studied but the consumer who reads the food story. To this end he emphasises the importance of storytelling that connects with the reader. His story of the papaya was largely descriptive

and allowed room for the reader to make sense of the arguments by stepping into the shoes of actors. He explains that the act of following the papaya chain was a Marxist approach but the story unveiled historical and contemporary themes. Providing a detailed account of the fruits' story uncovered various concepts that would otherwise have been lost if the story was confined to discipline boundaries (Cook *et al.*, 2006). Clapp (2012) echoes this view claiming that there is a mental gap in the knowledge people have of where their food comes from or the processes it undergoes to get to their plate, thus this act of following and storytelling bridges the gap.

Hughes and Reimer (2004) identify a major critique of commodity chains and the unveiling of the hidden stories within chains. Most of the emphasis is on commodities that travel from the global south to the global north, skewing resulting theoretical discussions towards globalisation. They suggest, "*future geographical debates about commodity chains appropriately might be advanced by attention to aspects of production-consumption dynamics which are not necessarily stretched across global spaces*" (p. 7). The focus on the global scale of production marginalizes small-scale producers and has portrayed the periphery, mainly low-income countries as being sole producers for the core, excluding their "*participation in the consumption process*" (Raghuram, 2004:121). Consumption practices of low-income countries have no room within this framework; they are viewed as "*subjects*" (ibid., p. 122) producing for the western consumer, further exposing the production and reproduction of global inequalities in the food system. This is further echoed by Gregson *et al.* (2010) arguing that commodity chain literature reveals a focus on western consumers and commodities that are produced in the global south for western consumption.

This is where this thesis takes it cue – to follow a commodity that is produced in the global south for national consumption. Research on commodity chains is focused on longer commodity chains involving the movement of food across borders, however, national and local commodity

chains are equally important as they have a local community that includes local consumers. In the case of food losses, commodity chain analysis provides an adequate framework for walking the food chain and revealing the entry points of losses from farm to fork, to identify the actors, key spaces, relationships, institutions, activities that occur between actors and food to understand the point or points where various factors combine to have food cross that line to become waste. Although the chain in this context will be shorter, it has the ability to reveal its story. It allows key spaces to be engaged with in totality while connecting the influence of processes in one space to effects of processes in other spaces. Raghuram further states that:

> "*Focusing on those who produce in order to consume what they produce also provides an interesting methodological twist to existing stories. It entails the inclusion of personal biographies as well as product biographies and requires the study of circuits of production to also include the histories and geographies of producers. Critically, this mode of analysis might help to strengthen the political edge to studies of consumption and production*" (2004:123).

3.3 Commodity Chain Analysis and Postharvest Losses

Spurgeon (1976) proposed the systems approach for the study of PHL. His research was in reference to grains, but is transferrable to other food products. The postharvest systems approach is defined as "*encompassing the delivery of a crop from the time and place of harvest to the time and place of consumption, with minimum loss, maximum efficiency, and maximum return to all involved*" (Spurgeon, 1976:15). This approach takes the socioeconomic aspects of losses into consideration. He further highlights that the complexity of a system is determined by the crop and will vary from country to country. The components of a system will differ but important aspects will include: harvesting, storage, processing, packaging, transportation, marketing, communication at all phases of the chain and the management of the entire system (ibid.). The commodity systems assessment methodology by LaGra (1990) (see figure 3.1) suggests twenty six components that are fundamental to a commodities system for postharvest research. He points out that the inclusion of these

components will be dependent on the crop, country and other associated factors.

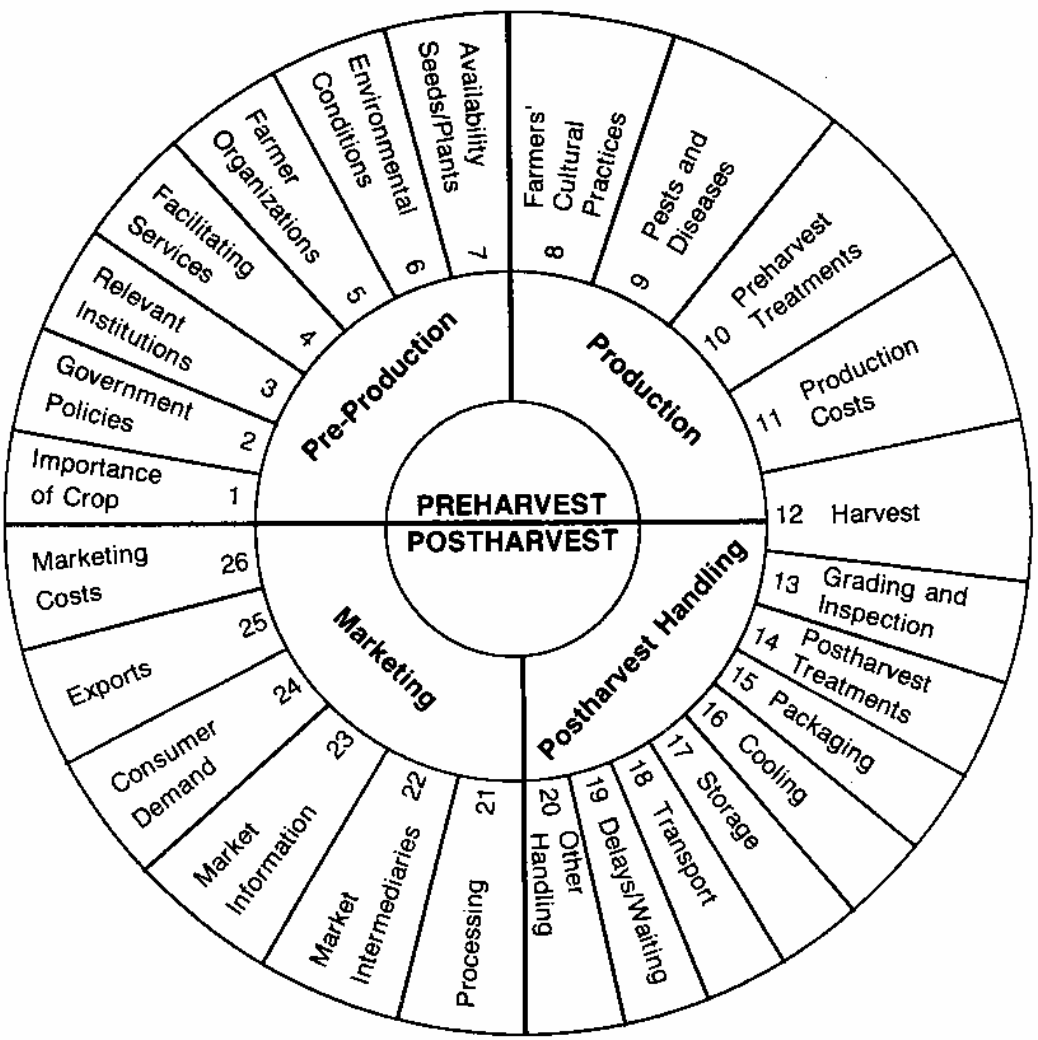


Figure 3.1 Physical components of a commodity systems assessment.
Adopted from LaGra (1990).

Different aspects of postharvest losses are studied depending on the author and the aim of the research (Grolleaud, 2000). Most studies have attempted to measure losses and analyse the technical aspects of the postharvest system, with less concentration on the socio-economic factors that impact the losses (ibid.). This has promoted critiques of the term 'chain', which breaks down the activities and phases of the movement of food to farming, harvesting, storage, transportation, processing, retail, distribution and consumer – the vertical links of the chain (Gille, 2012).

This linear depiction of the FSC, suggests that all causes of food losses fit into one of the stages of the chain and presents the FSC as too rigid to accommodate the "*dynamics of waste circulation*" along the chain (ibid., p. 12). In addition, Grolleaud (2000) argues that the system approach is a more suitable method for studying postharvest losses because it embraces the dynamic interconnected activities and operations taking place simultaneously; whereas the use of the word 'chain' ignores the dynamics of the system but refers to the physical operations that take place.

The evolution of research on the global supply chain and its efficiency in recent years has prompted a paradigm shift in the way the FSC is perceived, from a series of separate independent factors to a unified value chain connecting producers and consumers. This gives room for better analysis to discover the major participants, the various gaps in different countries and promote improved system efficiency (Hodges *et al.*, 2010). Murcott *et al.* (2013) argue that the chain enables the understanding of social, political and environmental dynamics of food production and consumption. The use of the chain is necessary to research losses within "*various national, institutional and regulatory contexts as they occur*" (Evans *et al.*, 2012:10). Nevertheless, studies of food along the FSC are limited; because they have focused on the technical physical operations of the chain (Nellemann *et al.*, 2009). This is evident from interventions and programmes that have been provided to developing countries.

After the 1975 declaration, the technical aspects of the chain (limited to the farm) were studied and the lack of adequate storage facilities, pests and diseases were identified as the main causes of losses for grains (Bourne, 1977, Boxall *et al.*, 1979). As a result, the provision of technological solutions have been the focus of interventions and programmes (Spurgeon, 1976, Affognon *et al.*, 2015). The FAO's Council Session in 1977 suggested that PHL research carried out in various countries should accommodate the "*prevailing conditions*" of the countries in question before reduction strategies were put in place (FAO, 1980:2). In retrospect, with the low adoption of technologies by low-income countries

it is obvious that the said prevailing conditions of countries were ignored before the provision of solutions. For instance, an FAO funded project in Malawi aimed at distributing over 5000 metal silos to farmers for the storage of maize. This was unsuccessful because Malawian farmers prefer to store their grains inside their homes to prevent theft and the metal silos were created to be placed outside their homes, but this was not considered (World Bank, 2011).

The study of PHL cannot focus solely on physical operations but has to include the socio-economic and human factors of the actors involved, because they have significant impacts on the level of losses incurred (FAO, 1981). Leslie and Reimer (1999) argue for the inclusion of horizontal concepts into commodity chain analysis such as gender to explore their influence on the vertical links. Spurgeon (1976) suggests that a poor understanding of the postharvest system and user perspectives are the reasons behind the suggestion of technologies as sole solutions. Losses occur along the FSC, therefore a proper understanding of the chain in a particular location will reflect operational and performance gaps (Zorya *et al.*, 2011). There may be a lot of research on the scientific principles of postharvest, that reveal storage as an entry point of losses but there is a dearth of applied research that acknowledges the dynamics of individual postharvest systems (Spurgeon, 1976). If individual components of the system are not understood it will be impossible to provide acceptable solutions.

Various reports and manuals produced by the FAO and World Bank after the 1979 resolution (Grolleaud, 2000, FAO, 1980, FAO, 1981, FAO, 1989, World Bank, 2011, Lipinski *et al.*, 2013) have clearly indicated that a systems approach be adopted to study PHL, because socio-economic and cultural conditions cannot be separated from the immediate actors along the chain. Their analysis includes identifying the stages along the chain where losses occur and contextualising them within broader themes of socioeconomic, cultural and political drivers (FAO, 1981, Grolleaud, 2000). Even though the system is studied as a whole, the movement and transfer

of food from one party to another depicts a 'chain' (FAO, 1981) and reveals weak points (HLPE, 2014). The value chain is therefore an important component of the systems approach (World Bank, 2011). Despite this recommendation, a review by Affognon *et al.* (2015) indicates that most postharvest studies do not consider external factors that might influence losses and the interactions that occur along the chain between actors.

Grolleaud (2000) asserts that a systems approach will shift the focus of studies based on observation and measurement of losses at different phases to prioritise the understanding and identification of the factors that influence these losses at different points along the value chain. He states that this process:

> "*would be descriptive, analytic and explanatory, rather than quantitative and hence, more in keeping with both the spirit and understanding of a complex whole in which technological, sociological, and economic elements are closely interwoven. This would provide a more credible and solid basis for developing possible technical improvements (human position and intervention, equipment, structures, materials, etc.) and introducing effective innovations*" (no pagination).

This resonates with Cook *et al.*'s (2006) argument on the way food stories are told to reveal all the elements of a commodity's movement.

Postharvest losses have been studied differently, with authors adopting varying perspectives. A majority of available research superficially identifies the causes of losses at certain points along the chain. The Life Cycle Assessment (LCA) was used to study the rice value chain in Nigeria to evaluate its environmental impact (Oguntade *et al.*, 2014). The management of water resources steered the farm to fork analysis by Lundqvist *et al.* (2008). The World Bank (2011) adopted a policy approach to the study of PHL in SSA to evaluate the level of knowledge available on grain losses and technological approaches available for its reduction. A comprehensive meta-analysis of existing literature available in SSA by Affognon *et al.* (2015), revealed methodological gaps and the necessity for more applied research on postharvest losses in different geographical regions. IMECHE (2013) provided an engineering perspective to the

causes of losses, as well as the environmental impacts of losses and increased production on natural resources.

3.4 Commodity chains and consumer waste

Similar to PHL, most of the food waste studies have quantified the causes of waste and not attempted to understand the relationships people have with food in their homes and the behaviours that drive these waste patterns. This has resulted in consumers being viewed as profligate and part of a throwaway society (Gregson *et al.* 2007, Evans, 2014); these views have been supported by food waste estimates. However, recent studies are moving away from the throwaway thesis to consideration of everyday, ordinary, social and domestic practices (Warde, 2005, Exodus, 2007a, Exodus, 2007b, Evans, 2012, Watson and Meah, 2012). According to Miller (2001), the "*home is the primary site of consumption*" (p. 239) therefore, research needs to begin to understand what goes on "*behind closed doors*" (p. 1) that causes food to become waste. This is because consumers are typically blamed for household waste production when other activities earlier on along the chain caused the waste at home. For instance, large portion sizes for packaged food are regulated by retailers (Miller, 2001, Alexander *et al.,* 2013). Thus, following consumers to the spaces where they actually consume food enables consumption practices to be explored and provides explanations for why consumers do what they do (Warde, 2012).

Food waste is a by-product of a routinized way of consumption (Watson, 2013c). Leslie and Reimer (1999) suggest that the study of households and how consumers interact with food in the spaces of their homes is what consumption literature is concerned with. Consumption is ordinary and food waste occurs as a result of these mundane everyday activities that are not usually waste related (Evans, 2014). As a result, food waste is explored in the household context to understand the point where food becomes waste and how everyday practices influence waste patterns (Evans, 2012). This context has only been explored in middle/high-income countries.

Practice is defined as:

> "*a routinized type of behaviour which consists of several elements, interconnected to one another: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know how, states of emotion and motivational knowledge*" (Reckwitz, 2002:249).

These routine behaviours are part of everyday life and everyday life is central to the study of consumption (Trentmann, 2012). Knowledge is the element of a practice that holds the acts of behaviour of an individual together. It is the basis for how an individual understands the world, interprets it and engages in activities such as cooking and eating (Reckwitz, 2002). Individuals are carriers of practice and they perform practices in their everyday lives for them to survive (Evans, 2014). Practices are then as a result of sayings and doings dependent on knowledge and know-how, thus the process of carrying out practices is a performance (Warde, 2005). As a result of the knowledge individuals have of their place in the world "*every practice implies a particular routinized mode of intentionality, i.e. of wanting or desiring certain things and avoiding others*" (Reckwitz, 2002:254). Consequently, consumption practices result in food waste. Theories of practice have shifted the focus in consumption literature from the consumer to practices (Evans, 2014).

Broadly constructed institutions that differ with respect to location, time, social and cultural contexts influence practices, e.g. household structures (Warde, 2005, Murcott *et al.*, 2013). In the UK, external pressures like the EU Landfill Directive, food quality and labelling influence domestic routines (Watson and Meah, 2012). Therefore consumer behaviours and waste patterns will differ via location, time and social constructs. Two studies in the UK by Watson and Meah (2012) and Evans (2012) explore domestic practices relating to food waste.

Evans' (2012) ethnographic study revealed that everyday practices and the organisation of everyday life resulted in food becoming waste. He argues that activities like work schedules, the search for variety, the material and social context of food underline the transfer of food to waste.

As a result, he referred to food waste as a "*fall out of everyday life*" (p. 45). Consumption practices include the disposal of commodities and food becomes waste when it is "*matter out of place*" (Gregson *et al.*, 2007:189). This is drawn from Mary Douglas' argument of dirt being the "*by-product of a systematic ordering and classification of matter*" (Douglas, 2002:44). The social domestic orders of people's homes are constructed based on how they understand themselves and the world around them, as Schatzki (1996:13) states, "*social order and individuality…result from practices*". Thus, household boundaries keep food 'in' or 'out' of the system (Douglas, 2002), built around the "*prevailing organization of practices…of what people take to be "normal" ways of life"* (p. 19).

According to Ventour (2008) some consumers had no awareness that they were wasting food, its monetary value or the impacts food waste had on the environment. Others claimed to not like the idea of wasting food but their everyday practices and routines reflected otherwise (Exodus, 2007a). Ian Cook's story of the papaya revealed that everyday activities like busy schedules and eating out resulted in food becoming waste (Cook *et al*., 2004).

Research by Watson and Meah (2012) highlighted some important factors about consumers and food waste. From all the reasons that people offered for feeling bad about wasting food, none related to greenhouse gas emissions during agricultural production or in landfills, the amount of food in landfills or the wasting of resources that were involved in its production. Cook *et al*. (2004) also identified that the papaya consumer considered the origin of her food but not in the line of exploitation or poverty.

Research on the causes of post-consumer waste is only prevalent in middle/high-income countries. Households have been identified as the spaces where most of this waste occurs excluding retail and processing. As a result most of the research has been focused on understanding consumer behaviours in their homes. It is believed that understanding this process will lead to the reduction of waste at other points along the chain

(Watson, 2013c). The management and reduction of food waste is difficult because of the interconnected social relations of everyday life. The moments and processes where waste occurs is the gap sociological research is trying to fill, because that is the only way consumer waste can be managed and reduced (Watson and Meah, 2012).

3.5 Conclusion

This chapter has discussed commodity chains as a theoretical framework and their applicability to studying postharvest losses and food waste. As stated in chapter 1, this thesis adopts the commodity centred approach to study the citrus value chain. The four agro food commodity chain approaches (commodity circuits, commodity networks, systems of provision and filière approach) are combined in this thesis as in most food waste research and are subsequently referred to as 'commodity chain analysis' or 'follow the thing' (adopted from Friedland, 2001, Cook *et al*., 2004, Collins, 2005). However, there are notable differences. This research does not follow the citrus value chain across the Nigerian border; first because it is beyond the scope of the thesis and second, Nigeria does not export its citrus fruits. Instead, it traces the movement of the fruit along the Nigerian commodity chain, identifying the actors and understanding their activities and relationships to reveal the whole system and its boundaries. One of the underlying aims for following commodities has been to expose areas of exploitation, poverty and dominance as commodities move from the global south to the north. Yet these may also be happening within national chains albeit on a different scale. The differentiation of postharvest losses and food waste has caused a spatial distinction in the way they are studied. Looking through the literature, supply chains in low-income, middle/high-income countries are merged into one, in that, studies identify the causes of postharvest losses along the chain in low income countries and then move to the causes of waste in middle/high income countries. Entire chains are not studied and low-income consumers in the global south are completely excluded from commodity chain and food waste research.

One of the strengths of the filiere approach for intra-country studies is its ability to provide in-depth and historical coverage. As agricultural activities do not occur in a vacuum the political economy of agriculture cannot be ignored. This thesis aims to demonstrate the importance of using commodity chain analysis to study a national value chain. It also aims to push for the study of losses and waste along the chain in a particular country and not just one aspect of the chain. The reconnection of production and consumption is applicable on a smaller scale and its revelations can improve the value chain of that crop, in this case, impact policy on the management of losses. The contextual background on the citrus industry and postharvest losses in Nigeria is provided in Chapter 4.

Chapter 4: Setting the scene: Background information on Nigeria

4.0 Introduction

This chapter provides background information on Nigeria providing an agricultural context for the thesis. It starts by introducing the emergence of citrus into the country and the current state of production and consumption. Then, it provides an overview of postharvest losses providing estimates and causes for various crops.

4.1 Introduction of Citrus to Nigeria

There are controversies on the origin of citrus, with some researchers claiming that the fruit is traced to Southeast Asia – some parts of China, India and Malay Archipelago (Jolaoso *et al.*, 2011b, Liu *et al.*, 2012). Recent research carried out by the Center for Plant and Food Science at the University of Western Sydney revealed that 50% of the true species of citrus originated from Australia, New Caledonia and New Guinea whereas commercial species like oranges, mandarin and lemons are indigenous to Asia (Anitei, 2007, Liu *et al.*, 2012).

The spread of citrus to other parts of the world was very slow. In African history, the planting of trees was usually aimed at the protection of individual species or the transportation of seeds. For fruit trees, more value was placed on their leaves and seeds. In June 1654, the first sweet orange tree (brought in from the island of St. Helena) was planted in the Governor's private garden in Capetown and is believed to have spread to other parts of Africa from there (Webber, 1967). During the Colonial era, forestry departments extended fruit trees across West Africa (Blench, 2000). Nigerian Annual Colonial reports indicate that in 1920 - 1921 the Department of Agriculture decided to introduce trees of economic value into the Northern Provinces of the country that could be grown under irrigation; these included citrus varieties, banana, pineapple and other tropical fruits (Anon, 1920). Missionaries and forestry workers are responsible for extending the range of citrus fruits. Gradual marketing and

trade of citrus started in the 20th century and over time it has become an important economic fruit crop (Blench, 2000).

Citrus trees are traditionally intercropped with other crops like yam, cassava, oil palm and soya beans. Nigeria's climatic conditions favour the production of different citrus cultivars resulting in high levels of production. During the Colonial era (1900-1960) and Post-independence (1960-1975), the horticultural sector received minimal attention from the Nigerian government. Research was barely carried out in this area, as a result, research on citrus is limited in Nigeria (Jolaoso *et al.*, 2011b). In 1975, the Nigerian Government established the now National Horticultural Research Institute (NIHORT) supported by the United Nations Development Programme (UNDP) and Food and Agriculture Organization. NIHORT was established to increase citrus production and ensure its all year availability. It was also tasked with spearheading citrus research development in Nigeria (ibid.).

4.2 Benefits of Citrus

Citrus is a subgenus of the *Rutaceae* family, the genus of flowering plants (Ezejiofor *et al.*, 2011, Etebu and Nwauzoma, 2014). The most widely grown commercially significant citrus crops are: sweet orange (*Citrus sinensis*), tangerines (*Citrus reticulate*), lemon (*Citrus limonum*), lime (*Citrus aurantifulia*) and grape fruit (*Citrus grandis*) (Okwu and Emenike, 2006). According to UNCTAD (2013) citrus is the most important fruit crop based on value in international trade. Citrus is characterized with a rough outer rind or skin also known as the epicarp or flavedo that surrounds and covers the fruit (Etebu and Nwauzoma, 2014). The colour of the skin ranges from green to yellow or orange and its shape is round or oblong (UNCTAD, 2010).

Sweet orange is the most common citrus fruit grown around the world and constitutes a major part of the human diet (Ezejiofor *et al.*, 2011). This is as a result of its importance in nutrition and medicinal attributes. Sweet orange, as the name suggests, has a sweet taste making it suitable for fruit

juice production and other by-products like jam and marmalades (Okwu and Emenike, 2006). Citrus is also noted for its richness in vitamins (ascorbic and folic acid), fibre, minerals, soluble sugars, organic acids (citric and formic acid), phytonutrients (flavonoids), macronutrients (folate, potassium, copper), whilst also being fat free and low in cholesterol (Okwu and Emenike, 2006, UNCTAD, 2010, Ezejiofor *et al.*, 2011, Liu *et al.*, 2012, Bamise and Oziegbe, 2013).

Research has shown its health benefits to include the following: reducing the incidence of cancer and cardio-vascular diseases, lowering blood pressure, disease prevention, stimulating the immune system, acting as a powerful antioxidant, preventing osteoporosis, arteriosclerosis, stomach ulcers and cataracts amongst others (Okwu and Emenike, 2006, UNCTAD, 2010, Liu *et al.*, 2012, Etebu and Nwauzoma, 2014). In addition, citrus oil is appreciated for its antibacterial and insecticidal properties (Liu *et al.*, 2012).

4.3 Citrus Production and Consumption in Nigeria

In 2012, Nigeria produced 3.9 million metric tonnes of small citrus fruits (FAO, 2012). This ranked Nigeria as the 9th highest producer of citrus in the world (UNCTAD, 2010). In Nigeria, after tomatoes, citrus is the second main fruit crop grown. However, there is a lack of data on previous production levels. As a matter of fact, the Annual Abstract on Statistics in 2009 did not include citrus as a major crop produced in Nigeria (NBS, 2009). The production of citrus in Nigeria is carried out mainly by small-scale farmers, with minimal investment by the government (Adeyemi, 2005, Olife *et al.*, 2015). Citrus is produced in fifteen states: Benue, Nassarawa, Osun, Anambra, Ekiti, Imo, Kogi, Ebonyi, Edo, Delta, Oyo, Kwara, Ogun, Taraba and Kaduna (Olife *et al.*, 2015). Available statistics for all state production levels is unavailable. Based on data provided by NIHORT, the estimated level of production in Benue is about 32,000 MT (Jolaoso *et al.*, 2011b) whereas other figures provided as estimates of citrus production in Benue are 800,000 MT (Odbanjo and Sangodoyin, 2002) and 1 million MT (Okigbo, 2012). The differences in production

estimates underscore the paucity of citrus research in Nigeria. Based on these estimates 45% of citrus fruits are consumed fresh, 30% are lost due to postharvest losses (PHL) and 25% are processed into concentrates for the production of fruit juice (NIHORT, 2002, Ezejiofor *et al.*, 2011, Bamise and Oziegbe, 2013).

Nigeria's fruit juice demand is increasing by 10% every year (FMARD, 2015). From 2002 to 2012, the fruit juice consumed in Nigeria soared from 220 million litres to 550 million litres (FMARD, 2015). This increase is as a result of rising incomes and the expansion of the middle class, which is becoming aware of the necessity for more nutritional drinks. Likewise, the influx of hotels and restaurants are increasing demand for fruit juice (Flake and Nzeka, 2009). Nigerians consume 50% of the total quantity of fruit juice consumed in Africa (Onwualu *et al.*, 2013). Thus the food and beverage sector is described as the "*only thriving aspect of the manufacturing industry in Nigeria*" (Onwualu, 2012b:36).

Up until 2002, Nigeria was importing about 200 million litres of Tetra Pak fruit juice; this was worth 250 million USD and amounted to 90% of the fruit juice consumed. As a result of the high cost of fruit juice imports, the Federal Government of Nigeria (GON) banned the import of packed fruit juice. At the same time, the import tariff for juice concentrates and premixes was lowered from 10% to 5%. A 40% rebate on exported fruit juice was introduced. These policies according to the GON were put in place to 'add value', encourage and promote the manufacturing of local fruit juice and processing in the country, as well as generate income and create employment (Flake and Nzeka, 2009, Onwualu *et al.*, 2013). As a result of the ban, there was an increase in local fruit juice processing and new industries were established. Coca-Cola established a concentrate processing and packaging plant along with citrus and pineapple farms for their Five Alive Brand. Other fruit juice producing companies were Dangote Group, SCAO Nigeria and Nutricima. Over time, the demand for fruit juice exceeded domestic production causing a demand and supply gap (Flake and Nzeka, 2009). Consequently, from 2002 to 2007 the

demand for citrus concentrates increased from 1.5 million kg to 30 million kg and has been on the increase ever since (ibid.) Nigeria has had to import concentrates to meet local market demands.

Today, Nigeria barely produces citrus concentrates for fruit juice production as 95% of the concentrates used in the country are imported. The cost of these concentrates amounts to 200 million USD annually and most are imported from South Africa, European Union, and South America (FMARD, 2015). Citrus accounts for the most concentrate imported (40%), then pineapple (25%), mixed fruit (20%), apple (10%) and others (5%) (FMARD, 2015). In 2009, Coca-Cola Nigeria shut down due to high manufacturing costs and a hostile operating environment (FMARD, 2015). From 2009 to 2011 Nigeria did not have a concentrate processing plant and imported all of its concentrates for fruit juice production. Some processing facilities have been established in Nigeria, but most of them are moribund, with processing never really commencing – others start and stop abruptly. The story was the same for the Benfruit factory. It was constructed by the Benue State Government and commissioned in 2005, but production never started (Teragro, 2016). However, in 2012, Transnational Corporation of Nigeria (Transcorp) purchased the concentrate plant (now named Teragro) via a public–private partnership with the Benue State Government and started concentrate production. At the moment, this is the only concentrate processing facility in Nigeria. The plant produces citrus, mango and pineapple concentrates and its capacity is 26,000MT. Teragro is in partnership with Coca Cola and is the sole domestic provider of their concentrates (Teragro, 2016). The establishment of Teragro is described as "*a major milestone for Nigeria's agricultural sector*" (Okigbo, 2012) as it provides a market for the major fruits produced in Nigeria. However, with only one functional citrus concentrate processing facility, there is still a high dependence on the importation of concentrates.

There is limited research on the consumption rate of fresh whole fruits in Nigeria, including citrus. Available studies have analysed the consumption

rates amongst students and staff in a certain part of the country – Oyo State. This may be influenced by the presence of the National Horticultural Research Institute in the state capital – Ibadan. A study carried out by Abdullahi and Abdullahi (2014) in Sokoto, revealed that 75% of respondents consumed fruits regularly- at least once every week and 31% on a daily basis. The types of fruits consumed were not mentioned. Layade and Adeoye (2014) found that citrus was the third most preferred fruit to students in Oyo state and its purchase was dependent on available income. However, a survey of staff in eight agricultural institutions in Oyo showed that price was not really important; rather the health benefits of fruits were their main reason for purchase. This is understandable, as staff will readily have more disposable income than students. The staff survey also revealed that citrus was the main fruit consumed. In Jos, Banwat *et al.* (2012) noted that respondents were aware of the nutritional importance of consuming fruits but were unable to consume the required quantity. This was mainly due to the cost of the fruits and their perception of its importance. Fruits were however purchased when in season and at intervals as snacks for children. The absence of proper storage facilities in the home was recognised as the main constraint to the purchase of fruits (Oyedele *et al.*, 2014). This suggests that consumers experience difficulty in preserving their fruits after purchase.

4.4 Postharvest losses and food waste in Nigeria

Postharvest losses in Nigeria reveal broader structural problems within the agricultural sector that has significantly declined since the 1970s. The production of food is predominately by small-scale farmers and as a result productivity levels have been relatively low. It is estimated that 70% of the Nigerian population lives on less than $1 a day (Aworh, 2015). About 9.4 million Nigerians are undernourished, which is about 6% of the population (Oguntade *et al.*, 2014). The Nigerian Government has regularly created agricultural policies to revive the sector to improve the welfare of the populace and the economy. Unfortunately, set goals have rarely materialised, poverty is on the increase and the agricultural sector's

productivity is stagnant or declining (Ehui, 2009). This has become relatively worse due to the increase in postharvest losses, with higher levels experienced in horticulture (Morris and Kamarulzaman, 2014). The Government focuses more on procurement of fertilizers, provision of on farm storage facilities, irrigation and the increased planting of crops with minimal attention paid to postharvest losses (Adepoju, 2014). Nigeria produces various crops in abundant quantities and experiences high postharvest losses in the same crops. This shows the need for the management of food from when it is produced till it is consumed (Oguntade *et al.*, 2014).

Low production ensures that Nigeria imports a lot of food crops annually amounting to 8 billion USD. Most of these crops can be produced in Nigeria. Small-scale processing industries are lacking due to the erratic electricity supply, financial constraints in the form of high interest rates from banks, unavailability of capital, poor management and political constraints (Aworh, 2015). Accordingly, value addition along crop chains is limited. Low agricultural productivity, high postharvest losses, and the absence of value addition along crop chains increase food insecurity levels in the country. Postharvest losses are considered to be responsible for the importation of food products in Nigeria. Therefore the management of postharvest losses has the ability to make more food available for the populace, improve the income of smallholder farmers and their food security status as well (ibid.).

There is a scarcity of research in Nigeria on postharvest losses and their estimates (as discussed in chapter 1). Postharvest loss research in Nigeria has focused more on grains, because of its prevalence in the everyday diets of the populace. Most of the locally available estimation figures provided for postharvest losses in Nigeria are questioned based on their methodologies. PHL in Nigeria occur mainly as a result of poor packaging, the lack of adequate storage, processing facilities and marketing infrastructure (Taylor and Esan, 2012, Morris and Kamarulzaman, 2014,

Oguntade, 2013). Various studies are spread across different aspects of crop chains.

In 1997, yams experienced 12.4% losses during storage which translated to 10.45% of the farmers expected revenue (Okah, 1997). When yams are rough handled during harvesting and transportation, they are subject to bruises and cuts that promote fungal infections. During storage, dry rot is considered to be the most devastating disease to yam, reducing its quantity and market value. As a result, they are subject to up to 50% losses (Amusa *et al.*, 2003).

Recent estimates on rice postharvest losses indicate that about 25% is lost and this translates to significant economic losses to farmers in the form of revenue. The loss 'hotspots' are harvesting, parboiling, milling and retail in order of impact (Oguntade *et al.*, 2014). An extensive analysis of the cassava and maize value chain (production to retail) by Oguntade (2013) estimated the worth of cassava postharvest losses after the farm gate to be 144 billion Naira, whereas for maize it is 120 billion Naira. Cassava is very important in Nigerian diets as it can be processed into various forms locally (e.g. garri); hence the losses have severe consequences on food security. The losses occurred from harvest to market and were as a result of harvesting methods, pests, diseases and moisture content during storage and transportation processes. Likewise, maize is another important staple food that is processed into flour. Most losses were incurred during marketing (26.6%) due to pests, diseases and moisture (ibid.).

Fruits in Nigeria suffer from seasonal gluts and massive wastage because of the lack of adequate storage and processing facilities. As well as the absence of value addition along the chain into products like juice and jam (Oluwalana, 2006). Most of the fruits and vegetables are consumed locally and there is no value addition along the chain, so food chains are relatively short. Morris and Kamarulzaman (2014) studied plantain losses in Nigeria and identified the major actors to be: farmers, village trade collectors,

wholesalers (who transported to other states in Nigeria), retailers and consumers.

Pineapple losses are estimated to be between 45-50%, due to harvesting techniques and improper transportation (FMARD, 2015). Tomatoes experience 20% losses on the farm and 28% during transit while losses for bell pepper are 12% on the farm and 15% in transit. These losses are caused by the use of improper packaging materials used for transportation (baskets and sacks) that do not protect the fruits from mechanical damage. According to Pastuszek (2015) tomato losses are more than 50% every year because of poor storage and postharvest handling. Most of the fruits produced in Nigeria are grown in specific parts of the country and have to be transported to other states resulting in transportation losses. Tomatoes and peppers are highly perishable and when not managed properly they deteriorate at a fast rate, reducing their quality. (Olayemi *et al.*, 2010). The hot and humid climate greatly contributes to the level of losses experienced (Akinbode, 1983). These losses adversely affected the income of farmers.

A study on tomatoes in Ibadan markets by Adeoye and Odeleye (2009) identified three main causes of PHL: physiological, pathological and mechanical damage. When the tomatoes were loaded and offloaded from vehicles they were often rough handled giving rise to bruises that accelerated microbial deterioration. During transportation, the baskets were stacked on top of each other causing mechanical damage and inadequate storage facilities ensured that the fruits were stored under direct sunlight. This resulted in over 50% monetary loss for wholesalers and retailers (ibid.). The transportation of produce in Nigeria greatly increases the losses experienced, due to poor road networks and the inappropriate vehicles used (Adepoju, 2014). With the lack of adequate infrastructure, as food moves along the chain its quality reduces which affects its economic value (Morris and Kamarulzaman, 2014).

Tomatoes suffer from the nonexistence of adequate storage and processing facilities, as a result farmers have to transport their fruits to

markets immediately following harvesting resulting in market gluts. Farmers who cannot afford to transport their fruits to market sell them at the farm gate and dispose of what is not consumed (Adepoju, 2014). In markets, tomatoes with reduced quality or rotten tomatoes are sold at much lower prices. Whatever is not sold is disposed of. The relatively low prices received by farmers and traders had negative impacts on their livelihoods (ibid.).

Fruits and vegetables were lost by farmers in Benue State due to the lack of processing and storage facilities, as well the absence of buyers. Therefore, the fruits and vegetables were quick to spoil resulting in the loss of income and the wasting of resources. Other reasons for PHL include poor prices and the condition of roads that were not motorable in the rainy season (Kughur *et al.*, 2015).

As stated earlier, there is limited food waste research in low-income countries, including Nigeria. The only studies that show a presence of food in bins are solid waste-related. This is due to the open disposal of waste that results in pollution and has public health implications. In Southwest Nigeria, Amori *et al.* (2013) noticed that the waste collected from residential houses of junior and senior tertiary staff consisted of 62% and 32% food and fruit waste. Another comparative study revealed that solid waste in eight different cities was composed of 59.3% food/organic waste (Amber *et al.*, 2012). The review of municipal solid waste literature in Nigeria by Nnaji (2014) identified that food waste was a regular component of everyday household disposal estimated at 50%. The quantity and composition of waste varies by location due to socioeconomic differences, but as the above studies reveal a significant amount of food is disposed of in households.

4.5 Conclusion

This chapter has reviewed estimates and causes of postharvest losses in Nigeria, based on available literature. It can be noticed that there is more research on postharvest losses than there is on consumer waste. For

perishable crops, more data is available on tomato losses than other fruits in Nigeria. This further reveals the gap that this study is attempting to fill. The next chapter discusses the methodological strategy employed in the collection of data.

Chapter 5: Methodology

5.0 Introduction

This chapter provides a description of the methods adopted to answer the aims and objectives of this study. My methodological approach is discussed as well as important components of qualitative research - reliability and viability. The challenges and limitations to the study are provided and it concludes with a reflection on ethical issues and the impact positionality had on data collection.

5.1 Ontological and Epistemological underpinnings of the study

The methods used in social science are strongly linked to the underlining positions of how the social world/reality is viewed and expectations of how it should be studied (Bryman, 2012). The study of human geography has evolved over the years. Philosophical debates since the 1960s have developed distinct approaches for the study of human geography. Ontological and epistemological paradigms are fundamental philosophical positions adopted by social scientists in order to explain human behaviour (Graham, 2005). These define the manner in which research is carried out.

Ontology debates the nature of reality between two positions -realism and idealism. The central question relates to the existence of a real world outside human conceptions. Realists adopt this view while idealists refute it and maintain the position that there is no real world beyond what the human mind can constitute. Different questions arise from this position of what people can come to know and or if at all there is a deeper world outside the realisations of the human mind (Graham, 2005, Creswell, 2007).

Epistemology is the philosophical position on the theory of knowledge, answering the question how do we know what we know (Bryman, 2012). Positivist positions take the view that the social world can be studied with the same methods as the natural sciences, relying on the principles of

justification against empirical evidence (Graham, 2005:16). Anti – naturalism has its roots in hermeneutic or interpretative approaches and disagree with the use of natural sciences to study human behaviour claiming that the 'subject matter' of both disciplines is different and therefore requires a different epistemology (Graham, 2005, Bryman, 2012).

Realism argues that external underlying structural mechanics have a reality independent of individuals and determine human action; and this reality is discoverable (May, 2011, Bryman, 2012). This view of reality determines the research approach adopted to acquire knowledge. Positivists have a realist view of reality: discoverable and measurable. Positivism argues that human behaviour can be explained in terms of cause and effect if data is collected objectively (where the researcher detaches himself from the research) about the social and explained with laws and theories (Graham, 2005). Positivism excludes metaphysical questions because they cannot be measured and believe that the testing of various laws and theories against empirical evidence is the only route to knowledge (Kitchin and Tate, 2000).

Interpretivism is critical of positivism as a model to study the social and seeks to interpret and understand human action (Graham, 2005). It has an idealist ontological view that sees the social order as a process of constant understanding and interpretation of the social world (Bryman, 2012). Idealists assert that knowledge and reality is subjective. An understanding of the meaning and interpretations of external structures determine the certainty of what is real and define human action. Reality to idealists is based on an individual's interpretation of the social environment (May, 2011). Consequently, patterns of behaviour can only be explained if the thoughts behind them are understood (Kitchin and Tate, 2000). Intrepretivism embodies the study of the causes of human action – the desires and beliefs of humans. The core characteristics of human action are – intentionality, rationality and reflexivity. In order to understand human action, individual actions and characteristics central to the cause of

action have to be understood and interpreted, hence interpretivism is subjective (Kitchin and Tate, 2000).

The core of idealism is the understanding of the process of interpretation by individuals while realism explains the impact of external structures on human action. May (2011) claims that the study of external structures precedes human action because these structures are responsible for human action. To idealists knowledge is acquired from the interpretations of how people come to know the world, therefore, there are multiple realities. Individuals interpret culture, rules, norms and external structures in various ways; this constant understanding and interpretation allows for the understanding of the individual's environment and thus informs human action (ibid.).

One of the major differences between positivism and interpretivism is that the former aims to explain and the latter seeks to understand human behaviour (Bryman, 2012). Positivism is criticised for its exclusivity; positivists argue that the same methods can be used to explain the physical sciences and social phenomena. Intrepretivists on the other hand aver that humans are distinct beings and natural science methods ignore the characteristics of humans and the spatial patterns in social, economic and political structures that affect human behaviour (Kitchin and Tate, 2000, Bryman, 2012). The research strategies employed to explain human behaviour (human action) are different from the approaches used by the natural scientists to test hypothesis (Graham, 2005).

Graham (2005) points out that ontological positions of what really exist do not necessarily reflect naturalism and anti-naturalism perspectives. However, a positivist and interpretivist position can reflect a realist or idealist ontology (May, 2011). The data collected for positivist research consists of numbers, statistics and empirical evidence that is measurable in order to test theory (Graham, 2005) while interpretivist research relies on lived human experience and collects 'words' based on how people make meaning of and interpret the social (May, 2011).

5.2 Quantitative and Qualitative methodological approach

Simplified distinctions between quantitative and qualitative methods of social research are based on the presence of quantification in the former and its absence in the latter. However, methodological writers suggest that there are deeper differences such as their epistemological foundations and the manner in which data is collected and analysed (Brannen, 1992, Bryman, 2012). The use of quantitative methods does not make a piece of research positivist, this is determined by the "*underlying principles of objectivity and formal logic*" (Kitchin and Tate, 2000:8). Realism can adopt qualitative methodology to study "*individuals in their contexts*" and qualitative methodology to provide "*descriptive generalizations*" (ibid., p. 16).

Quantitative research "*emphasizes quantification in the collection and analysis of data*" (Bryman, 2012:35). It adopts an objective ontological position and deductive approach; relying on the testing of theories as the route to knowledge (Bryman, 2012). Qualitative research on the other hand, assumes an interpretivist epistemological position and inductive approach focused on words, the generation of theories and understanding the interpretation of the social world by the individuals studied (ibid).

The researcher defines variables and creates a hypothesis to test data collected at the onset of quantitative research, this is to ensure objectivity (Bryman, 2012). Flexibility is more limited compared to qualitative research as the procedure is outlined from the beginning. Data collection methods include surveys and experiments. On the other hand, qualitative research starts out with a general problem, which structures itself as the research unveils variables and gains meaning (Brannen, 1992). The research is shaped by emerging trends, the researcher's experience and worldview. Therefore the initial research strategy is modified to suit present realities (Creswell, 2007). This inductive process allows the researcher to be more involved; their worldview and interpretations of

social reality influence the outcome of research. Data techniques include interviews and observations (Bryman, 2012).

The concept of generalization is a significant difference between qualitative and quantitative research. A major critique of qualitative research is the inability to generalise findings, because they are not representative of populations due to small sample sizes and thus cannot be replicated (Winchester and Rofe, 2010, Bryman, 2012). The basis for qualitative research is to provide an understanding of the social, making it context specific and reliant on in-depth analysis from a small sample. The results generate theories. On the contrary, quantitative research requires large samples to test theory that are generalised (Brannen, 1992).

Critiques of quantitative research share the base of the positivist position for treating the social sciences the same as the physical sciences. Schutz (1962) argues that the same models used to study atoms and molecules cannot be adopted to study individuals that interpret the world around them, as this actively ignores the differences between the social and physical world (see Bryman, 2012). Qualitative research is criticised for its subjectivity in the sense that the researcher decides what is important and significant having an impact on the outcome of the study (Creswell, 2007). Researchers bring their experiences, perspectives, ideas and values into the collection and interpretation of data, therefore absolute objectivity is impossible (Dowling, 2010).

5.3 Mixed Methods

Differing philosophical perspectives determine the differences between quantitative and qualitative research strategies and these reflect the methods adopted for data collection (Bryman, 2012). As a result, the combination of both research methods in a single research study raises questions on the philosophical position of the research (Brannen, 1992). Some writers argue that methods have epistemological and ontological assumptions inherent in them, thus the use of a method connotes a commitment to its underlying philosophy (Brannen, 1992, Bryman, 2012),

while Bryman (2012:593) claims that research methods are "*free-floating in terms of epistemology and ontology*". He further argues that research methods are capable of collecting various forms of data.

The combination of qualitative and quantitative research methods in a single piece of research is known as triangulation or mixed methods. Brannen (1992) suggests that research questions dictate the methods required to provide the best answer(s) for the questions. Opponents of triangulation base their arguments on the view that research methods have inherent epistemology and ontology, and that qualitative and quantitative research make up two distinct paradigms that are not compatible. This is refuted by proponents of mixed methods, claiming that research methods are "*autonomous*" (Bryman, 2012:606).

The integration of qualitative and quantitative methods offers various benefits. The crosschecking of findings from different sources enhance validity (Brannen, 1992, Bryman, 2012). The use of different methods complements the limitations of one single method whilst aiming to add credibility (Bryman 2012). For instance, the combination of questionnaires and interviews provide general and specific perspectives of an issue (Winchester and Rofe, 2010). Also, different methods may reveal gaps in data that allow further research and analysis (Bryman, 2012). The integration of both methods is at the heart of the mixed methods debate, in the sense that if the integration of methods serves different purposes – the testing and creation of theory - then integration is not valid (Brannen, 1992). Despite the theoretical arguments, the use of mixed methods in social research is on the increase (Bryman, 2012).

5.4 My Methodological approach

The study of losses along commodity chains suffers from the dearth of context specific research on the causes of losses (from farm to fork) and the impact on immediate actors, as well as the social, economic and political factors, and the everyday practices that drive these losses. Most of the studies seek to quantify the losses in yield and totality. For this reason,

this research aims to identify socioeconomic factors that influence losses, as well as the causes and impact of these losses from the perspective of different actors along the orange supply chain. The specific aim and objectives likewise drove the choice of methods. Drawing on previous research that adopted a multi-method approach to collect data on pomegranate, mandarin and citrus postharvest losses in India, Nepal and Zimbabwe (Sudharshan *et al.*, 2013, Bhattarai *et al.*, 2013 , Musasa *et al.*, 2013) and consumer studies using various ethnographic methods (Cook *et al*., 2004, Watson and Meah, 2012, Evans, 2012), a multi-method approach was adopted for this research.

Data for this research were collected via questionnaires, interviews, an online survey, direct observation, the production of a field diary and taking of photographs. The research methods were adopted to reveal "*human environments, individual experiences, and social processes*" (Winchester and Rofe, 2010:3). To answer the research aims and objectives adequately, it was imperative to gather data exhaustively. As this could not be achieved with only one research method, mixed methods offered a sense of completeness (Bryman, 2012). The questionnaire is capable of providing general and specific insights into issues and revealing emerging trends (McGuirk and O'Niell, 2010), that can be explored further in interviews.

5.4.1 Sampling Strategy

A purposive multi-stage sampling technique was used to select the area of study as well as the sampling units. Two-level sampling of contexts and then cases is a particular attribute of qualitative research. This method of sampling is determined by the research questions and the criteria used for selection to enable the research questions to be answered (Bryman, 2012).

5.4.2 Study Area

Nigeria is in West Africa and bordered by Cameroon in the east, Republic of Benin in the west, Chad and Niger in the North. The climate in Nigeria is characterised by two main seasons – the rainy/wet season and the dry season. From April to October, Nigeria experiences heavy rainfall, which is

the main characteristic of the wet season and temperatures are between 28-33˚C. The cool, dry, windy and dusty dry season is from November to March and at this time temperatures reach 12˚C and lower in different parts of the country. Before the rainy season begins between February and March, the weather is extremely hot and temperatures reach a high of 38˚C. The North of Nigeria is classified as dry and the southern parts as wet. This is due to the varying lengths of the dry and wet season in both regions. Nigeria has six different vegetation types – Guinea Savannah, Sudan Savannah, Sahel Savannah, Saline Water Swamp, Freshwater Swamp and Tropical Evergreen Forest (Karmalkar *et al.*, n.d., NPC, 2014).

Nigeria's diverse vegetation allows for a plethora of tropical and subtropical crops to be produced in the country (Olayemi *et al.*, 2012). Alongside abundant agricultural production there is huge potential for freshwater fishery production with the abundance of surface water and the rivers Niger and Benue running through the country (NPC, 2014, Karmalkar *et al.*, n.d.). Nigeria has thirty-six states and sweet orange is produced in fifteen: Benue, Nassarawa, Osun, Anambra, Ekiti, Imo, Kogi, Ebonyi, Edo, Delta, Oyo, Kwara, Ogun, Taraba and Kaduna (Olife *et al.*, 2015).

Since Benue State produces the most citrus it was chosen as the case study. It is located in the Middle-belt region of Nigeria; bordered by Nassarawa to the north, Kogi to the west, Taraba to the east, Ebonyi and Cross River to the south. The capital of Benue is Makurdi. Benue produces a majority of the crops consumed in Nigeria, blessed with rich soil types (Guinea Savannah) and an abundance of freshwater, earning its name as the 'Food basket of the Nation' (Ogiji, 2004). Benue is an agricultural state and the main occupation is farming. Major crops produced in Benue include: oranges, yams, cassava, sesame, oil palm, mango, tomato, rice and sesame (Nwakonobi and Onwualu, 2010). Benue produces the most horticultural products in Nigeria, with an estimated production of 800,00MT of citrus annually (Okigbo, 2012, FMARD, 2015). The sole

concentrate processing facility in Nigeria (Teragro) is located in Benue State.

There are three main ethnic groups in Benue – Tiv, Idoma and Igede, with Tiv being the dominant. There are twenty-three Local Government Areas (LGAs); fourteen are occupied by Tiv, with Idoma, Igede and other ethnic groups spread across the remaining nine (Anon, 2016). Benue state has three political zones: A, B and C. Zones A and B produce the most citrus. In these three zones, the major citrus producing LGAs were selected (based on local knowledge, as there are no statistics on citrus production in the three zones). So in Zone A, Vandeikya, Ushongo and Konshisha LGAs were selected. In Zone B, Gwer West, Buruku and Gboko were chosen and in Zone C, Oju and Otukpo. These LGAs (see figure 5.1 below) were selected due to their levels of production. Zone C was included in the sampling even though it produces less citrus. This was to provide a representative picture of citrus production and postharvest losses in areas with high and lower production levels.

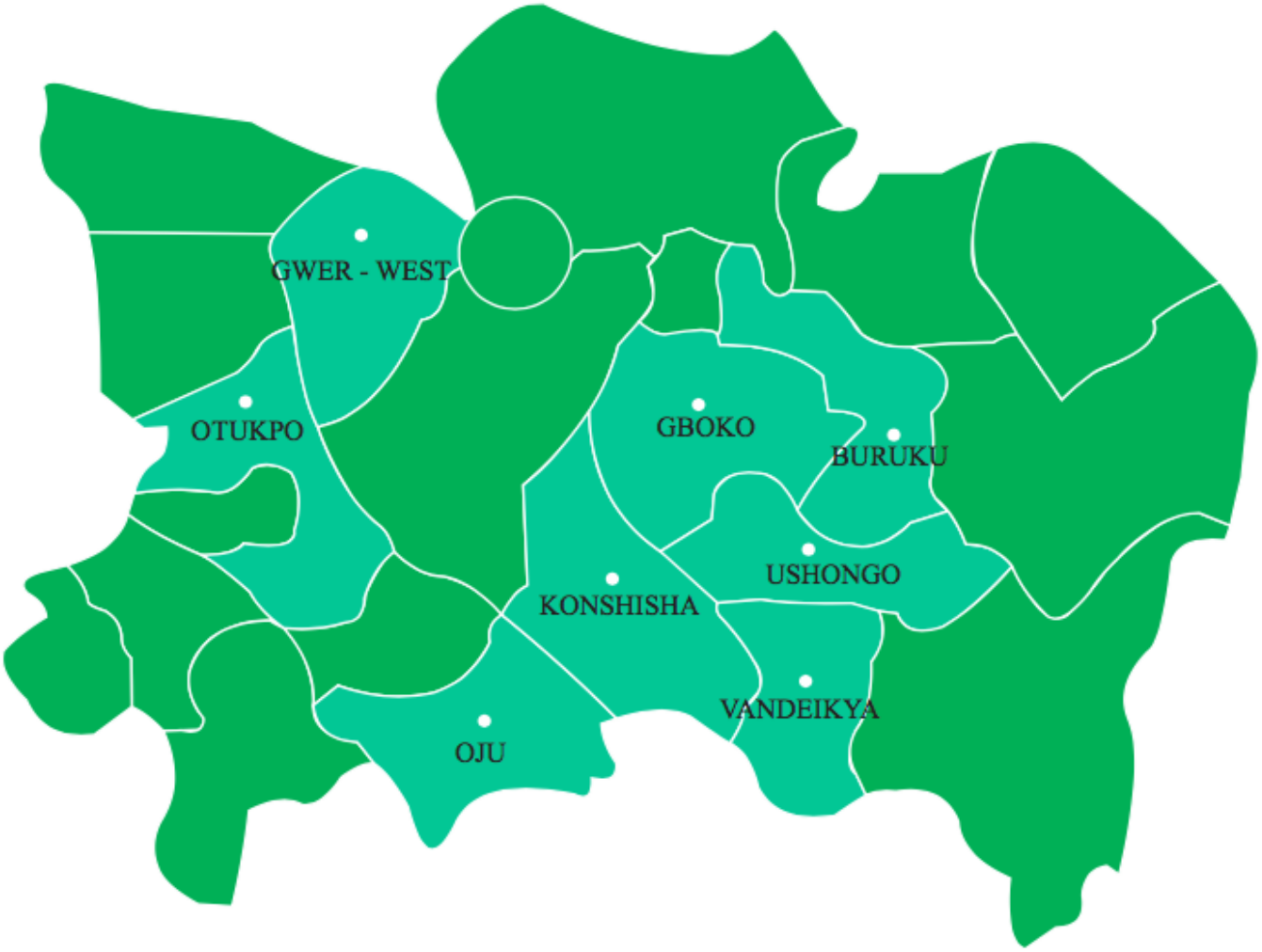


Figure 5.1 Map of Benue State showing LGAs sampled

5.4.3 Data collection

The data collection period was from October 2014 to April 2015. The initial objectives of this research were to investigate the key causes of citrus postharvest losses along the citrus value chain, to identify external factors hindering the reduction of postharvest losses (focus on fruits) and the general perception of food waste in Benue state. I planned to carry out a survey with farmers, intermediaries, traders and elite society members on the causes of postharvest losses in Benue state, to gather descriptive statistics and a general idea of the questions to follow up on with in-depth interviews. These were to be accompanied by direct observations of farms, markets and landfills. To answer the second objective, I planned to analyse secondary data-policy documents from the Ministry of Agriculture and Environment, newspaper articles and University of Agriculture reports related to the management of postharvest losses in Benue State.

At the start of my research, I was fortunate in obtaining a letter of introduction from the Benue State Commissioner for Agriculture that greatly facilitated my data collection. I started my research by looking for secondary data on citrus, postharvest losses and agricultural policies in agricultural offices and libraries. This search was not particularly fruitful as the only data available on this topic was on citrus production and marketing channels from undergraduate dissertations and papers written by the faculty of Agricultural Economics at the University of Agriculture. I also located a pilot study carried out by a Dean in the University of Agriculture on citrus postharvest handling. He expressed his disappointment in the University's ignorance and negligence on postharvest losses, stating that he had tried to start a department that focused on postharvest losses but received negligible support from the University. There was a host of material on grains, cereals, legumes, tubers and tomatoes, but all of these on the production phase. The Dean of AgricEconomics took an interest in me and, as a result he introduced me to the entire department during a seminar and asked me to attend their seminars to provide feedback on postgraduate presentations. He was

particularly helpful in providing contacts and suggesting materials. Despite the unsuccessful attempt to locate materials, informal conversations with lecturers and academic staff provided valuable information with some staff expressing great enthusiasm for my research because postharvest losses are a widely ignored problem in Nigeria and Benue State. That was both surprising and quite alarming given the state's extensive production of citrus and other crops.

In my efforts to obtain information on agricultural policies and strategies for dealing with postharvest losses, I also visited Benue State Agricultural and Rural Development Authority (BNARDA), the main parastatal of the Benue State Ministry of Agriculture and Rural Development. Unfortunately, BNARDA did not have any agricultural policies on paper, although I was told that "*there are rules and policies but they are not on paper*". However, I was able to talk to present and past directors who provided valuable information on citrus farming in Benue. I also got three documents on production statistics from ten years ago. When I asked about data on losses, they said their job description did not cover losses and even though it was a known problem, it was costly to carry out such a survey. Other people did not see it as a problem because they felt that postharvest losses were worse in tomatoes than oranges. A particular conversation I had with a lecturer in BNARDA made me realise that my research was relevant in Benue. The lecturer was utterly disappointed that I decided to study citrus; his facial expressions could not show any more disappointment. He felt that tomato losses were of greater importance than oranges because orange waste had no impact on the environment. He claimed that the glut was seasonal and when compared to tomatoes the citrus value chain was not a problem.

This view of oranges not being a 'problem' was worrisome, because tomato losses were seasonal as well. It became evidently clear over time that a large proportion of the Nigerian population felt the same way, but with oranges being the second most important crop produced in Nigeria and increasing levels of concentrate importation, there was a knowledge

gap. This prompted further observations of the orange waste problem before the commencement of primary data collection and it was gathered that tomatoes were used in the preparation of almost every meal in Nigeria so its wastage was 'felt' more closely than the wastage of oranges. In addition increased postharvest losses were directly experienced by an increase in tomato prices. However, for oranges, consumers had the option of not purchasing the fruit and so their direct wastage was not equally experienced. This had resulted in various studies and intervention programmes investigating and managing tomato losses. For example, The Rockerfeller Foundation Initiative and PYXERA Global are partnering with Dangote Farms Limited to manage tomato losses and process Nigerian tomatoes into paste (PYXERA Global, 2017). None of this sort of action was identified for citrus.

As stated in chapter 1, orange waste is an eyesore in markets, with heaps of rotten oranges lying around in skips and gutters acting as a breeding ground for disease vectors. The identification of orange waste to be a 'common thing' revealed an attitudinal problem. This initial phase of my data collection revealed a clear gap in knowledge and information on citrus postharvest losses in Benue state (and also in Nigeria as a whole).

5.4.4 Farmers survey

The lack of existing data on citrus farming and postharvest losses in Benue encouraged me to conduct a survey that would elicit a range of information on the types of oranges grown, post- harvest handling practices, levels and causes of losses, and the challenges faced by small-scale farmers. Questionnaires are a tool for collecting primary quantitative data relating to the "*behaviour, attitudes, opinions and awareness of specific issues*" from individuals (Parfitt, 2005:78). I decided to use questionnaires because of the type of information I needed from the farmers, middlemen and traders. The questionnaires included questions that classified the actors (socio-economic demographics), their behaviour in relation to farming, purchasing and sales practices, and their thoughts, beliefs and perception of the level of the losses they incurred and their causes. This

was the hard part of the survey, as I needed to avoid leading questions; however, through careful editing and testing of the questionnaires I was able to ask objective questions that provided answers for my research problem (see Appendix 1).

To help me achieve this, I was assured that I would receive the help of BNARDA Extension Agents (EAs) and the current Director; however, I needed to pay the EAs. As part of a piloting exercise, the staff at BNARDA helped me to improve my questionnaire based on their local field experience. In total, the survey was edited seven times, with different EAs to determine its level of understanding to the EAs that would administer them. The survey was piloted to ensure that it indeed answered the aims of the research and that it was understandable by the target audience (McGuirk and O'Niell, 2010). The process of testing the questionnaires resulted in its modification, as insights were received from the EAs and BNARDA staff (Parfitt, 2005). The help I received from BNARDA was particularly valuable because no one had carried out a survey like this, so the piloting process helped me to think about the problems that we notice and ignore daily. They also expressed interest in the results and so wanted it to be an instrument that could help them to better understand the problems of postharvest losses.

Before the questionnaires were distributed, the former Director of BNARDA gave me a lecture. He has an orchard himself and he felt there were certain things I needed to know about orange production that would help me get the most out of the questionnaires during analysis. A major challenge was ensuring that the contributions received were not deviating from the overall aim of the surveys. The editing process included regular emails back and forth with my supervisors' comments and this became a slight issue with the Director of BNARDA. His enthusiasm in the project was commendable because his vast experience was valuable, however, he critiqued every suggestion my supervisors made about broadening the scope of the surveys to gather information that would be beneficial to my analysis. He felt that we were out of touch with the realities of Nigerian

farmers so it had to be his way to get the desired results. I had to carefully provide reasons every time we had an editing session as to why their comments were important and acknowledge his contributions at the same time. This was quite hard because of the Nigerian culture. Normally, one would not argue with his/her elder; especially when they are doing you a favour. Somehow convincing him politely worked and the questionnaires included all that I needed them to.

The Extension Agents (EAs) from BNARDA were employed to administer the questionnaires in the respective LGAs. This was because they knew the terrain of the LGAs better than I did and would be able to locate farmers in the inner villages. In addition, due to security reasons it was not safe for me to travel into the interior villages. An interview-administered style was adopted for the survey. This was to maximise the time spent with farmers and allow a back and forth rapport between interviewer and interviewee. The EAs helped to ensure the farmers understood the questions, verified if they did not have enough information and put down the relevant answers on the questionnaire in the farmers' words. Another part of the pilot phase was to change the language to suit the education level of EAs, most of whom had stopped at tertiary studies. This helped to avoid unnecessary jargon and ensure that the questionnaires were worded to suit the relevant audience and avoid leading questions to reduce bias and response errors (Parfitt, 2005).

A total of 58 questionnaires were administered in Zone A and B (8 for each of the six LGAs) and 10 for Zone C (5 in each LGA) summing up to 58 farmer questionnaires by the EAs. The cost was N1000 ($5) per questionnaire (the exchange rate at the time of data collection was $1 to N199, so a total of $291). EAs were trained by the Director and I, given half of the payment, sent out to administer the questionnaires and allowed to collect the balance on retrieval.

The selection of the EAs was straightforward. I needed people who had undertake extensive fieldwork in the LGAs that produced large amounts of citrus (Zone A – Vandeikya, Ushongo and Konshisha; Zone B – Gwer West,

Buruku and Gboko; Zone C – Oju and Otukpo), with a good understanding of English as well as Tiv. The Director then called the Zonal Coordinators in BNARDA headquarters in Zones A, B and C, introduced me, told them what my research was about and asked them to suggest EAs. For Zones A and B we (the Director, my research assistant and I) were going to travel to the office headquarters to meet with the EAs and train them on the days when they had their monthly meeting. This was the best time to meet with the EAs because most of them lived far from the zonal office and it would cost them a considerable amount to visit the zonal office often. As for the EAs from Zone C, they were travelling to Makurdi for a quarterly meeting and so we seized the opportunity to train and mobilize them in Makurdi.

The training of the extension agents was to ensure there was a standard way in which the questionnaires were administered. This was to reduce bias and ensure that EAs understood and stuck to the questionnaire guide (Parfitt, 2005). I had never trained EAs before, so the Director trained the first set of EAs for Zone C in his office so that I could see what the procedure entailed. It involved reading out each question, explaining it to the EAs, providing more information or examples of supposed answers and what I was looking to capture with each question. When we got to Zone A, I realised that the zonal coordinator was unable to find an EA for Konshisha LGA and so got one from Kwande instead (Kwande was the next LGA with a high producing rate after the three I had selected earlier). This was because they were lacking EAs for all the LGAs, with salaries not paid frequently they had a low staff count and due to the lack of funds, they had been unable to recruit and replace those that had passed away. The extension agents were trained on the respective days and given the first instalment of pay. The training was conducted in English and Tiv, and as I do not speak Tiv fluently, my research assistant and the Director helped translate. The EAs were given opportunities to ask questions and we went over the questionnaire at least two times so they understood it properly. The EAs were given 10 days to administer the questionnaires.

I asked EAs to select farmers from different parts of each LGA to avoid information being collected from neighbouring farmers experiencing similar farm environmental conditions. During the training, I told the EAs I wanted answers in the farmer's words. This was repeated several times because I wanted responses that reflected the farmers' perspectives, I wanted to capture their attitudes, perceptions and feelings from their own point of view and then decide how to interpret the information provided. The Director however wanted them to summarize their answers and include only what they felt answered the questions and was relevant. I had to explain several times that I wanted the farmers' words and responses. I also wanted to minimize response errors. We discussed the time of day the farmers were to be located; usually most farmers go to their farms early in the morning, so the plan was to either meet them before they went to farm or to wait till mid-afternoon or evening.

At the same time, I was going to travel along the major roads (that link LGAs) within Benue State to administer questionnaires to farmers, intermediaries (usually referred to as 'middlemen' and used to refer to both male and female wholesalers that transport fruits from farms to markets in large quantities) and traders. The main criterion for interviewing a farmer was his or her consent. If we noticed a reasonably sized orchard, I would introduce myself to the farmer; and tell him the purpose of my research. During my travels I was accompanied by my research assistant (male cousin), a driver and vehicle provided by my mother's office. The use of a personal car and driver was the safest and most reliable way to commute to the LGAs, as the local transport system was neither trustworthy, nor convenient for reaching the places that I needed to access to undertake fieldwork. My research assistant followed me into every meeting space (farmers' homes) to ensure my safety and to help with the translation from Tiv to English. At this point, we lived with my grandparents (in Gboko LGA) because it was easier to travel to other LGAs from there. I travelled to five LGAs (Vandeikya, Ushongo, Katsina-Ala, Zaki-biam, Buruku) during that period to interview farmers, intermediaries and traders. This was to get a feel of the whole process

myself and to be able to know the kind of information the questionnaires would provide so that I would be better able to interpret the information contained in questionnaires returned by the EAs. One of the things I noticed was that the farmers, traders, and intermediaries were passionate about what they did, they loved to farm; they loved to talk and were willing to provide abundant information about orange cultivation, trading and postharvest losses. It made me wonder why so little material is available on the Nigerian agricultural sector when the people directly involved are so willing to offer relevant information. I met farmers who wanted to teach me about their farming techniques, show me the differences in their trees, the distinctions between the types of oranges they grew, feed me and give me a bucket of oranges when I was leaving.

When I administered the questionnaire to farmers, I noticed from some of their responses that a few questions had not been broken down properly, and this was going to have a slight impact on the answers the EA's provided. The questions were on the prices of fruits during peak and off peak seasons. I noted these corrections and modified the remaining questionnaires.

The process of collecting data via questionnaires is subject to response error (Parfitt, 2005). On the day of retrieval, I noticed that two of the EAs in Zone A did not provide adequate answers to the questionnaires and so I rejected 16 questionnaires (from Ushongo and Kwande LGA). I could see that there was a lot of cancellation on the papers, and when I asked them to explain a certain answer or clarify what they had written down, they were confused. Due to the experience I had with the farmers I had interviewed, I could not make sense of some of the responses provided. I also noticed that the two EAs had tried to paraphrase the responses the farmers provided. I asked for the phone numbers of the farmers on the questionnaire, so that in case of clarification, I would be able to ring them. However, it was impossible to reach any of the 16 farmers. Since I was uncomfortable with the data received I had no choice but to reject them. As I spoke further with the EAs I realised that they did not understand the

questionnaires from the beginning and thus could not elicit the required information. The main language of the EAs is Tiv, and the questionnaires were in English, increasing the possibility of translation causing errors in what they understood and how they explained it to the farmers. As mentioned earlier, the training was done in English and Tiv for different EAs, so this could have been a major cause of the problems encountered with the rejected questionnaires. The questionnaires in Zone B were much better answered although I needed to clarify a number of responses by contacting the respective farmers by telephone. Zone C provided very good responses and I did not have to clarify the responses. Poor interviewing technique (Parfitt, 2005) may have been the cause of the problem with the EAs in Zone A; but because the questionnaires were conducted in my absence I cannot state the influence of their techniques.

In January, I redid the 16 questionnaires that I had I rejected in December. As earlier stated, I travelled along the major roads connecting LGAs and identified farmers. I had two farmers that were quite scared of talking to me at first but finally opened up when I told them I was a student and they could see my questions were just for research purposes. In particular, an elderly man complained bitterly about the politicians who have not taken the plight of farmers seriously, saying he would provide us with information that will not be used for the betterment of farmers. Many other people echoed this. When I had to redo the rejected questionnaires, I included the modified questions.

5.4.5 Interviews with traders and intermediaries

As with the farmer questionnaire, the questionnaire for traders and informal questions for the intermediaries[1] were edited in the pilot exercise by BNARDA staff and EAs (see Appendix 2 and 3). The information required here was on the level and causes of losses during transportation and in marketing channels. Issues relating to consumer preferences for different oranges, packaging materials, transportation

[1] Intermediaries in Benue are referred to as 'middlemen' and this includes both male and female wholesalers that transfer commodities from one state to the other. For the remaining part of this thesis intermediaries and middlemen will be used interchangeably.

methods and the challenges faced by traders and intermediaries were also discussed. As stated earlier, we (my team) travelled along the major roads to administer questionnaires to farmers, traders and intermediaries. The interview approach was used for intermediaries and traders, and proved very useful here because both groups were approached when they were working. Therefore, I approached them, introduced my research and myself and asked for their consent. The conversations were informal and were recorded and the survey questions were more of a guide to ensure I covered all the bases.

There was a mixture of single and group interviews with traders and middlemen. This depended on the group and how they were identified. Some groups had one spokesperson, others had everyone talking and chipping in with answers to different questions. In order to access orange traders and intermediaries, we drove round the LGA major roads in search of places that they tended to frequent. Whenever we spotted a group of traders, we stopped to ask if we could chat with them. The traders were located and approached while they were working and I had limited time to discuss with them before they were approached by customers or attended to other tasks. During interviews with some of the roadside traders, cars sometimes stopped to purchase fruits and every trader at the station including the one I was interviewing would run to the car with a handful of oranges for the consumer to taste and the interview continued after that. While I travelled through the LGAs, only roadside traders were identified. There were no market traders selling oranges.

My initial interviews with intermediaries and traders revealed questions that I had ignored, so the future interviews were modified to include areas that I had not originally included in the surveys and interview guide. For the intermediaries, we would search for groups of men and women sometimes sitting under a large tree with bags of oranges around them – that's how we knew they were middlemen (see figure 5.2). Often they were waiting for more bags of oranges or a vehicle for transportation. In most cases middlemen were glad that someone was finally looking into

their problems and reported feeling hurt, that for years they have been complaining about the problems they faced but the government had turned a blind eye. They were therefore keen for me to go out and tell the world about it because they needed help.

Market traders were conveniently selected in the fruit markets in Makurdi. There is one major fruit market in Makurdi – Wurukum Market, three traders were selected from there. The second market was the former fruit market and looked deserted, it had just three traders and so one trader was interviewed.

The intermediaries identified were in Zones A and B (11 and 8 respectively), there was none from zone C. All the traders were from zone B (11), with none identified in zones A and C. There were seven roadside traders and four market traders. In total, there were 19 intermediaries and 11 traders.



Figure 5.2 Identification of intermediaries.
Intermediaries were identified by the presence of bags of oranges under a tree along major highways. Katsina-Ala LGA, Benue State. Author's photograph. 12th December 2014.

5.4.6 Interviews with academics, friends and other chain actors

Interviews provide rich insights into how people interpret the world and act in it. There are different types of interviews but the semi-structured interview was adopted for this research. Semi structured interviews provide interviewees the liberty to show how they interpret the social world, to answer the questions in their own terms, based on their understanding and interpretations of the world they have come to know (May, 2011). Interviewees are able to explain how and why they feel a certain way about a situation, to explore the questions in ways that had never occurred to the interviewer and provide ample meaning in their answers (ibid.).

From my initial contact with the University of Agriculture, I was interested in interviewing academics that had interests in postharvest losses and find out their views on the level of losses in the state and Nigeria. The interviews occurred after I had collected information from farmers, intermediaries and traders. I had started transcribing the data at the time and began to recognise recurring themes. These were included in my interview questions for the academics (see Appendix 4). In particular, I was curious as to why they were an agricultural university and did not carry out research on postharvest losses. The flexibility of interviews allowed me to follow up concerns that had risen from my surveys and observations.

I consulted with a friend who is a lecturer in the Engineering department and asked for contacts in AgricEconomics with an interest in postharvest losses and food security. I was given six contacts and their phone numbers, so I rang them, introduced myself and my research and asked for their consent to conduct interviews. They were all happy to meet with me and remembered that I was introduced to them during one of their seminars. The interviews took place in their offices in the University of Agriculture and at times that suited them and lasted for an average of 30 minutes. The questions covered were on the causes of postharvest losses, what the

University was doing as a research institute and how losses can be curtailed.

The interviews turned out to be interesting conversations that provided a different perspective to the problems that I had not considered. I was able to go back and forth over confusing themes generating rich detailed material (Parfitt, 2005). In-depth interviews can be used together with other research methods to provide a robust understanding of research questions (ibid.). Five of the academics interviewed were male; as a result, I was very cautious when going in for interviews. At the time, my research assistant was unable to accompany me for the interviews.

I had informal conversations with friends about my research and sought their ideas on the level of losses in the state. Through this, I was introduced to their friends and colleagues that they felt would be of great assistance to me ('snowballing'). This was to capture the broader context, impact and relevance of my research to people 'distant' from the flow of oranges.

Before I obtained my letter from the Benue State Commissioner for Agriculture I conducted an interview with him on the level of citrus losses in Benue State and what the government was doing to manage the losses. This was because there was limited information regarding the government's role in the management of postharvest losses and the government is the key actor in the Nigerian agricultural sector (FMARD, 2017). As a result, conducting an interview with the Commissioner on Benue State was highly important in understanding the role of the government in managing the losses in Benue and future plans for the agricultural sector.

During the interview, we also discussed the establishment of processing facilities in Benue State (see Appendix 5). I planned to have other interviews with government officials but I was unable to do so. At various times I was granted interview dates and times but whenever I arrived for my interviews it never took place. This was because at the time of my data

collection, the Nigerian elections were drawing near and so government officials were busy with their campaigns and unable to make appointments.

I approached Teragro and tried to arrange an interview with the Manager and also tour their facility but the manager was uncomfortable with my research and refused to grant the interview. Afterwards, I was approached by a member of staff who was willing to answer a few questions, so far as it did not have a negative impact on the business. I assured the worker that my questions for were solely for research purposes. The interview lasted 30 minutes and included questions on how they plan to reduce the level of citrus losses in the state, the management of the cold chain in respect to unstable power in the country and how they manage the waste (see Appendix 6).

Six semi-formal interviews were conducted with a Businessman, an Architect, a worker at Teragro, a supplier to Teragro, a Politician/Lawyer and a Public servant (Commissioner for Agriculture).

5.4.7 Online Survey

Initially, the third objective was to explore the perceptions of individuals in Benue relating to food waste and this data was collected via household surveys. However, the overall primary aim of this research was to follow the citrus value chain from farmer to consumer and the data I had collected on the value chain stopped at the trader. Another data collection period was scheduled for December 2015 to capture the consumer end of the value chain. The plan was to interview consumers on the consumption of fruits, oranges, fruit juice; cosmetic preferences; storage conditions and how they manage the fruits at home (see Appendix 7). I was also going to find out if there was any form of local processing of oranges in the state. In designing an interview guide, I used the procedure I had adopted when I created the interview questions for the academic interviews.

When I travelled to Nigeria, I was able to conduct five individual interviews with consumers and four interviews with restaurant

managers/owners. I started interviewing friends and asked them to introduce me to other friends and colleagues. The criteria for conducting an interview were the person's consent and the consumption of fruits including oranges. Drawing on interviews with research participants along with informal conversations with family and friends, I learned of only four food outlets in the whole of Benue that were processing oranges into fruit juice. I was successful in locating all of these outlets and asked to speak to the manager of each. Afterwards, I introduced my research, and myself and asked for their consent to conduct an interview. At first, they were hesitant, thinking I wanted to gather information that would have a negative impact on their business. They were also suspicious of me trying to find out their marketing strategies. I had to explain that I was a student and needed nothing related to their finances or marketing strategy before they agreed to have an interview. The interviews were relatively short about 10-15 minutes and I ensured that I did not ask questions that would cause discomfort (see Appendix 8).

Unfortunately, in the middle of my data collection, there was a family crisis; my grandfather fell very sick and eventually passed away. This made it impossible to collect additional data on household-level orange consumption before my return date back to the UK and therefore I resorted to using an online survey to gather more data. The online survey followed Bryman's (2012) suggestions for conducting a survey. This included considering whether a survey was appropriate, deciding on the means of administration, developing questions, piloting questions, revising questions, finalizing the questionnaire/schedule, analysing data, and interpreting findings (Bryman, 2012). The interview questions were edited to suit a survey with multiple choice, ranking, open and closed ended questions. The survey was created with Esurveycreator and it was administered over the Internet (see Appendix 9).

To minimize response error, the survey was limited to ask questions in a simple manner, different from the initial interviews carried out for this part of the study and the questionnaires for the market actors. This was

because for the interview-based questionnaires, there was room to explain questions to respondents. By contrast this survey had to be produced in a way that respondents came to a quick understanding of the questions themselves within seconds. The pilot of the survey provided useful feedback on the language and understanding of the questions. This also helped kick-start the thought process of analysis of certain questions that were quite confusing. The piloting of surveys enables the researcher to check the aspects of the survey in relation to format, design, language, analysis and the importance and relevance of questions (Parfitt, 2005).

Initially the survey link was emailed to a small group of friends and family, who are primarily middle class and then I requested they pass it on to work colleagues, friends in and outside their immediate social circles. Some of the conditions for snowballing were respondents from different age groups, various socio-economic backgrounds to avoid a homogenous sample and more importantly people who consumed oranges. According to Bryman (2012) snowballing is the preferred option when it is difficult to create a sampling frame for a population the sample is to be drawn from. It also made it easier for respondents who fit the sampling frame – be consumers of oranges – to be selected (Parfitt, 2005). Because the survey was administered over the Internet, it was not possible to limit it to Benue State. So the participants for the consumer study include consumers from different parts of Nigeria. The sample size of the survey was not intended to be a representative sample of the Nigerian population; however, it was to provide an understanding into the consumption of oranges and fruit juice in Nigeria. The findings from a survey are intended to serve as a basis for future research and convenience sampling is a major part of social research (Bryman, 2012).

The survey link was active for 10 days. A hundred and ten (110) responses were received, however during analysis it was discovered that twenty-two (22) respondents had only filled the first page of the survey. These entries were not included in the analysis. It was also noted that through the snowballing technique, two respondents who lived outside Nigeria had

filled the survey and these were deleted. Due to the anonymity of the surveys, I have been unable to understand why 22 respondents did not complete the survey. This could be as a result of non-interest in the survey or other factors (Parfitt, 2005).

5.4.8 Field Observations and research diary

Participant observation is a qualitative approach that provides an understanding of the "culture and processes of the groups being investigated" (Denscombe, 2007:206). One of the purposes of observations is to complement other data collection methods by providing contextual material. This can be to provide an interpretation to the experience or place where an interview is conducted. The material obtained from observations sometimes complements or contradicts the material obtained from the other methods used (Winchester and Rofe, 2010).

The role an observer plays may be proactive or passive (Winchester and Rofe, 2010). During my observations, I was a passive observer and adopted the observer as participant approach (Bryman, 2012). This was because there was little participation on my part in the observation, as I was mainly interviewing the actors when I was with them. During my interviews with the farmers, I observed their farms, the types of trees they had, the wasted oranges that were usually at the bottom of the trees, infestation by pests and diseases. These observations were with the farmers where they provided further detail on what I was observing. For intermediaries, I observed them packing the oranges into bags and the end part of transportation of bags of oranges on motorcycles from the inner villages to the highway where I was interviewing intermediaries. I also observed intermediaries loading packaged oranges into vehicles.

For the traders, I observed how they sorted out their fruits, stored them and their approach to consumers when they came to purchase. Before I interviewed the market traders, I observed the women selling, sorting and disposing their fruits. I listened to conversations traders had amongst themselves and observed how they transacted with customers.

Taking notes of observations is an important part of participant observation. These notes are usually "*detailed summaries of events*" and include the researcher's reflections (Bryman 2012, p.417). These may cover what was observed and may also include conversations that occurred during observations (ibid.). During my fieldwork, I wrote down brief notes initially during interviews and observations following Bryman's (2012) recommendations and then at the end of the day I added more detail to the notes. I also reflected on the activities of the day, which included interviews I had conducted, or conversations I had overheard. If I needed clarification on anything I had heard or seen, it was followed up during an interview with the actors. My field notes also included a log of the decisions I made during fieldwork and the factors that shaped those decisions. The observations during the fieldwork provided contextual data that was used in the analysis and understanding of results (Denscombe, 2012).

5.5 Reliability and Validity

Reliability and validity are important aspects of the quality of research; these have somewhat different meanings from quantitative research. Internal validity is easier in qualitative research where the researchers findings are "*a good match*" with theoretical ideas developed (Bryman, 2012:390). However, external validity is a main critique because the results are unable to be generalised due to small sample sizes (Bryman, 2012).

Qualitative research achieves reliability and validity through the following criteria – trustworthiness and authenticity. Qualitative research should be credible, transferrable, provide "*thick descriptions*" of the cultural and social context and individual studied to show rigour (Bryman, 2012:401). The descriptive nature of qualitative research is to emphasise its rigour and transferability, although it should be noted that the specific context, methods used and subjectivity of the researcher influence the outcome of the research (Bradshaw and Stratford, 2010). These details are important

to understand human behaviour that may not make sense without knowledge of the culture and values in that context.

I took extra caution to guarantee the trustworthiness of the data collected. I had a research journal with me all the time and recorded all that transpired. The research methods adopted were the most preferred to elicit the required data. The interview questions and questionnaires were constantly reviewed against the aims and objectives of the study so that they remained within scope. In order to check their validity, after the questionnaires were designed they were reviewed by a friend who is a lecturer at the University of Agriculture. Then the editing process occurred with the staff at BNARDA and EAs. The questionnaires were also emailed to my supervisors and included their thoughts and concerns. This was the same for the interview questions; the lecturer and my supervisors however only reviewed these questions. In order to ensure a high level of validity, after summarizing findings of my chapters, I read over the transcripts to ensure that what I was reporting reflects the viewpoints of respondents. In addition, the use of various methods was an important way of crosschecking my findings (Williams, 2003)

This research adopted an unstructured approach and enabled me to immerse myself into the research with a general focus on the research questions, finding out specific problems as the research developed and using the required tools to answer the questions developing along the way. This offered more flexibility, and allowed the change that emerged to shape the course of the research. The aim of this research was to tell the story from the viewpoint of my respondents. The subjectivity of qualitative research has the ability to distort the data unintentionally (Williams, 2003). Various writers (Hanson, 1992, Sample, 1996) debate the idea of objective research claiming that knowledge in itself is situated, as it does not take place in a social void; therefore, research is affected by the researchers' knowledge of the world (Dowling, 2010).

5.6 Challenges and Limitations

There were a few challenges and limitations experienced in the course of my data collection. In January, when I was administering the questionnaires in Konshisha LGA we had an encounter with some of the local youths. While driving through the LGA, we noticed a large orchard and inquired about the owner. From where the car was parked on the highway, my research assistant and I had to walk for about five minutes to get to the farmer's house. After explaining my research and asking for his consent he reluctantly agreed to be interviewed. My research assistant was speaking to the farmer because it was in Tiv. Mid-way through the questionnaire, one of the youths walked towards me and asked if he could talk to me. He started asking who we were, why we came into their LGA without asking for permission to speak to the security team before meeting one of their farmers. At this point, I called my research assistant to talk to him. The youth then asked the farmer why he was talking to us. We could see the fear in the farmer's eyes and he said he was also wondering who we were but never mentioned it to us. From the whole scenario, it was obvious that the youth wanted to extort us, and when we refused to give him money, he called out to some other youths that were hanging around trees about 150m away from us. My research assistant tried to talk to them, narrating how we had gone round different villages and never heard of a security team. They had spotted the driver by the roadside, and noticing that the car plate number was government owned they insisted that we give them some money. They made threats when we did not succumb to their demands. The group still tagged along as we made our way towards the car and drove off.

There were a few misunderstandings with the director of BNARDA. For the most part, this related to him attempting to take over the research and portraying me as someone who did not really know what she was doing, mainly because of my age and gender. He usually undermined my knowledge and tried to ignore contributions from my supervisors on the questionnaires. As stated earlier, at different times I had to explain to him

that I needed to include their comments and thoughts as well as his. I needed to work with BNARDA and they wanted my results, so on occasion, I accepted being in the background and allowed him lead so we had no future misunderstandings.

Other challenges experienced with the administration of the questionnaires was the issue of transportation - for me, some roads were not accessible by car so we could not get to farmers in interior villages with the poorest road connections. For my extension agents it was hard to spatially distribute the surveys, because they had to travel to parts of the LGA they had not been to before. Sometimes they got to a farm and the farmer was not around and they had to begin to identify other potential respondents. I also had the same issues with the questionnaires. We could drive for an hour; locate about five reasonably sized orchards only to discover the farmers were unavailable. With some of the farmers and intermediaries, I was unable to carry out the interviews because I am not fluent in Tiv, so my research assistant did these. After they had been transcribed, I noticed for one transcript in particular that some parts of the conversation had been removed. Afterwards, he attempted to translate as close to verbatim as possible.

During the second data collection period, which coincided with the Christmas holiday, I had a family emergency that stopped data collection midway. My grandfather was seriously ill and eventually passed away.

When I was analysing the online survey, I noticed that some of the participants had started and not completed the survey. They had just answered the questions on the first page and left the other pages. Out of the 110 participants that participated; only 88 were completed. This was still a good turn out and was complemented by the interviews taken during the Christmas vacation and with that of food services in Benue state.

This research is limited by the research methods adopted. The sample size was selected to provide a deeper understanding of the citrus value chain

from the perspective of actors. Data collection stopped when the point of saturation was achieved. As a result, the research is largely qualitative and suffers the main critique of qualitative data – it is not generalizable (Bryman, 2012).

5.7 Data Analysis

The data for this research was collected via questionnaires, online survey, interviews and direct observations. During and after data collection, all the interviews were transcribed. My research assistant transcribed the interviews in Tiv from the intermediaries and I handled the English interviews. Afterwards, I cleaned up the transcripts, corrected grammatical errors and filled in the gaps identified during data collection. The questionnaire data was first transferred to Google sheets. Then, all the qualitative data was imported into Nvivo.

The use of mixed methods enabled the collection of quantifiable categorical data that was analysed with Microsoft Excel, where response patterns, commonality and relationships were identified, simplifying the process of data aggregation and comparison (McGuirk and O'Neill, 2010). eSurveyCreator collated the results of the online survey, making it easier to view respondent answers and filter out incomplete questionnaires. Quantitative analysis enabled the development of themes for further investigation from qualitative responses, offering insights into respondents' interpretation of phenomena and social structures (May, 2011). This process put the quantitative findings into perspective and provided greater meaning (McGuirk and O'Neill, 2010).

Afterwards, I began an initial review of the qualitative data to highlight commonly used words, phrases, trends, patterns, noteworthy quotations and recurring themes (Bryman, 2012). This initial review shed more light on already established analytical themes such as marketing channels, postharvest handling, political will power and causes of losses. It also identified new themes such as livelihoods, the impact and role of the consumer. This process and richness of the data revealed that a coding

system was required for proper analysis. Accordingly, I employed Nvivo to organize and classify themes (Bryman, 2012). The above themes were then broken down into codes such as transportation, weather, quotes, harvesting methods, storage and quality. Material from my research diary and interviews with academics and friends provided context for analysis. Findings were then compared with the broader literature to identify similarities, contradictions, gaps and missing information (McGuirk and O'Neill, 2010).

5.8 Ethical issues and Positionality

Following the University's quality manual guidelines, I ensured that I carried out my research in an ethical manner. Before I solicited information from my participants, I introduced myself, my research and asked for their consent before following up with questions. Some of them wanted to know what the questions were about before we started. I made them aware of their right to stop the interview if at any time they felt uncomfortable and to skip questions if they decided not to answer. I assured them that information provided would be treated with the utmost confidentiality according to the rules in the University's quality manual. All the information provided in the results chapters is anonymous, and cannot be traced to respondents. The names used in the results chapters are pseudonyms.

Reflexivity is an important aspect of qualitative research. While it is important that the researcher is as objective as possible, the ability for a researcher to identify how their social relations influenced the outcome of the research is crucial. Research in low-income countries must pay close attention to the importance of power relations (Parfitt, 2005). Gaining access to the group that is to be studied is a critical aspect of qualitative research. I was fortunate enough to get a letter from the Commissioner of Agriculture for Benue State at the beginning of my fieldwork. It introduced my research and myself and asked for all relevant organisations to provide the help I needed and make the process of gathering data a smooth one. This played a huge rule in creating and granting access to people and

institutions. Therefore, when I went into an office, introduced myself, and showed the letter, I was treated in a better way than I normally would have been. The letter carried undertones of respect and political connections. This along with the fact that I was studying 'abroad' made some of the students and lecturers perceive me as someone who 'knew her onions'.

Being a young female PhD student is quite a new concept in Nigeria. The norm is for PhD students to be mature and most often married if they are women. Therefore, anytime I introduced myself as a PhD student on fieldwork, there was always a look of disbelief and surprise on the faces of respondents. This then prompted the "*who is your father*" question. Nigerians attach a great deal of importance to family name; if your family is well known and respected, you have a higher chance of receiving favours. When I mentioned my family name there was an expression of "*now we understand why you're able to do it*" (referring to the PhD). I am not exactly sure what this meant, but it all related to privilege. These views of privilege shifted the balance of power with the academics I met and other offices I walked into for information. The idea of me being young and focused at such a young age gave me an edge in my relationship with the academics and elites. They began to talk to me as an adult (contrary to their first impressions of my physical appearance) and wanted to provide anything I needed. It also felt like they took the view that finally, someone was actually doing research that could be beneficial to them, so they needed to be of assistance. The privilege I received was probably in order to pave the way for their favours to be returned, as some would ask when it was possible to meet with my family. I however, respectfully declined from granting personal favours due to the ethics of academic research.

This privilege had a downside however. In researching in my own country, I regarded myself as an insider, but the director of BNARDA for instance felt I was an outsider. He made this perfectly clear by referring to me as "*spoilt, not knowing what it entails to do a PhD because I had it easy*". Other times when he would introduce me to his colleagues, he would inform

them that he suggested I use the EAs because he "*did not think I had what it took to go into the villages and gather this kind of information*." Again, because of the emphasis placed on respect by Nigerians, for the most part I had to listen to everything he said and not defend myself.

Some of the farmers, intermediaries and traders saw me as privileged as well. So they would ask, "*what is in it for me*"? Once I explained to them that this was a school project they obliged and I would get a bucket of oranges in return when I was leaving. Some farmers had their wives cook the local traditional meal (pounded yam and soup) for my team after the interviews. Tiv people are known to be hospitable and feeding you with a traditional meal was their way of welcoming you into their home. Again, due to respect we could not decline the offer.

Being an insider, I was aware of the cultural norms and in particular the importance of respect for elders. It was the defining line between getting help and being rejected. As a result, whenever I went into any office, located a farmer or anyone I was going to talk to, I ensured I greeted them properly and humbly. This made a noticeable difference, because I would hear phrases like "*that is a good girl, she has gone abroad and not forgotten her manners*." Other times, my behaviour was deemed as disrespectful, for example, constant eye contact with an elder during conversations.

I viewed myself as an insider considering my knowledge of the culture, the socio-economic conditions and the language expressions. Although it can be argued that most of my respondents were on the other side of the socioeconomic divide, I was able to get a taste of their living and working conditions by immersing myself in the field during my travels. I was there to learn and I made sure I showed that to everyone I met. This was to avoid making them feel like because I was schooled abroad I knew more than they did, which in itself is not true. I approached fieldwork with a theoretical edge, but lacked practical knowledge. To further understand the impacts of these losses from their perspectives I ensured that the interviews I conducted were exhaustive. This was mainly with farmers that wanted to teach me everything they knew. I had gone over the

questionnaires completed by the EAs and asked questions about confusing and conflicting ideas. This provided me with an in-depth understanding of my research problem. Dowling (2010) claims that the interpretation of data by an insider is more valid than that of an outsider because an insider is more likely to understand and resonate with what the respondents are saying because of a shared outlook of the world.

I started my data collection with my worldview and ideas of how the research would unfold, however I must say that this changed drastically over the course of six months. That is the beauty of qualitative research. I allowed the research to shape itself within the boundaries of the overarching aim and this produced rich detailed material. Despite the fact that I was researching in my home country and state, I had to actively ensure that my background and insight did not affect the interpretation of my data (Winchester and Rofe, 2010).

5.9 Conclusion

This chapter has reviewed the methods adopted to answer the aims and objectives of this study. The theoretical positions of the study are discussed as well as other issues like ethics, positionality and reliability. The chapter also provided thick descriptions of the way the methods were used to elicit required information.

As stated earlier, the empirical chapters of this thesis are in publication format and are broken down into key spaces. The key spaces are farm, transit and market, and the home. Chapter 6 explores the causes of citrus postharvest losses on the farm. Chapter 7 then looks at the space of transportation and markets focusing on intermediaries and traders. Chapter 8 is a conference paper that combines results from chapters 6 and 7 with new material on gender, fertilizers and pesticides. Chapter 9 critiques the Nigerian agricultural sector, and examines commodity chain analysis for the study of postharvest losses. It then provides a market map that identifies the external factors that influence the management of losses. Chapter 10 looks at the home space – it critiques commodity chain

analysis and food waste research for excluding low-income consumers from research. It then discusses citrus consumption and consumer behaviours and preferences that influence waste patterns. Chapter 11 provides a discussion of the results and conclusions of the thesis.

Publication 1 - On Farm citrus postharvest losses: A case study of Benue State, Nigeria

1.0 Abstract

The reduction of postharvest losses in low-income countries is a matter of priority with an increasing population and high levels of food insecurity. However, there is a dearth of crop and region specific data in low-income countries. Available research has focused on the quantification of losses providing limited understanding of the socio-economic and cultural causes of losses. This paper explores postharvest losses in Nigeria focusing on the citrus value chain. Purposive multi-stage sampling was employed to target sixty citrus farmers in eight of the major citrus producing Local Government Areas of Benue State, Nigeria. Data was collected on production statistics, causes and extent of postharvest losses, methods of harvesting and challenges faced. The results identified the lack of a market (processing facilities) as the major cause of losses. The absence of political willpower in agricultural investment in processing and infrastructure was highlighted as the main barrier to the management of postharvest losses. The findings reveal the importance of studying individual commodity postharvest systems to avoid suggesting one size fits all approaches for the management of postharvest losses.

Keywords: postharvest losses; Benue; sweet orange; farmers

1.1 Introduction

The reduction of postharvest losses (PHL) has been a matter of international concern and priority since the 1970s. At the time, the United Nations (UN) resolved to reduce losses by 50% in 1985 (FAO, 1989, Grolleaud, 2000). Significant progress has however not been recorded on the reduction of postharvest losses in low-income countries (Affognon *et al.*, 2015). In recent years due to an increasing population, food insecurity, increase in food prices and sustainable development there is renewed interest in its management (Parfitt *et al.*, 2010, IMECHE, 2013, Affognon *et al.*, 2015). Declarations by the African Union and UN (2014 Malabo declaration and 2015 Sustainable Development Goals respectively) have

succeeded in creating more awareness of the importance of reducing and managing PHL in low-income countries (AUC, 2014, United Nations, 2015).

The *Special Action Programme for the Prevention of Food Losses* established by the Food and Agriculture Organization (FAO) in 1978 kick-started the surge of research on postharvest losses (Spurgeon, 1976, Grolleaud, 2000). Postharvest research over the years has focused on quantification of losses and not the causes of these losses (Kitinoja and Kader, 2015). It is estimated that approximately 1.3 billion tonnes of food produced every year is lost at some point along the food chain (Gustavsson *et al.*, 2011). Estimates provided on losses are questioned based on the use of recycled data that are generalised to suit all crops and regions. This is due to the absence of baseline surveys and primary research (Parfitt *et al.*, 2010, Affognon *et al.*, 2015). This amplifies a major critique of postharvest research: the lack of a consistent methodology and reliable data on its magnitude and causes which is furthered by the absence of 'applied research' in affected countries (Spurgeon, 1976, Grolleaud, 2000).

Affognon *et al.'s* (2015) comprehensive meta-analysis identified methodological gaps resulting from the lack of research in Sub-Saharan African countries along food chains as a problem in managing postharvest losses. There is a paucity of data on the causes of losses along various commodity chains in different geographical regions. Efficient and accurate PHL data collection systems are lacking in most low-income countries, with available statistics based on limited datasets which frequently underestimate or overestimate the scale of the problem (Parfitt *et al.*, 2010). Losses reported in various countries differ due to variations in variables assessed, measurement tools and quantification of physical, economic and qualitative losses (Kitinoja and Kader, 2015).

PHL vary via region, crop, climatic conditions, cultural, social and economic factors (Hodges *et al.*, 2010). Without adequate information and a proper understanding of the level and causes of PHL, adequate solutions and policies cannot be provided. Postharvest losses do not occur in isolation but are influenced significantly by a variety of socio-economic

and cultural factors (FAO, 1981, Affognon *et al.*, 2015) that have to be taken into consideration. In 1976, Spurgeon suggested the systems approach for the study of PHL to take into account the totality of factors that influence an individual crop. Therefore, postharvest loss research ought to be specific to crop and region (Kader, 2005).

This paper explores PHL in the Nigerian context with a crop that is widely produced and experiences high PHL but receives minimal attention from the government: citrus. It investigates the qualitative causes of citrus PHL on the farm, identifying different cultural and economic factors that influence these losses and the resulting economic impacts on small-scale farmers from their perspective. The significance of this study hinges on the importance of providing specific geographical information on citrus postharvest losses, to bring the Nigerian situation to the forefront, highlight the perceptions of citrus farmers with respect to postharvest losses and to serve as a basis for further research, provision of applicable solutions and to inform policy. The remaining part of this section explores postharvest losses in Nigeria.

1.1.1 Postharvest Losses in Nigeria

In Nigeria, the management of PHL is not ranked as a priority in agriculture; rather the procurement of fertilizers to increase production takes precedence (Adepoju, 2014). Nigeria produces various crops in large quantities and at the same time experiences high postharvest losses (Oguntade *et al.*, 2014). A resulting gap between demand and supply has to an increase in food imports amounting to 8 billion USD annually. There is no value addition along the chain for fruits and vegetables due to the lack of processing facilities, erratic power supply and financial constraints (Aworh, 2015). As in other low-income countries, there is a dearth of data on postharvest losses in Nigeria.

Fruits suffer major losses and wastage due to seasonal gluts and the deficiency of storage and processing facilities (Oluwalana, 2006). These losses are experienced on the farm due to harvesting techniques, during transit because of poor roads and inadequate packaging materials, and in

markets (Olayemi *et al.*, 2010, FMARD, 2015). According to FMARD (2014) citrus is one of the crops affected most by PHL in Nigeria, with losses estimated to be between 30-50% (NIHORT, 2002).

Postharvest loss research in Nigeria for the most part has been concentrated on grains and durable food crops with less attention paid to perishable crops (Atanda *et al.*, 2011). For perishable crops, preference is given to tomatoes and peppers. The production of fruits by small-scale farmers in low-income countries plays a significant role in improving the livelihood of rural populations (Musasa *et al.*, 2013). Fruit production provides nutritious food when other agricultural crops are yet to be harvested and acts as an "*economic buffer*" (Clarke *et al.*, 2011:1). It is also a valuable component of sustainable agricultural systems and provides a source of livelihood diversification for women (Clarke *et al.*, 2011). Therefore postharvest losses have a negative impact on the economic status and livelihood of farmers and are an unsustainable use of resources (IMECHE, 2013).

Before postharvest losses can be managed adequately there has to be a proper understanding of the biological and environmental factors that promote postharvest deterioration (Kader, 2005). Thus food crops have to be studied in various geographical locations under different climatic conditions. One of the most important steps for managing postharvest losses is to understand the different stages of the commodity chain associated with the food crop in question (Elhadi, 2011).

Such research in relation to the citrus value chain is limited in Nigeria. A number of studies have reviewed other aspects of citrus production in Nigeria: the health benefits, environmental impacts of orange peels and their potential use, demographic features of citrus producers, citrus disease prevalence and citrus fruit fly control strategies (Ezejiofor *et al.*, 2011, Okwu and Emenike, 2006, Umeh *et al.*, 2004, Ezeibekwe, 2011, Ortese *et al.*, 2012). However, there is no study that analyses the qualitative causes of citrus losses on the farm.

1.2 Study Area and Research Design

Nigeria's geography is diverse and its tropical climate is associated with the wet/rainy and dry/Harmattan season (NPC, 2014). As a result of the different ecological belts, climatic conditions and rich soil types a wide variety of tropical and subtropical crops can be produced nationally (Olayemi *et al.*, 2012). The vegetation of Nigeria consists of Mangrove Swamp Forest in the south south[2], Sahel Grassland in the north and Guinea Savannah in the north central. The abundance of surface water also offers potential for freshwater fishery production. The rainy season comprises of heavy rainfall from April to October, ranging from 2,650mm in the south-eastern states to about 600mm in some of the northern states. The dry season is from November to March and is characterized with cool, dry and dusty Harmattan winds mostly from December to January in the north. Temperature in Nigeria ranges from 20˚C to 40˚C (NPC, 2014, Karmalkar *et al.*, n.d.). These seasonal differences cause different reactions with oranges that will be discussed in the following section.

Citrus is the second largest fruit crop grown in Nigeria (FMARD, 2014), which is the world's 9th highest citrus producer, providing 3% of global production (UNCTAD, 2010). Production of citrus in Nigeria was 3.9 million metric tonnes in 2012 (FAO, 2012). Most of Nigeria's citrus producers operate at a small-scale and investment by the country is minimal (Adeyemi, 2005, Olife *et al.*, 2015). About 45% of sweet oranges produced in Nigeria are consumed fresh and 25% are processed into concentrates for fruit juice production (Ezejiofor *et al.*, 2011, NIHORT, 2002, Bamise and Oziegbe, 2013). In Nigeria, sweet orange is cultivated in 15 states: Benue, Nassarawa, Osun, Anambra, Ekiti, Imo, Kogi, Ebonyi, Edo, Delta, Oyo, Kwara, Ogun, Taraba and Kaduna (Olife *et al.*, 2015). Benue State is the largest producer in the country; its production is estimated at over 1 million MT every year (Okigbo, 2012, FMARD, 2015).

Benue State is located in the Middle-belt region of Nigeria. It is known as the 'Food basket of the Nation' because of its fertile soil and provision of

[2] Refers to states in the southern region of Nigeria

water from the two major rivers (Benue and Niger) running through it. The vegetation of the state is largely Guinea Savannah and the land and climate are suitable for a majority of the crops produced in Nigeria (Ogiji, 2004). The predominant occupation is farming with fishing being regarded as the main secondary occupation (Nwakonobi and Onwualu, 2010). Some of the major crops produced include yam, cassava, rice, sesame, soya bean, mango and tomato. Benue has three major ethnic groups – Tiv, Idoma and Igede as well as other minority groups. The dominant ethnic group is Tiv and they are spread across fourteen LGAs (Nigeria, 2016).

Purposive multi-stage sampling was employed to target sixty citrus farmers in the main orange producing Local Government Areas of Benue State. The data were collected over a four-month period from October 2014 – January 2015 with the help of extension agents from BNARDA. Information on production statistics, postharvest losses, methods of harvesting and challenges faced were collected via structured questionnaires and complemented by observations of farmers' orchards, recorded in a research diary. Benue is divided into three political zones (A, B and C) and has twenty-three LGAs seventeen of which produce abundant amounts of citrus. The majority of citrus production is in Zones A and B with lower levels of production in Zone C. In these 3 Zones, the major producing LGAs were selected (based on local knowledge from BNARDA staff as there are no statistics on citrus production in these zones). So in Zone A – Vandeikya, Ushongo and Konshisha LGAs were selected, in Zone B - Gwer West, Buruku and Gboko and in Zone C – Oju and Otukpo. Zone C was included in the survey despite the lower levels of citrus produced, to provide a more balanced picture of citrus production and postharvest losses in areas with high and low production levels. Citrus farmers were selected in the LGAs: twenty five from Zones A and B and ten from Zone C. Qualitative data were analysed using Nvivo, which involved coding and identifying recurring themes. Microsoft excel was used to analyse quantitative data and plot charts and tables.

1.3 Discussion of Results

1.3.1 Socio-economic characteristics of citrus farmers surveyed

Table 1.1 below provides key socio-economic characteristics of the citrus farmers surveyed. It can be noticed that 97% of the farmers are male. This does not support findings that indicate women make up 60-80% of the agricultural labour force in Nigeria (World Bank, 2003) and can be attributed to wider cultural influences. In Benue, especially in Tiv land (major ethnic group), women are seen to have no authority in the home; so when households were approached, the women would direct the questionnaire to the men. Sometimes they (women) sat down with the men and provided answers to questions the men did not know. At other times they were attending to domestic chores. There were times when households with large citrus farms were identified but information was not provided because the men were not at home. This suggests that women are involved in agricultural production but because of cultural norms in the area, they would not give out the required information without a man being present.

Table 1.1 Characteristics of farmers

Gender	**Total (N=60)**	**Percentage**
Female	2	3%
Male	58	97%
Marital Status		
Single	2	3%
Married	57	95%
Age group		
20 - 29	4	7%
30 - 39	6	10%
40 - 49	11	18%
50 - 59	24	40%
> 60	14	23%
Education level		

No formal education	5	9%
Primary	7	12%
Secondary	18	30%
Tertiary	28	47%
Farm land acquisition		
Inherited	56	93%
Personal	1	2%
Purchased	3	5%
Size of farm		
Less than 1 hectare	3	5%
1-4 hectares	18	30%
5-6 hectares	8	13%
> 10 hectares	4	7%
No response	27	45%

In Nigeria, the agricultural roles of men and women vary because of the various ethnic groups in the country. Buckland and Haleegoah (1996) observed that traditions and beliefs of a culture defined the roles of men and women. Ityarvyar (2008) also underlined the importance of society and societal expectations in dictating the roles of men and women. These gender differences are also noticeable in agriculture. A study by Agada and Ejembi (2010) revealed that in soybean production in Benue State, there were stark gender differences. Men were accustomed to the heavy duty tasks such as land clearing, harvesting and fertilizer application while the women focused on lighter tasks like planting, weeding and domestic activities. Across Nigeria there is a similarity in the role women play which includes domestic activities, taking care of livestock, postharvest activities and food production (Ityarvyar, 2008).

The results reveal that 40% of the citrus farmers surveyed are between ages 50-59 and 23% are over 60 showing that the older generation is more involved in citrus farming than the younger generation. Young people between ages 20–29 and 30–39 made up 7% and 10% of farmers respectively. This is consistent with studies by Olayemi *et al.* (2012) and

Ekong (2003) which indicate that less young people are involved in farming due to the migration of youths to urban areas in search of white collar jobs, thus the Nigerian farming sector is dominated by the elderly.

A majority of citrus farmers (93%) inherited their farmland from their parents. In Nigeria, the traditional method of land acquisition is through inheritance (Ortese *et al.*, 2012). Some of them had inherited the land and citrus trees from parents; others had inherited just the land and went ahead to plant citrus trees. Most of the respondents are married (95%) and 85% of the farmers got into citrus production solely to generate income. This reveals the role of citrus farming in aiding farmers to provide for their families and put their children through school. Table 6.1 also demonstrates that 91% of the respondents have some form of education with 47% having tertiary education. Citrus farming was defined as a "*continuous farming project*" by a farmer because of the longevity of the trees and their ability to produce for a long time. The lucrativeness of this business as a steady source of income could be the reason for attracting highly educated people (Ortese *et al.*, 2012). In addition, the farmers had been involved in citrus farming for a minimum of six years and a maximum of forty-four years.

1.3.2 Citrus Production

The farmers in the survey had various farm sizes, with the prevalent size being 1-4 hectares. A majority of the farmers however were unaware of the size of their farms with respondents reporting ownership of between 110 and 5000 trees. The citrus tree stands of the respondents total at 45,949, with an average of 766 citrus tree stands per farmer. There was no relationship between farm size and number of trees, as farmers used their farms for other crops or allowed them lie fallow. The farmers used different sizes of bags to sell their oranges and this was dependent on the destination of the purchaser. The main size used was a recycled 50kg[3] bag

[3] The main bag used is the recycled 50kg bag also known as the direct bag. The reference to 50kg is the initial weight stamped on the bag by the company for the intended content –sugar, or wheat as figure 6.1 shows. For example, a 50kg direct bag filled with sugar will

that was 29 inches wide, 47 inches long (see figure 1.1) and capable of holding an average of 868 oranges of different sizes[4] (very small, small, medium and big oranges). Information from BNARDA and farmers revealed that on average a young citrus tree produces one to three 50kg bags of oranges and a mature tree would produce four to six 50kg bags of oranges. Therefore the total amount of oranges produced by the respondents should range from 92,298 – 230,745 50kg bags of oranges. However, the total production of oranges according to respondents' calculations is 25,460 50kg bags of oranges. This is less than one third of the expected production and can be explained in part by the lack of record keeping by farmers. A majority of farmers were not sure how much they produced, lost or even sold every year and many farmers could not give a clear indication of the number of trees owned. The uncertainty also reflects the high postharvest losses experienced by farmers and will be explained further in the next section. From the above production estimates, annual citrus income generated by respondents was N30,480,000 ($152,915)[5].

weigh 50kg but this does not apply to oranges. The bags are fitted with a cover to allow room for more oranges.

[4] The quantity of oranges always varied in 50kg bags; it depended on the size of oranges and the person who packaged the oranges. The above estimate is an average of three 50kg bags collected from a farmer and two traders.

[5] During data collection the exchange rate was $1 to N199 (Naira)



Figure 1.1 50kg bag of oranges
Oranges are packaged in recycled 50kg wheat bag and fitted with a cover in Vandeikya LGA, Benue State. Author's photograph. 10th December 2014.

The questionnaire results show that farmers intercrop their orange trees with yam, cassava, tomato, pepper, soya beans, groundnuts, rice and maize. A Nigerian survey carried out by Jolaoso *et.al.* (2011a) in 2005 revealed that about 70% of citrus farmers intercrop their citrus fruits. Most of these crops are for home consumption and the surplus is sold to complement income from citrus production. The annual income derived from all crops planted by the survey farmers including oranges was estimated as N50,250,000 ($252,513). Of this citrus provides about 60% of these farmers' income, contributing greatly to farmers' livelihoods.

Figure 1.2 provides a breakdown of the categories of other food crops planted by the survey farmers according to zone. Roots and tubers are the main staple crops for the Benue State populace. Oilseeds, pulses and cereals constitute the major cash crops in Nigeria.

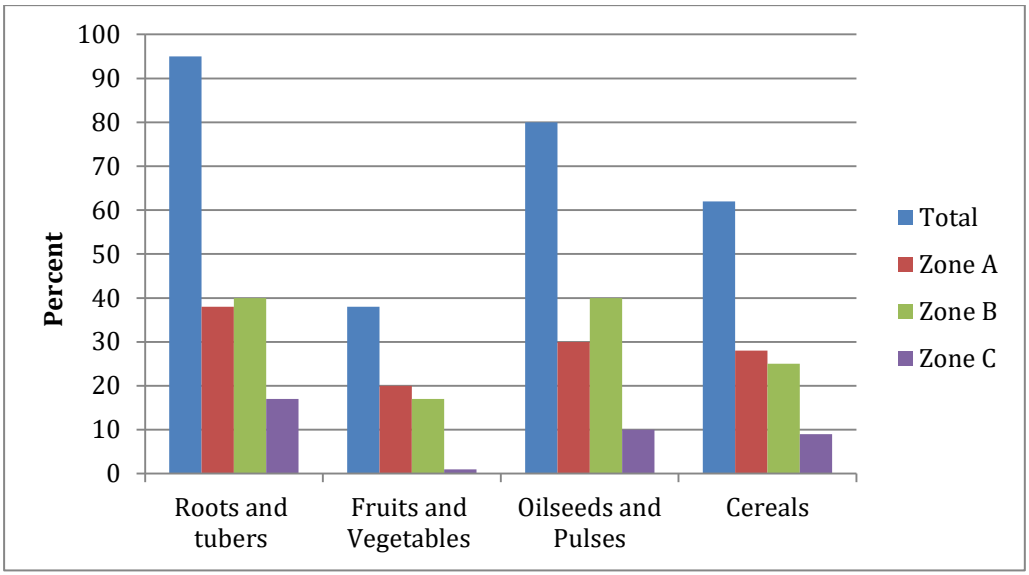


Figure 1.2 Categories of other crops planted by citrus farmers

There are different sweet orange varieties in Nigeria. Eight varieties are produced by the farmers in this study (see table 1.2 and figure 1.3). 67% of the farmers in this study stated that extension agents, friends, family members, neighbours and other citrus farmers, advised them on the type of varieties to plant. This showed relationships that existed between community members involved in citrus farming. The most preferred varieties are Ibadan sweet, Valencia, Washington Navel and Tangelo. Ibadan sweet is the most common because of its dual harvesting period (in the dry and wet season). This enables farmers to sell their oranges throughout the year. Also the price for Ibadan sweet is higher than the other varieties because it can be harvested in the wet season during the months of June and July when other oranges are scarce and prices appreciate. This period coincides with the Ramadan (Islamic) fast where fruits especially oranges are always in high demand (Ibrahim, 2017). During this period farmers are able to make good profits which helps to compensate for losses during the seasonal glut.

The timeline in table 1.2 shows the different sweet orange varieties and when they are harvested during the year. This is not fixed as harvesting periods often spill over into other months not highlighted in the table.

Most of the varieties are harvested between October and March causing a seasonal glut in November and December.

Table 1.2 Timeline of sweet orange varieties in Benue State

Varieties	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Ibadan sweet												
Valencia												
Washington Navel												
Tangelo												
Tangerine												
California												
King												
Agege Sweet												

Source: Authors analysis




B


C

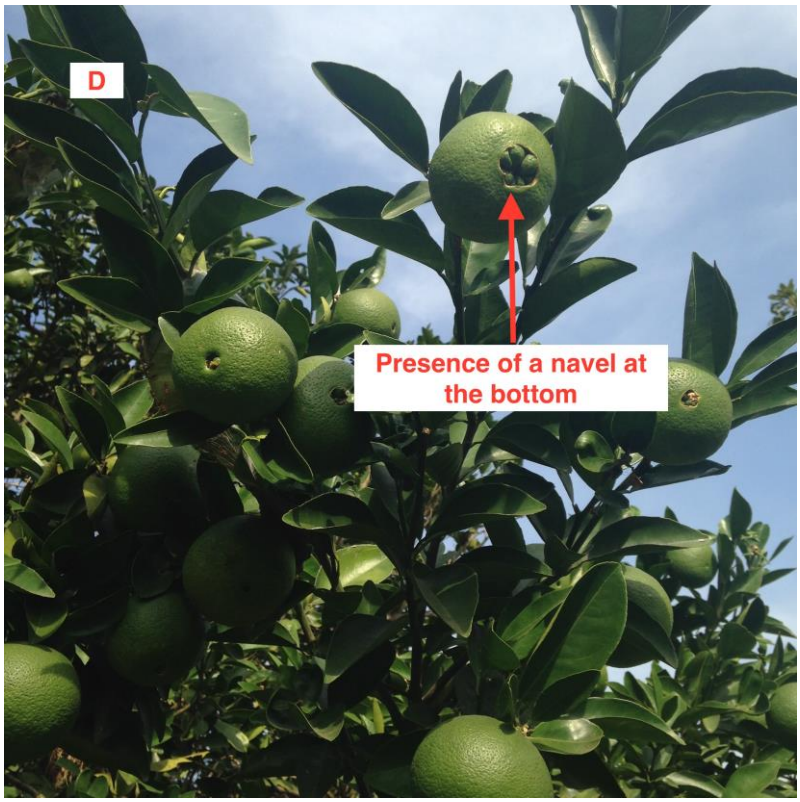


Figure 1.3 Pictures of orange varieties
A is King, B is Ibadan sweet, C is Valencia and D is Washington navel. Author's photograph. 4th and 5th December 2014.

1.3.3 Causes of Postharvest Losses

1.3.3.1 Harvesting methods

The inappropriate methods used to harvest oranges in Benue State are an important cause of losses within the orange value chain. Middlemen usually approach farmers before harvesting takes place. When this happens, the youth in the area offer their services to the farmer to harvest and package the oranges. The harvesters employed a range of methods to harvest the oranges including picking by hand, shaking of the trees and using long sticks with hooks. The methods were somewhat dependent on the variety of orange and the weather conditions. When trees are shaken, the fruits often get damaged by the branches that they hit whilst falling to the ground, causing the fruit to become bruised and punctured. The impact of falling a distance onto a hard surface causes fruits to become discoloured or bruised and often break open in the process. Citrus fruits have a quick response to physical stress (Murata, 1997), with bruised and

punctured fruit becoming susceptible to microbial deterioration and rotting within a day or two.

The degree of damage during harvesting is dependent on the variety and the weather conditions. Due to the soft nature of the rind of Valencia and Tangelo, they easily break open when damaged by sticks, branches or impact with the ground surface. Significant losses are also recorded when oranges are harvested when it is wet or when moisture levels are high. The losses during the wet season are more significant because oranges are scarce at the time and sold for higher prices so PHL equates to higher economic losses. For this reason, harvesting in the morning (when there is dew on the ground) is generally avoided to prevent oranges from becoming swollen or breaking open due to the reaction of the orange with water. Turgidity usually leads to olleocellosis (rupturing of the oil glands) that physically damages the fruit and causes blemishing (Defelsko, n.d). The farmers refer to this process as burning. During harvest some of the farmers place grasses at the bottom of the trees to reduce the impact as the oranges land or to stop them from coming in contact with water (if the soil is wet). The farmers were unable to state how effective the grass was in reducing losses. Sometimes the grass was not dry enough and the moisture in it reacted with the oranges when they dropped and caused spoilage. Oranges harvested in the rainy season have more juice and a softer rind and are therefore more delicate than those harvested from December to March. In the dry season the tree controls the amount of juice the fruit contains and the rind is stronger which helps to reduce the losses incurred during harvesting.

Improper handling of fruits after harvesting frequently causes them to become bruised as the bags of oranges are thrown on hard surfaces. Fruits that are not handled carefully are far more susceptible to damage and bruising which induces fungal rot as well as rind physiological disorders (Murata, 1997).

1.3.3.2 Pests and diseases

Pests and diseases limit the yield of fruits and affect their market acceptability (Umeh *et al.*, 2004). The insects and diseases identified by respondents include:

a. Fruit piercing moths (*Papilio demodocus*) that bruise and attack the matured and maturing fruits by piercing them and sucking out the juice. The bruises lead to secondary bacterial and fungal infections that cause the fruit to drop from the tree prematurely (Jolaoso *et al.*, 2011a).
b. Farmers identified the fruit fly as the most devastating pest. The female fruit fly lays her eggs in the fruit and the larvae render it undesirable. These fruits remain on the tree and the effect is noticed after harvest because the fruits affected have a lower quality and it reduces their economic value (Umeh *et al.*, 2004).
c. Citrus aphids and scale insects (*Margarodoides* pp*. and Coccidae* spp.) use their piercing mouthpiece to suck the juice from leaves, flowers, barks and branches of citrus. The sap is excreted as honeydew that attracts ants. The honey also acts as a good media for sooty mould fungi to thrive on the leaves. This inhibits photosynthesis and results in malformed leaves, shoots, and stunted growth (Jolaoso *et al.*, 2011a, Kamel, 2010). The ants on the tree hinder the farmers from harvesting the oranges by hand because they bite. The use of stick with hooks and shaking of the trees for harvest expose the fruits to mechanical damage.
d. Citrus rust mites feed on the juice from the fruits and leaves that blemish the fruits. They are serious pests in tropical and subtropical regions and cause the skin of the fruit to appear like it has a "*dark tan shoe polish*" (Mitchell, 2003:3) (see figure 1.4). The rust mites become more severe the longer the fruits stay on the tree. They cause the fruits to lose water

and deteriorate rapidly as a result of which they appear smaller and substandard (Kamel, 2010).

e. Fungal infections were suggested by farmers as important diseases but exact names were not given except for Powdery Mildew. This is an important disease that collapses the shoot and covers it with a white colour. Young fruits covered by the fungus drop prematurely from the tree. Mildew reduces the yield of citrus trees (Etebu and Nwauzoma, 2014). Citrus fruits are susceptible to fungal invasion after bruising. The green mould (*Penicillum digitatum*) is typical of bruised/wounded fruits and spreads to other fruits by contact (Murata, 1997).

The fruit fly and fruit piercing moth have been characterised as the most important fruit damaging insects in Nigeria and significantly increase the losses experienced by farmers (Umeh *et al.*, 2004). Devastating impacts of the fruit moth and fly can be as high as 70% of the fruit (Babatola, 1985). Allowing citrus fruits to get over ripe due to late harvest increases the susceptibility of the fruits to the fruit fly and moth (Attaway, 1971). Ezeibekwe (2011) proposes that Nigeria's level of production is lower than it should be due to the high prevalence of pests and diseases.



Figure 1.4 Oranges attacked by the citrus rust mite
Katsina-Ala LGA, Benue State. Author's photograph. 23rd January 2015.

1.3.3.3 Lack of market

Market here refers to the lack of direct consumers and processing industries. The scarcity of a market in Nigeria has been referred to as the most important cause of PHL (Olife *et al.*, 2015). One of the farmers stated, "*the mouth is the only processing industry – how many millions of people will you wait for to sell your oranges*?" This quote reflects the frustration of many citrus farmers. The lack of processing facilities forces them to rely on local direct consumption by the populace and they recognise that there is only so much a human being can consume. In order to reach as many direct consumers as possible, the points of sale used by farmers is detailed in table 1.3.

Table 1.3 Point of sale by farmers

Point of sale	Total (n=60)
Farm gate	43 (72%)
Farm gate, act as intermediaries	6 (10%)
Farm gate, local market	3 (5%)
Local market	6 (10%)

Farmers in Benue have become accustomed to intermediaries locating them to purchase their fruits; as a result there is a reliance on farm gate sales. Most of them cannot afford to hire a vehicle to transport their fruits to markets. The reliance of farmers (72%) on intermediaries creates periods of high and low demand, lower prices and somewhat unfavourable experiences. Intermediaries always beat down the prices with farmers and because a large number of farmers sell at the farm gate, they would rather sell oranges at a lower price than leave them on the trees. From November to February the prices of oranges are very low - 50kg bags of oranges can be sold for N500 – N1000 ($1.5 - $5). In many instances, farmers had sold 50kg bags for N200 ($1). In the rainy season when oranges are scarce and in high demand, Ibadan Sweet is sold for N3000 – N5000 ($15 - $25) per 50kg bag. The intermediaries usually tell the youths bagging the oranges to pick the smaller ones so that a larger number fits into the bag. At the end of the day the farmers are left with bigger oranges that have been rejected by intermediaries.

Sometimes farmers were approached by intermediaries and asked to harvest oranges before payment. After harvest the purchasers did not return and the oranges harvested went to waste. As a result of such experiences farmers now wait to be paid first before they harvest their fruits. When there are no buyers, the oranges remain on the trees. If fruits from young tree stands are not harvested early, they dry up and when the rains start they do not contain juice. To counter this, farmers harvest the

oranges from the young stands and place them at the base of the tree to serve as manure. This counts as a loss because they could have been sold but were not. Farmers cannot leave oranges on the tree stands for very long periods after maturity otherwise the trees don't begin to produce flowers at the beginning of the rainy season. Any delay in sales/harvesting results in a delay in flowering and subsequently affects the output of the following year. Leaving oranges on the tree after maturity due to the lack of market increases their susceptibility to pests and diseases by fruit flies, fruit piercing moths and rust mites (Umeh *et al.*, 2004).

In contrast to Olife *et al.*'s (2015) suggestion that wastage is avoidable (as farmers prefer to sell their oranges at markets in order to receive a higher price instead of to processing industries), evidence from Benue State indicates that farmers have no opportunity to patronize processing facilities. As a result, the losses incurred by farmers would only be avoidable if there is a ready constant market for citrus:

> "*…there is a lack of manufacturing industries that will process it [oranges]….there is no stable market especially when the production is very high, many of the fruits go bad…..Government should provide small-scale processing machine loans to farmers*…" (Brian, farmer).

Farmers estimated they incurred 10% losses from improper handling of the fruits, pests and diseases. They however experienced more losses when intermediaries did not approach them for sales, sometimes as high as 100% losses because they were unable to sell their fruits.

1.3.3.4 Lack of political willpower

All respondents identified the lack of political will power as the main cause of PHL in the state. This is because it is a major barrier to creating an enabling environment for curtailing losses. There is a shortage of processing facilities in Benue and Nigeria; the only functional concentrate processing facility –Teragro- started processing fruits in 2012. With a capacity of 26,000 MT its output does not cover the magnitude of orange production in Benue State. None of the farmers in this study supplied fruits to Teragro, and some had never heard of its existence.

Various processing facilities were identified in Benue that are not functional. That was a similar story with Teragro: it was established and commissioned in 2005, but was not functional until 2012 when the State government went into a public-private partnership with Transnational Corporation of Nigeria (TRANSCORP) (Teragro, 2016). This lack of political willpower can be traced back to over fifteen years ago when the Nigerian Government was importing over 90% of the fruit juice consumed in the country. As a result, a ban was placed on the importation of fruit juice in 2002 (Nzeka, 2013). The aim of this decision was to reduce the amount of foreign exchange expended on importing fruit juice and concentrates/premixes that can be produced locally, and to improve and encourage local production and processing (Olife *et al.*, 2015). The import tariff on concentrates was reduced at the same time from 10% to 5% (Nzeka, 2013). Although the ban was successful in stimulating the manufacturing of fruit juice in Nigeria, today over 95% concentrates are still imported from the European Union, South Africa and South America, amounting to 1bn NGN (200Mn USD) (FMARD, 2015). This is because it is cheaper for companies to import concentrates at a lower tariff than establish processing units that will require large sums of money to operate, especially with the erratic power supply. High manufacturing costs and a hostile operating environment were the reasons behind the closure of the Coca-Cola processing plant in 2009.

This along with the absence of motorable roads for middlemen to reach farmers in interior villages and a commitment to the reduction of postharvest losses has discouraged farmers from producing more oranges. The agricultural parastatals acknowledged the importance of reducing postharvest losses but were unable to do anything about it because there was no funding for such projects. An elderly farmer who was frustrated from the moment he was approached lamented:

> "*You won't use the information in this interview to bring change. We have sons in positions who do not want to alleviate our suffering. You will use the information I have given you in pains to excel in your academics but not bring any solutions to the farmers. Our Tiv sons who are in positions of leadership have the opportunity to*

establish factories here in Tiv land for us, so that the idea of outsiders coming to cheat on us by compelling us to sell our products at very low prices while they go and trade them at very exorbitant prices- enjoying the fruits of our labour and establishing themselves in their own states. We have much money in Benue State but we don't have leaders who have the interest of the masses at heart who will channel these resources to the benefit of the masses. It is so disheartening".

1.4 What the losses mean to farmers

The farmers in this study were mainly involved in citrus production because of its economic benefits. They reported that about 60% of their income was from citrus production; therefore experiencing postharvest losses reduced their income levels and impacted their livelihoods. The losses were viewed as economic losses to farmers because they had invested human and economic resources that had yielded little or no profit. The farmers reported that when less income was received they were unable to manage their farms properly. This is because 78% of the farmers relied on family and hired labour to maintain their farms. Lowered income meant that they were unable to hire labour for farm maintenance and this resulted in the production of fruits that were very hard and unable to be sold. When farms are not weeded regularly, the weeds compete with the citrus fruits for nutrients and moisture and overall, reduce the longevity and productivity of the trees (Onwualu *et al.* 2012). Due to the high prices of fertilizers and pesticides, if they made no sales they were unable to purchase these inputs, which ultimately influenced output.

In addition, the farmers identified their inability to send their children to school when high losses were incurred because they were unable to pay their fees. The farmers were also unable to purchase other food products that were needed in their households that they did not produce on their farms. This had significant impacts on their food security status as their access to required food was reduced. Due to the level of losses experienced by farmers they were generally not motivated to increase production because what they were producing at the moment was not always purchased. Consequently they expressed a desire for the

establishment of processing facilities. This led them to suggest that the government was ignorant to their problems and not interested in investing in orange processing despite the amount of fruits produced in Benue. The farmers referred to citrus production as a "*continuous farming project*" because of the ability of citrus trees to produce fruits for years, giving them a constant source of income but high postharvest losses reduced their income levels. When sales were made at low prices farmers still viewed that as a loss because they were not getting the desired profit for their fruits after all that had been expended in producing them. To the farmers selling the oranges at a low price and no sales meant the same thing – losses.

1.5 Conclusion

Postharvest losses are caused by various socioeconomic and cultural factors that can only be determined by studying crop value chains in various geographies. In low-income countries, the production of fruits is important in improving the livelihood of small-scale farmers. Citrus postharvest losses are a major problem in Benue State, Nigeria. The farmers are involved in citrus production to earn a living and provide for their families. Fruit production does provide a good source of income when they are able to make sales. These losses are important to farmers who have put in so much effort to produce crops with the hope of earning a profit but experience losses instead. Farmers experienced 10% losses due to pests and diseases, postharvest handling and much more due to the absence of processing facilities. There were instances where 100% losses were recorded when farmers were not approached by intermediaries. The farmers in this study were not sure how many citrus trees they had or the extent of the losses they incurred. The 10% is a conservative estimate as losses experienced would be way more if more accurate estimates were provided.

The absence of political willpower in the form of providing a market for citrus fruits, mobilizing research in the study of postharvest losses and the provision of basic infrastructure in the form of motorable roads

discouraged farmers from producing oranges. However, due to the need to have sources of income, the farmers had no choice but to continue the trade. It is imperative that processing facilities in Benue State are provided to manage the seasonal glut. This can be aided by improving research and development in the horticultural sector. For postharvest losses to be managed adequately in Nigeria and low-income countries, and for set targets to be achieved, there is a need for more crop and region specific research to identify problems associated with individual value chains. The importance of standardising postharvest measurement tools cannot be understated in order to reduce the discrepancy in reported losses estimated. It is important that there are records of how much is produced, consumed, lost and wasted. Also, there is a need for future research to identify the entry points of postharvest losses and provide adequate solutions.

Publication 2: Distance Decay

2.0 Abstract

Postharvest losses occur at any point along the chain from farm to fork. The magnitude and causes of losses vary by crop and geographical region. However, research on postharvest losses for the most part has focused on losses on the farm, with little emphasis on the losses that occur beyond the farm gate. This article builds on this gap to study losses that occur during transit and in markets using the citrus value chain in Nigeria as a case study. This article draws on experiences of intermediaries and traders in Benue State, Nigeria to explore the causes of losses beyond the farm gate. Packaging materials, the process of transportation, postharvest handling and the lack of processing facilities are identified as causes of losses. I conclude that the level of losses incurred negatively affects the livelihoods of intermediaries and traders. In addition, there is a need for infrastructure in the form of processing facilities to reduce the citrus losses incurred.

Keywords: citrus; middlemen; traders; postharvest losses; Benue

> *"The problem is losses. You know we gain, at times we lose….we buy and will not make market then we lose. At times you lose more than what you buy; you even lose your whole capital"* (Citrus trader).

2.1 Introduction

Postharvest losses are a product of a variety of social, cultural, economic and political factors which are specific to crop value chains in different geographical regions (Kader, 2005, Hodges *et al.*, 2010). Their prominence in research results from an increasing population, food security and sustainable agriculture (IMECHE, 2013, CFS, 2013). Available literature on PHL is "*geographically scattered*" (Tomlin *et* al., 2016:3) with limited information available on commodity value chains that reveal the magnitude of losses and their causes in low-income countries (Sheahan and Barrett, 2016, Ugoh *et al*., 2017 Ugoh *et al*., 2017a). This hinders the management of postharvest losses (Affognon *et al.*, 2015). Available

statistics on loss estimates are based on out dated data sets that are generalised to suit different countries (Parfitt *et al.*, 2010). In low-income countries including Nigeria, available research is fragmented and focused mainly on the farm, when in reality, PHL can occur at any point along the value chain, where activities like sorting, grading, packaging and distribution occur (Parfitt *et al.*, 2010, Affognon *et al.*, 2015).

Postharvest loss research requires a radical shift in the way it is studied, to move beyond the farm gate and capture the socio-economic characteristics that influence particular value chains in different geographical regions. With a change in consumer demands and urbanisation in developing countries, value chains are extended and there is a growing need to focus on other aspects of the value chain where value addition occurs (Parfitt *et al.*, 2010, Affognon *et al.*, 2015). Commodity chain analysis involves following of commodities along value chains to explore their trajectories within human and social contexts (Appadurai, 1986). This involves following the commodity where it goes to identify relationships, actors, activities and processes to reveal the hidden story of the value chain (Busch, 1990, Cook *et al.*, 2006). Commodity chain analysis is specific to a commodity and spatially rooted (Dixon, 1999, Collins, 2005, Friedland, 2001), which is advantageous to the study of PHL, as it explores the context of the commodity including political, cultural, economic and social factors that influence losses. Although commodity chain analysis has been adopted to follow commodities from the global south where they are produced to the north where they are consumed Ugoh *et al.* (2016a) propose the use of the framework in a national context, particularly within the global south. In this way a commodity will be followed from farm to fork to identify the entry points of PHLs and the various factors that influence losses within a geographical region.

In Nigeria the study of PHL is in its infancy and has, to date, been focused on grains and selected perishables (tomatoes and peppers) (Olayemi *et al.*, 2010, Atanda *et al.*, 2011, Nenguwo *et al.*, 2015). Fruits and vegetables suffer significant losses, as 45% is lost before consumption (Kitinoja and

Kader, 2015). While there has been a gradual recent shift towards horticultural postharvest management (Choudhury, 2006), limited attention has been paid to fruits including citrus. According to Kader and Arpaia (2002) this is because citrus is seen as 'less perishable' when compared to other horticultural crops like tomatoes. However, citrus experiences major losses due to poor handling during harvest, transportation and marketing (Kader and Arpaia, 2002). LaGra (1990) posits that a country will not invest in managing PHL of a crop that it does not benefit significantly from in foreign exchange. Adelaja *et al.* (2005) suggest that citrus is one of the major crops Nigeria has comparative advantage in, however, it is increasingly clear that Nigeria is unaware of its advantage in this sector. This can be attributed to the lack of agricultural policies in Nigeria with emphasis on PHL. The Agricultural Transformation Agenda created in 2011 aimed (among other things) to manage the PHL of crops that Nigeria had comparative advantage in from farm to fork. Although this emphasis included rice, cassava, cotton and maize, (FMARD, 2011, Adesina, 2012), fruits are noticeable for their absence in this agenda. There is a lack of data on the citrus value chain from farm to market with a focus on postharvest losses in Nigeria. Most of the available data and agricultural policies have focused on the farm with less attention on the whole chain (Ugoh *et al*., 2017a).

Available postharvest literature on low-income countries (Adebamji, 2011, Kereth *et al.*, 2013, Oguntade, 2013, Olife *et al.*, 2015) reveals gaps in understanding the role of intermediaries, the level of losses they incur and the causes. There are also noticeable exclusions on socioeconomic, cultural and political factors that affect these losses. The premise of this article is to provide crop and region specific insights into the causes of postharvest losses beyond the farm gate. For a country that produces 3.9 million metric tonnes of citrus and loses 30-50% (NIHORT, 2002, FAO, 2012, FMARD, 2014) PHL are indeed an important problem. This paper focuses on the intermediaries and traders and follows the journey of an orange from the point it is purchased on the farm to the moment before purchase by a consumer. This study draws on in depth qualitative research on the

experiences of a range of intermediaries and traders in Benue State along the citrus value chain in Nigeria to provide an account of the journey of an orange in a way that has not been done before. I explore the role of intermediaries in the remaining part of this section and discuss the results of the study.

2.1.1 Postharvest losses and the role of intermediaries

Postharvest handling of fresh fruits is vital in determining their shelf life and microbial activity (Kereth *et al.*, 2013). Therefore the transportation and storage of fruits from farm to market is a significant part of the value chain (Sharma and Singh, 2011). Most smallholder farmers and supply chain actors lack the necessary means in funds and infrastructure to adequately manage fruits during transportation and marketing. As a result they experience high postharvest losses (Kader, 2005). In Nigeria, the intermediary section of the value chain that includes the transportation of fruits from farm to market is largely ignored. Instead, more focus has been placed on the farm despite the fact that major losses are incurred after the farm gate (Adepoju, 2014).

The losses experienced after the farm gate occur mainly as a result of the absence of appropriate packing materials and the high cost of transporting fruits. The transportation of fruits over long distances on poorly constructed roads, usually under high temperatures in poor packaging is a major cause of losses (Sharma and Singh, 2011, Taylor and Esan, 2012) Agbowuro (2012) studied the handling and transportation of pawpaw in Ekiti State, Nigeria and revealed that 84% of respondents incurred the most losses during transportation. In Tanzania and Ghana, the major forms of transportation adopted are lorries, bicycles, tricycles and head carriage, which are not appropriate but are relied on because of their availability and in some instances lower costs (Kereth *et al.*, 2013, Nenguwo *et al.*, 2015). The lack of appropriate packaging and improper handling of fruits during transportation results in spoilage, mechanical damage and microbial deterioration (Kereth *et al.*, 2013).

About 45% of the citrus fruits produced in Nigeria are consumed fresh. As a result they have to be transported immediately from farm to market after harvest in adequate conditions (NIHORT, 2002, Ezejiofor *et al.*, 2011). In Nigeria, due to the seasonal nature of citrus production, a glut is experienced within the months of November and December (Ugoh *et al*., 2017c). Citrus was identified as the major fruit transported to other states in Nigeria (Idah *et al.* (2007). A study in Osun State revealed that there were no intermediaries or traders involved in the transfer of oranges from farm to market (Adebamji, 2011). The farmers were responsible for fruit transportation and sold their fruits themselves to eliminate the transfer of profit to other actors (intermediaries and traders). However, various other studies on the movement of produce to and from different parts of Nigeria have indicated the presence of middlemen (Adeyeye and Dittoh, 1989, Ekefan *et al.*, 2004, Idah *et al.*, 2007, Oguoma *et al.*, 2010, Fakayode *et al*., 2012, Imam *et al.*, 2014, Ugoh *et al*., 2017c).

Intermediaries dominate agricultural value chains in low-income countries and have a significant amount of power; causing large disparities between the prices paid to farmers for goods and the prices paid by consumers (Mitchell, 2011). This is because they have more market information than farmers. Dixon (1999) and Morris and Kamarulzaman (2014) discovered that the intermediaries along value chains were the centre of power and controlled the prices of food products at various points along the chain. Despite the influence intermediaries have on farmer revenues they play an important role in transferring food crops to markets. In Benue, Ugoh *et al.* (2016c) observed that a majority of citrus farmers (72%) sold their fruits to intermediaries at the farm gate because of the shortage of funds to transport fruits to market. As a result, the intermediaries played a vital role although they dictated the prices farmers received. Other farmers (10%) acted as intermediaries and also sold their fruits at the farm gate to maximise profit and avoid transferring the profit to intermediaries. The importance of intermediaries was emphasised by Oguoma *et al.* (2010), as 72.9% of their respondents regarded them as vital in mitigating challenges and limitations the

Nigerian government has been unable to respond to such as the provision of adequate storage and processing facilities and the lack of access to market information. Although middlemen are widely viewed as exploitative of farmers or vital in markets, Mitchell (2011) highlights the existence of both types of intermediaries (purely exploitative or those fulfilling an important role) operating in the same market. This was also found to be the case with intermediaries in Benue State, Nigeria (Ugoh *et al*., 2017c).

Adeyeye and Dittoh (1989) identified the presence of six classes of intermediaries (whose roles involved the transfer of commodities from farm to market) in Nigeria and the operation of two kinds of distribution channels – centralised and decentralised. The types of marketing channels vary by crop and region, as well as the number of individuals involved along the chain. The geographical spread of commodities and consumers in Nigeria results in commodities passing through three chain actors at least before getting to the consumer. Normally for fruits the chain would include producer, assembler, wholesaler and retailer (ibid., Imam *et al.*, 2014). Anyone financially buoyant can become an intermediary at any time; also the activities of intermediaries cause seasonal price differences (ibid.).

2.2 Materials and methods

Nigeria's climate is characterized by two seasons – the rainy/wet season and the dry/Harmattan season. The rainy season is from April to October and is distinguished by heavy rains and temperatures ranging from 28-33˚C. The dry season is from November to March. In December and January the weather is cool - dry, windy, dusty and temperatures reach a low of 12˚C and much lower in different parts of the country. From February to March it is extremely hot with temperatures ranging from 33-38˚C. The length of the rainy and dry season varies in the northern and southern parts of the country. Nigeria has different vegetation types but Benue is primarily Guinea Savannah (Karmalkar *et al.*, n.d., NPC, 2014).

The data for this paper were collected over a period of two months in Benue State, Nigeria. Benue is the highest producer of citrus in Nigeria – providing about 1,000,000MT annually (Okigbo, 2012, FMARD, 2015), and houses the sole concentrate processing facility (Teragro) in the country. The state is divided into three political Zones A, B and C. Out of its twenty-three LGAs; seventeen of them produce citrus in abundant quantities. Citrus is particularly dominant in Zones A and B. Intermediaries were identified in Zones A and B from nine LGAs: eleven from Zone A and eight from Zone B. No middleman was identified in Zone C. Traders were selected from Zone B but no traders were identified in Zone A and C. The traders are divided into two categories – roadside and market traders (seven and four respectively).

Semi structured interviews were conducted with a total of nineteen middlemen and eleven traders. As middlemen and traders were often located in groups beside major highways linking LGAs, it proved fruitful to conduct group discussions rather than individual interviews. A total of five such group discussions (numbers ranged from two to ten persons – male and female) took place. Information sought was on marketing channels, the level and causes of losses during transportation and in markets, as well as on issues relating to consumer preference for different orange varieties, packaging materials, transportation methods and challenges faced. Direct observations of middlemen negotiating, harvesting and packaging the fruits, plus traders during sales complemented the interviews.

2.3 Results and discussion

2.3.1 Respondents' profiles

The role women play in agriculture varies by country and ethnicity and these are culturally and socially defined; however, their activities are important in developing rural economies (Buckland and Haleegoah, 1996). In Sub-Saharan Africa, agriculture is identified to be very important to women in terms of employment and in Nigeria there are distinct variations in the roles women play in agriculture. Men undertake tedious

production tasks, while women are more involved in postharvest activities (packaging and post-processing) and the sale of market produce (Butterworth *et al.*, 2008, Raney *et al.*, 2011).

Gender differences amongst traders and middlemen in Nigeria are also pronounced. Nigerian women tend to have a high level of involvement in nonfarm activities including informal and small-scale processing of produce and retailing in open markets. The importance of fruit trading is especially important to women with Aliber *et al.* (2010) noting that the women involved in this sector in South Africa make up two-thirds of the markets and identified it as their only source of income. Wholesale retailing and the middleman sector, by contrast, tend to be far more male dominated (Oseni *et al.*, n.d.). According to SAHEL (2014), there are no women acting as middlemen along the agricultural value chain in Nigeria as the sector is predominately male-dominated. This is because intermediaries have to travel greater distances to deliver their produce and spend significant periods of time travelling away from home. Mamfimisebi and Okunmadewa (2006) argue that many Nigerian men would be reluctant to allow their wives such freedom to participate in wholesale retailing because of its social implications.

Despite these broader gender divisions within the retailing sector, research in Benue state identified four female middlemen who were interviewed alongside thirty-six male middlemen. On average, these middlemen had been involved in the trade for fifteen years. When questioned about the male-dominated nature of this sector, one of the female middlemen (who also doubled as a roadside trader) mentioned that her husband never liked her travelling to other states when they got married and had kids. He preferred her trading, but since her kids have all grown up, she now travels to other states to distribute oranges. This is because she makes more profit from being a middleman than a roadside trader in the village.

Interviews with traders were made up of twenty-eight female respondents and two males. All the traders identified in this study were satisfied with

the benefits from orange sales. It was their main source of livelihood although they sold other crops (mango, yam, pawpaw, groundnut, pineapple, coconut, cashew, guava) when they were in season to augment their incomes. Some of them had started this trade when they were younger and used the profits to put themselves through school. Two traders started selling fruits with their mothers when they were younger and have stalls of their own on different sides of the road. The marketing of fruits gives women the opportunity to generate income, provides food security for their households and acts as a "*useful source of livelihood diversification for women and vulnerable groups*" (Clarke *et al.*, 2011:7).

2.3.2 Farm gate transactions

There are eight main varieties of oranges produced in Benue State. The major varieties are Ibadan Sweet, Valencia, Washington navel and Tangelo. The Ibadan sweet variety is the sweet orange type preferred by most farmers, middlemen and traders because of its dual harvesting period (December to March and June to July). Most consumers however are said to prefer Washington navel because it lacks seeds. Therefore farmers, middlemen and traders produce, transport and sell all varieties to meet the various preferences of consumers (Ugoh *et al*., 2017c).

Oranges are packaged in different bag sizes for transportation and these depend on the final destination of the fruits and/or the farmer. The main bag (woven polypropylene sacks) used is the recycled 50kg bag that is 29 inches wide and 47 inches long. The bags are fitted with a cover to accommodate more oranges. When the bags are filled with oranges they are not weighed but their original content (sugar or wheat) would weigh 50kg. The average number of oranges in a 50kg bag is 868 – this is a combination of small, medium and big fruits (ibid.).

The reliance of farmers on middlemen gives the latter the power to dictate farm gate prices. As noted earlier, 72% of farmers in Benue sold their fruits to middlemen. Oguoma *et al.* (2010) argue that due to market information on the part of middlemen, they can dictate farm prices, purchase at reasonably low prices and manipulate market prices in urban

markets. Therefore, they make the most profit along the chain. In Benue, market information is key, however, there is a cultural element to farm gate sales. The farmers believe that because they produce oranges in large quantities, middlemen should locate them. This dependence allows for price manipulation. Also, the farmers usually lack 'cash at hand' to transport the fruits to market after heavily investing in production.

There are two main orange harvest seasons in Benue State – from October to March and June/July. The former season is known as peak period because seven varieties are harvested at the time so there is a seasonal glut due to the amount of oranges available on farms and in markets. The second harvesting period is off-peak where only two varieties are harvested so oranges are scarce and in high demand. The orange peak period coincides with the dry season while off peak coincides with the rainy season. The prices of oranges vary greatly during the different seasons. From December to March, on farm prices are between N500 – N1000 ($3 - $5) per 50kg bag and in June/July between N3000 – N5000 ($15 - $25). Due to the seasonal glut sometimes the middlemen can reduce the farm prices to as low as N200 ($1). The Islamic Ramadan fast occurs during the off peak season when oranges are in high demand so the prices can be easily inflated (Ugoh *et al*., 2017c). Some middlemen like Emmanuel[6], felt purchasing oranges and delivering in the peak season was a waste of time because the profit gained was minimal. He said they would usually wait until the off peak season to invest because at that time there is a "*lot of profit*".

At harvest time, the farmers wait to be approached by middlemen first where they agree on a price before they harvest their oranges (Ugoh *et al*., 2017c). The prices of the oranges per bag depend on the season and the farmer. If the farmer presents himself as desperate to the middleman he is offered a lower price. One of the middlemen referred to on farm prices as "*poor*" because the "*farmer cannot convert the money he gets into anything tangible*". Most of the roads leading to interior villages are not in a good

[6] All names used in this thesis are pseudonyms

condition and are sometimes not passable by vehicles; so the middlemen would locate farmers closer to the highway.

In one LGA the middlemen were 'not allowed' to approach farmers themselves. Instead, they had to meet John[7] who would introduce them to farmers. This was an unwritten rule, but John had significant control and he tried to ensure that middlemen adhered to his rule. He emphasised that he wanted to help and protect the farmers from middlemen that wanted to exploit them, so he tried to guarantee that all the farmers he liaised with were patronised and received fair prices. At the end of the day it was a decent source of income for him. Only one middleman was identified in this LGA that had used John as an intermediary. Another middleman (Sony) who supplied oranges to Teragro went through the same route to locate farmers. He had not been involved in this trade before but was told it was a good money making venture. In order to locate farmers with large orchards, he will travel to LGAs and meet youths who acted as his middlemen. They would locate farmers on his behalf and were paid N200 ($1).



[7] John described himself as the director of the LGA - anyone that wanted to purchase oranges had to come to him first and state their needs. Based on the requirements given he would send his 'boys' to different farmers to bring samples of oranges on the farms. Then they paid John and were taken to the respective farms.



Figure 2.1: Oranges harvested and packaged for transportation
In A the oranges have been harvested and are waiting to be packaged, sometimes they are laid on grass to release the gas, because if packaged immediately after harvest it will 'burn' (discussed in next section). In B the oranges are in the process of being packaged for transportation. Gboko LGA, Benue State. Author's Photograph. 4th December 2014.

Orange production is seen as a community project. The youths living around a farmer with a large orchard take informal ownership of the harvesting activities during sales. It is a time the youths look forward to because they earn an income. When a middleman comes to purchase fruits, he has to make use of the youths in that immediate community and is generally not allowed to bring youths from other communities to help harvest the oranges. The price the middleman agrees with the farmer is solely for him and the middleman has to pay additional wages to the youth for their work. The harvesting activities and their associated prices are provided in table 2.1.

Table 2.1 Harvesting activities and cost from October 2014 to January 2015

Expenses (per bag)	Cost
Harvesting	N150 / $0.75
Bagging	N100 / $0.50
Sacks and cover	N100 / $0.50
Loading vehicle	N150 / $0.75
Offloading at destination	N70 / $0. 35

Source: Authors analysis

It should be noted that the prices are paid per activity and are not dependent on the number of people engaged in that activity. So for every bag harvested, N150 is paid to the group of harvesters.

2.3.3 Causes of losses

2.3.3.1 Postharvest handling and packaging

The handling of fruits after harvest is critical in increasing their shelf life. After the fruits are harvested they are placed on dry grasses/straws to allow the gas in the rind to be released. This can take from one to four days and is dependent on the variety. If the gas is not allowed to escape the fruits can get 'burnt' (also known as olleocelosis). This is caused by the rupturing of oil sacs in the orange rind which spoils the fruit (Defelsko, n.d). It also occurs when the fruits come in contact with water/moisture. Poor harvesting (e.g. shaking of trees) practices result in physical and qualitative losses (appearance, taste, nutritive quality) of fruits before they get to the consumer (Kereth *et al.*, 2013, Ugoh *et al*., 2017c).

The bags used for packaging the fruits are polypropylene sacks (as seen in figure 2.1 and 2.2) that are not really suitable for packaging fruits or keeping them in a good state until they get to market. Other packaging materials used in Nigeria include: jute bags, sacks and baskets because they are easily accessible and cheap to purchase, as they are recycled between products (Idah *et al.*, 2007, Olayemi *et al.*, 2010, Kereth *et al.*, 2013). A study by Kereth *et al.* (2013) revealed that 40% of fruit handlers

used plastic sacks and 20% used baskets to package their fruits in Tanzania. This always resulted in losses because the bags cannot protect the fruits from mechanical damage such as crushing and physical injury. Also a large number of fruits are forced into the sacks which increases the internal temperature and promotes rotting and microbial deterioration (Kereth *et al.*, 2013).



Figure 2.2 Oranges packaged in polypropylene sacks
Gboko LGA, Benue State. Author's photograph. 5th December 2014.

Fruits are still living things after harvest and continue to respire; therefore external factors determine how the fruits respond after harvest. The rate of respiration inversely determines the postharvest life of a fruit. Citrus has a low respiration rate but is adversely affected by external factors. Temperature is characterized as the most important environmental factor affecting the metabolism and respiration of harvested fruits. The increase in temperature within the range of 0-30˚C causes a sharp rise in respiration. Physical stress also influences respiration (Saltveit, 2004). In Nigeria where the temperature reaches 38 degrees, the rate of respiration escalates rapidly and makes oranges more perishable as it leads to rapid microbial deterioration. The respiratory activities of fruits under high

temperatures and humid conditions cause particularly heavy losses of fruits during transit and storage (Idah *et al.*, 2007).

To prevent this, fruits need to be placed in packages that have sufficient ventilation openings for the fruits to breathe (from figure 2.2 it is noticeable that the internal temperature in the bags is high causing the fruits to sweat; this increases the rate of microbial deterioration) (Kereth *et al.*, 2013), but in practice, this rarely happens. In the rainy season for example, the trucks that transport the oranges are often lined with dry grasses/straw, as the oranges need to be handled with extra care because they are quick to spoil. Unfortunately, this does not prevent damage to the fruits when they are poured into the back of the truck. Even though the trucks are covered with a tarpaulin to ensure the fruits do not come in contact with water, this helps to increase the internal temperature when the weather is warmer. In the dry season, the oranges are packaged in bags first before transportation. This is to prevent the fruits from drying up, as the weather is cool and dry so the oranges lose water quickly. In trucks, the bags are stacked on top of each other and fruits at the bottom usually get crushed because of compression. At the same time, dense packing increases the internal temperature of the sack, promoting spoilage. Once one fruit goes bad the other fruits in contact with it spoil within a few days due to microbial deterioration. As a result of these problems, respondents identified the impact of poor postharvest handling in relation to the weather as a significant cause of losses. One middleman that incurred losses due to weather variations stated:

> "*My wife carried a full gongoro [type of truck] of oranges to Kano, she lost everything including her transport…[because of] the Harmattan and there were too many oranges in the market. This season they were selling a bag for N1000 ($5). If the bag is N1600 ($8) there it was sold for N1000 ($5) and did not cover the transport fare for a bag – it was a loss*" (Charles, farmer and middleman).



Figure 2.3 Arrangement of oranges in vehicle for transportation
The interior of a J5 with bags of oranges arranged for transportation in Ushongo LGA, Benue State. Author's photograph. 22nd January 2015.



Figure 2.4 Trailer load of oranges
This trailer was transporting oranges from Vandeikya LGA, Benue State to Sokoto. Author's photograph. 6th December 2014.

The traders identified weather as a more serious problem than the middlemen because they had to preserve their oranges in the markets for a longer period of time. This is because they sell their fruits in open markets so preservation was difficult. In order to preserve the oranges in the dry season they are left in sacks and covered with extra sacks or plastic bags/tarpaulin to ensure that they do not lose water and dry up (see figure 2.5). In the rainy season, the fruits have to be cleaned properly and spread on a sack to allow ventilation and then covered with another sack so that that water does not touch them. Some of the traders said their fruits could last up to two weeks during the Harmattan (desert winds and dust storms emanating from the Sahara) if they covered them properly. The arrangement of oranges in buckets, basins or baskets for sale allowed the generation of heat at the bottom to increase the level of losses experienced in markets. The condensation at the bottom of the heap encourages the growth of mould on the fruits (Kereth *et al.*, 2013).



Figure 2.5 Storage of oranges by roadside traders
Roadside traders use tarpaulin to cover their bags of oranges to protect them from weather elements in Gboko LGA, Benue State. Author's photograph. 4th December 2014.

Poor handling of fruits can cause them to split open, as well as create superficial and internal wounds or crushing (Kereth *et al.*, 2013). The traders discarded a lot of their oranges daily as part of a process of sorting the good from the bad. If the bad oranges were left in the mix they would contaminate all the oranges they were in contact with in a few days. The discarded oranges were usually thrown away behind their stalls. Some of the roadside traders had dug pits behind their trading stations for disposal (see figure 2.6). In Railway market there was a communal skip that was regularly emptied. Traders paid N100 ($0.5) tax for every bag of oranges brought to the market. This tax was used by the directors of the market to ensure the bin was emptied regularly. In Wurukum market, the bin was far from the fruit market so young boys with wheelbarrows transported bags of damaged fruits to the skip for N100 ($0.5). One market trader mentioned selling her bad fruits at lower prices (N50/$0.25) to individuals who wanted to feed their cows. The prices were much lower but to her it was better to get a low price than nothing. Middlemen and

traders regarded the sale of fruits at lower prices as a loss because it reduced their level of income, thus impacting their livelihoods negatively.

Due to poor postharvest handling by farmers and during transportation, most of the oranges with the traders spoil quickly due to microbial damage. This is triggered by the harvesting methods employed by farmers (Ugoh *et al*., 2017c)**.** The nature of packaging materials, the condition of the roads and distance to market contribute to the level of losses experienced by traders (Debela *et al.*, 2011).



Figure 2.6 Disposal of rotten fruits
A pit behind the selling station of roadside traders for orange waste in Gboko LGA, Benue State. Author's photograph. 4th December 2014.

2.3.3.2 Transportation

Oranges were transported outside Benue because the demand was reasonably high but in line with Adebamji's (2011) findings, the time fruits spent before transportation and in the market before sales were found to be a very important factor in the level of losses incurred. Sometimes when the middlemen approached farmers, it transpired that they did not have

vehicles for transportation. They would harvest the oranges, package them and transport to the roadside of major highways, then wait for empty trucks to be driving by so they could negotiate with the driver (see figure 2.7). This wait for vehicles could take anything from two days to two weeks and 58% of middlemen said it was a cause of losses. This was because occasionally, before the arrival of the vehicles, a good number of the fruits would go bad.



Figure 2.7 Packaged oranges waiting to be transported
Konshisha LGA, Benue State. Author's photograph. 23rd January 2015.

To prevent such problems, one of the middlemen interviewed (Sony) stated that he always rented a truck before purchasing fruits. He did this to ensure that he got the fruits to Teragro early while they were still in a good condition. Another middleman (Emmanuel), by contrast, opted to work with a group of people called 'charter men'. They were intermediaries between middlemen and truck owners, so if Emmanuel

needed to transport oranges he would contact the charter men and pay them for providing a vehicle.

The destination of the middlemen was usually not certain. It depended on whether they had received messages from their traders in particular markets or where they felt higher prices would be received. This echoes research by Idah *et al.* (2007) who noted how market forces usually determined the markets the middlemen ended up in. The middlemen located in this study transported oranges to seventeen states excluding the capital of Benue – Makurdi. More oranges were transported to the northern part of the country (11 states, see figure 2.8) and considerably less to the southern and southwestern states (6 states). This is because most of the middlemen said the northern states wanted more fruits and considered them as 'preferred markets'. Not all of the middlemen interviewed mentioned 'preferred' markets, however, because they considered the 'market' unstable and preferred to respond flexibly to market price differentials.

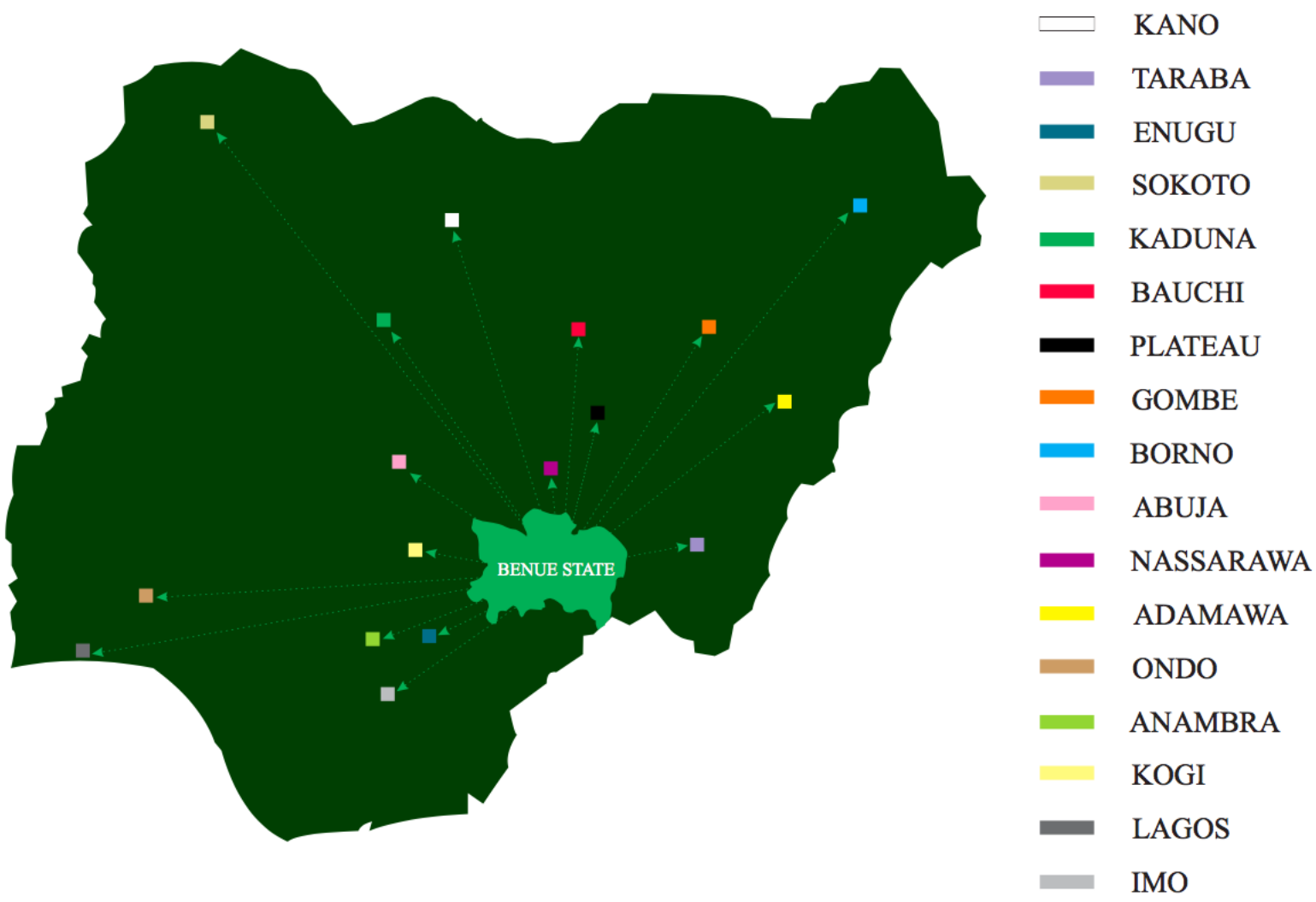


Figure 2.8 Map showing the destination of oranges

The actual transportation of fruits was solely dependent on the availability of vehicles and transportation costs varied with the size of the vehicle (which was distinguished by the number of tyres the vehicle had) and the distance from Benue State. Most respondents noted that they preferred trucks with wooden sides as opposed to metal. This is because if trucks with metal sides are used, the hot climate can cause the metal to heat up during transportation and when it comes in contact with the fruits they deteriorate at a faster rate.

Table 2.2 shows the major types of vehicles used and the associated costs of hiring them. The high cost of transportation is a well-known problem in Nigeria for middlemen and traders (Mamfimisebi and Okunmadewa, 2006, Idah *et al.*, 2007, Adebamji, 2011). The traders interviewed for this study noted that they often worked in groups as this made it easier to hire a vehicle and reduce the cost of transportation. Those who travelled into the villages highlighted the waiting time for vehicles as well as the associated transportation costs as key problems associated with this form of trade.

Table 2.2 Types of vehicles against cost*

Type of vehicle	**No of bags**	**Destination**	**Cost of vehicle**
J5	21	Kaduna Kano	N25,200/ $127 N29,400/ $1148
Packer	70	Kano	N105000/ $527
911	120	Makurdi Lagos	N60,000/ $301 N220,000/ $1106
10 tyres	160/180		N200,000/ $1005
12 tyres	250/270	Abuja Kano	N250,000 / $1256 N270,000 /$1357
Trailer	260/300		N300,000 / $1508

*Based on data collected in November and December 2015 in Benue State

Transit time was dependent on the condition of the roads, distance, the physical state of the vehicle, how many bags it contained, and the number of tax checkpoints encountered. From some LGAs (Ushongo) to Makurdi respondents noted that the typical transport time was on average five hours. Respondents that travelled as far as Sokoto (extreme Northwest of the country) stated that it could take about four days. These times are dependent on having a well-maintained vehicle and absolutely no problems but respondents emphasised that there was no certainty of getting a good truck. Their observations strongly support findings from a study by Idah *et al.* (2007) which revealed that the average number of days spent in transit were four to five days and this was not convenient for the fruits because of the way they were packaged and the conditions in which they were transported.

2.3.3.3 Transportation problems

According to Adebamji (2011) transportation losses were the most significant losses experienced by farmers in Osun State as they transported their fruits to other markets and states and had a significant impact on the total revenue of farmers. This is apparent in Benue where it is common to see trucks parked by the roadside filled with food crops that are yet to arrive their destinations. 37% of the middlemen interviewed for this study identified the breakdown of vehicles during the transportation of citrus fruits as a regular occurrence and one of the most significant causes of lost income (see figure 2.9). These losses occur not only because middlemen have to wait for broken down vehicles to get repaired, but also because of the perishable nature of the fruits and the manner in which they are packaged means that most of them rot in the process of waiting under the sun or rain. If the vehicle is repaired, middlemen usually have to sell the fruits at lower prices because of the delay. Taye a roadside trader and middleman said:

> *"Last week on my way to Kano I lost all my oranges because the car I used went bad for 4 days – they all got bad. I had a 911 truck worth N300,000 ($1508). If a car doesn't come in time you can't re-bag so it is a loss. Even if you want to re-bag they*

will not be complete because some will be bad and it is not the original amount you started with".

The mode of transportation was a significant contributor to losses because the roads are in poor conditions -not fully tarred and with potholes, forcing the fruits to smash against each other in transit. When the trucks are overweight (for example if a 911 truck has more than 120 bags) there is a greater risk of it overturning at a sharp bend, failing to climb a steep hill or having an accident; especially when the vehicle is old and poorly maintained (see figure 2.10). Inappropriate packaging materials and the damage caused by poorly maintained vehicles travelling on rough roads are key causes of losses during the transportation of fruits although the losses to citrus fruit tend to be less than those incurred by more perishable products such as tomatoes (Idah *et al.*, 2007, Mehmood *et al.*, 2011).



Figure 2.9 Vehicle with mechanical problems
Lafia, Nassarawa State. Author's photograph. 25th January 2015.



Figure 2.10 An accident along Lafia–Akwanga highway.
The driver and middlemen were badly injured. When I passed this route two weeks later the vehicle and oranges had not been moved. Author's photograph. 25th January 2015.

Another main problem during transportation are the expenses middlemen incurred which were identified by 32% of respondents as a major cause of losses. These losses stemmed from the fact that middlemen had to pay produce tax, LGA tax, quality control and also policemen at various checkpoints. The amount paid for tax at every payment station was at the discretion of whoever was at the station at the time and this was also the same with the security personnel. Middlemen narrated experiences of truck drivers with empty vehicles refusing to transport their produce because of these expenses. One respondent said that on his trip from Benue to Enugu State he needed to budget N37,000 ($186) for expenses. Of the said amount N31,000 ($156) is tax from Benue State Government alone. The usual system during journeys to market is for the middlemen to pay produce tax while the drivers pay the policemen. One of the middlemen narrated a story of a trip he embarked on where the driver was expecting to make a profit of N12,000 ($60). By the time they got to their destination the driver had spent the N12,000 on illicit expenses. He observed that for this reason, truck drivers do not want to transport oranges to other states in the country unless they can charge a lot more for transportation. The middlemen and drivers were displeased with the taxes because they claimed the monies paid were not used to provide better infrastructure in the form of roads or processing facilities but rather given to politicians that did not care about the needs of the people.

With regard to transportation problems faced by traders, findings from the study area echo those of Adebamji (2011) in Osun State where traders tended to experience fewer problems with transportation than middlemen because selling points were located close to production centres. The roadside traders interviewed for the study were based in villages and were much closer to the areas where they purchased oranges from the farmers and so did not experience transportation losses. Most stated that they do not incur as many losses compared to the middlemen or traders that travel to other states. They went on to emphasise that the damage is usually done over a distance due to market saturation and the trucks breaking down and in such instances the physical quantity is much more

than the roadside traders sell. Nevertheless, the market traders from Makurdi that travelled to other LGAs to purchase fruits directly from the farmers claimed to experience the same sorts of transportation problems as the middlemen and also complained about the illicit expenses charged.

2.3.3.4 The market place

There were two kinds of traders encountered –market and roadside traders. The most common type of market in Benue is informal, traditional and disorganised, where there are a large number of traders (each with his own space) participating in the sale of different food crops. Informal trading of fruits is a good source of livelihood for the traders and also contributes to the development of the economy (Rolle, 2006, Aliber *et al.*, 2010). In the markets some traders had high tables and benches where they placed their basins of fruits and an umbrella that acted as a source of shade. Others had makeshift stalls with a wooden/zinc covering that provided good protection from rain and the sun. However, some of the women closer to the road had the oranges in baskets/buckets and basins and sat down on stools to make sales. There are no local fruit markets in the villages because the bulk of fruit production takes place in the villages and almost every home has an orange tree so people do not go to local markets to purchase fruits. The fruits were sold in markets in the past, but over time the practise stopped for unknown reasons. Even when fruits are out of season, they are usually sold by the roadside and not in village markets.

Out of the five market traders interviewed in Makurdi, three of them travelled into the villages to purchase their oranges. Two market traders purchased their fruits from middlemen when they came to the markets. One of the traders mentioned her husband was not supportive of her going into the villages to purchase oranges because he thought it was not safe and viewed such trips as too stressful and dangerous for her.

The roadside traders had wooden sheds above their stored oranges to protect them from the weather and to ensure they keep for longer periods of time (as seen in figure 2.5). Roadside traders only sold oranges in 5L

size 7 buckets and this could contain about 26 small, medium and big sized oranges. However, the oranges for immediate sales were in buckets and much closer to the highway, which offered no protection from the weather.

All the roadside traders purchased their fruits from farmers in the villages close to their trading stations. The traders who travelled to the farms bought the fruits from farmers at different prices – depending on how far they travelled and their negotiation with the farmer. On farm citrus prices were dependent on variety and cost between N500 –N3500 ($2.5 -$17.5) peak season and N4000 – N6000 ($20 - $30) off peak. The market traders were able to sell their fruits in bags, basins, baskets and buckets whereas the roadside traders only sold in buckets. Bags of oranges in the peak period can be sold for N2500 – N4500 ($13 - $23) depending on the variety and N9000 – N10,000 ($45 - $50) in the off peak period. In peak season the price of a bucket was an average of N200 ($1) and in the off peak season it was N250 ($1.3). The basin was an average of N1500 ($8).



Figure 2.11 Roadside traders selling stations in Gwer East LGA.
Author's photograph. 18th January 2015.



Figure 2.12 Market trader's station
Makurdi LGA, Benue State. Author's photograph. 15th February 2015.

2.3.3.5 Market saturation

The fruits brought into markets by the middlemen were not always purchased because the markets became saturated. The middlemen usually have traders they sell their fruits to in various markets and when they needed fruits they called their middlemen to supply oranges. As a result, in the peak season the influx of fruits to the markets got them saturated and this led to losses. Market saturation was referred to as a cause of losses (63%) for middlemen. Some of the middlemen narrated their experiences:

> "*Sometimes the oranges go dry because there is no one to buy, some go dry without anybody pricing them, sometimes you run away from the market because there is no money to pay the driver, and the people who own the market will ask you to pay for them to pack the oranges and throw away*" (Sam, middleman)

> "*Sometimes you don't sell all, you dump it on the ground and turn back because what will you bring it back and do? Sometimes you will not sell it to even pay for the transportation. Sometimes the owner of the vehicle will be disturbing you…you look for a way to dump everything there and escape*" (Charles, middleman and farmer).

Due to the saturation of markets the prices of fruits in the markets were low. The level of sales, demand and the amount of oranges available in the market determined the price. The seasonal glut of fruits causes their prices to reduce (Clarke *et al.*, 2011). Middlemen had to accept the prices offered by traders because there was no other option, "*I was paid N300 ($2) in Yola and left about 20 bags there - sometimes we sell at N50 (0.25) and the rest get spoilt*".

The amount of fruits the traders sold in a week was dependent on the level of patronage. During the festivities – notably the Easter and Christmas holidays - they had many customers, especially the roadside traders that were patronized by the travellers travelling through Benue State. Most of the travellers stopped in Benue because it is known for fruits: as one of the traders said, "*Benue has the sweetest oranges*". There were times when they purchased up to four 50kg bags of oranges twice a week and were able to sell most of them. At other times they would purchase two 50kg bags of oranges once a week because of low patronage.

Kereth *et al.* (2013) discovered that in Tanzania, 75% of marketers sold most of their fruits after three days. The longer the fruits stayed in the markets the lower their value due to external factors like rain, dust and sunlight (ibid.). This was same for the traders in Benue; 55% of them said they incurred losses due to the lack of sales. Therefore, the longer the fruits stayed the quicker they physically deteriorated and got rotten. The traders complained about keeping their fruits for four to five days without significant sales. Over time the fruits get overripe and cannot be sold so are disposed of. The traders experienced a lack of sales during the seasonal glut because there were too many fruits in the market. Also for the roadside traders the level of patronage reduced after the festivities.

Experiences narrated by middlemen and traders revealed frustration with the absence of processing facilities for citrus. There was a sense of neglect looming across Benue, especially neglect by the State government. The actors felt it was a right for Benue to have processing facilities but the lack of an alternate market for fruits increased the losses incurred. Only one

middleman identified supplied to Teragro during data collection, some had not heard of them and the others suggested that they were better off supplying to other states than Teragro. This was because the method of measuring oranges and payment differed between farmers and Teragro. As a result the middlemen and traders who had supplied to them previously suggested that it was more lucrative to sell to traders or consumers than Teragro. The actors claimed consumers, middlemen and traders from other states cheated them because the state was not able to maximise its potential. They asserted that the prices they received for oranges would be high if there were factories. They also pointed out that they would not have to take fruits to other states and beg traders to purchase; instead other states will run to Benue. One of the market traders said:

> "*The thing that pains us is that we don't have a company, if we had a company here you can carry what you have on ground and rush to the company to sell it quickly. Someone won't buy what is already going bad, but a company can buy it and use it for some other thing. But now once it spoils your money is gone…that is the problem we have*".

The losses experienced by middlemen and traders negatively affected their livelihoods, as they were all involved in citrus production to earn a living. When they experienced losses they lost the capital that was invested in hiring the vehicles used for transportation, the purchase of the bags and payment to farmers for the fruits. When they were involved in accidents or experienced market saturation, the capital invested was not recovered. For example, if a middleman paid N25,200 ($126) to hire a J5 vehicle to transport 21 bags of oranges (N21,000/$105) from Benue to Kaduna and an accident occurred, he/she loses their entire capital of N46,200 ($232). This is because the oranges and vehicle are paid for before transportation and most often than not, it is not possible to recover the oranges and get another vehicle to get to their destination. This loss had a negative impact on their livelihoods. Some of the middlemen recounted experiences of borrowing money from family and friends to come back home after experiencing heavy losses. According to Taver:

"Sometimes the traders [in destination markets] will force you to pack the oranges and clear the place to the extent that you won't have transport money to come back, so you call home and they will send you money to return".

These experiences had direct impacts on their income levels and their ability to attend to household needs. Some of the middlemen lamented:

"The market is hard. We are still in it because it's based on luck. When you get market you get a lot of money. When you lose, you lose all your money. Sometimes you use the last money in your house and get nothing. Then you start running up and down looking for house money" (Tony, middleman).

"You will just take it like that - your money has been thrown away. Sometimes we borrow and lose, you lose all your capital and you have nothing. When you lose you borrow again because you have to pay and take care of your family and pay school fees. So you go into debt chasing your money" (Samuel, middleman).

The losses experienced by middlemen are not usually taken into consideration because of the ways they exploit farmers. However, it should be noted that they play a critical role in connecting consumers with commodities and also invest in the process; therefore the losses they experience are no less important than losses experienced by traders and farmers. Ultimately, the losses are a waste of the resources involved in the production and transportation of the fruits. The traders clearly stated that they had benefitted from the sales of fruits but if they were able to sell all their produce that will increase their income levels and subsequently standards of living.

2.4 Conclusion

Postharvest losses in low-income countries have become an international priority because of the need to improve the livelihoods of small-scale farmers and concerns over food security and poverty alleviation. As a result, postharvest scholarship is on the increase in low-income countries. However, there is a lack of research on various crop supply chains in different geographical regions. Available research has focused on the farm with limited studies looking at losses beyond the farm gate. Results from this study corroborate findings from Kereth *et al.* (2013) and Mashau *et al.*

(2012) in Tanzania and South Africa respectively and draw similar conclusions. The causes of losses in low-income countries are comparable but the socio-economic factors impacting losses will vary by country and region. This reveals an obligation to understand the causes of losses and the factors that influence them in different countries.

The underdevelopment of the citrus value chain in Nigeria is a result of the lack of local processing, exports and the absence of political willpower in the form of policies, factories and commitment to the management of food crops after they have left the farm gate. The transportation and marketing of fruits is an integral part of the value chain. However, major losses are incurred that affect the level of income of middlemen and traders. These losses were not quantified because the actors had no records of how much was disposed or not sold. PHL meant different things to actors but were mainly viewed in economic terms; the inability to make sales, the lowered prices received or the physical loss of the fruits.

Adopting the commodity chain analysis framework to study postharvest losses allows commodities to be followed beyond the farm gate. It captures the trajectory of the commodity from farm to fork to explore the factors that lead to losses and the identification of hotspots. It also highlights the socioeconomic and political factors that impact these losses. More research is required in this respect, to capture various geographical spaces, the wide array of crops and their associated factors. There is low investment in the agricultural sector in Nigeria, especially in the form of research and development. The lack of adequate agricultural data is a major barrier to the management of postharvest losses. Research on postharvest losses along different value chains specifically fruits and vegetables is lacking. It is important that food produced reaches the consumer in good quality.

The dependence of farmers on middlemen to purchase their fruits increases the power they have to dictate farm gate prices. However, the middlemen play a vital role in transporting fruits to market. The middlemen and traders echoed the need for processing facilities over and

over again. It is important that the government creates an enabling environment for businesses to thrive and for development to take place. There is also a need for the private sector to implement projects that manage postharvest losses while being supported by the government. Most of the production takes place in rural areas – an agribusiness development strategy has to be employed with small-scale farmers and the other actors that influence all areas of their lives. There was a sense of hope amongst the actors during data collection for this study, because they felt that more attention would be drawn to their situation in a few years.

Publication 3: Tale of an Orange

3.0 Abstract

In this paper I explore the journey of an orange from farm to market. I aim to understand the underlying cultural and economic dynamics that influence citrus postharvest losses from the perspective of immediate actors. Sixty citrus farmers, nineteen intermediaries and eleven traders were selected from nine Local Government Areas in Benue State. Data collected ranged from production figures to causes of postharvest losses and the impact of the losses on livelihood. The study revealed that the farmers produced approximately 25,460 50kg bags of sweet orange annually, which is less than one third of the estimated production based on the amount of citrus trees owned by the farmers. The farmers experienced no less than 10% losses as a result of improper postharvest handling, pests and diseases. More losses were incurred due to the lack of processing facilities. Citrus accounted for 60% of the income generated by farmers and 72% of these farmers relied on intermediaries for sales. The heavy reliance on intermediaries had negative impacts on the income of farmers because they had the power to dictate farm gate prices. Nevertheless, they played a vital role in ensuring that oranges made it to the market. All intermediaries and traders used polypropylene sacks to package their oranges for transportation. This alongside the transportation methods used increased the level of losses of fruits. All actors were involved in citrus production and marketing to earn an income and incurring losses had adverse impacts on their livelihoods.

Keywords: citrus; postharvest losses; Benue; livelihood; Nigeria

3.1 Introduction

Citrus is the most important fruit crop based on value in international trade (UNCTAD, 2013). Global citrus production has increased significantly in the last decades mainly as a result of its sweetness and flavour, consumer preferences for more healthy food options, rising income, economic affordability and larger cultivation areas (UNCTAD, 2013, Liu *et al.*, 2012). Sweet orange, as the name suggests, has a sweet

flavour making it suitable for fruit juice production and other by-products such as jam and marmalades (Okwu and Emenike, 2006). Nigeria produces 3.9 million metric tonnes of citrus annually making it the 9th highest producer of citrus in world (FAO, 2012).

The Nigerian horticultural industry is blooming with capabilities and opportunities. Horticulture adds to the coffers of rural inhabitants, it creates livelihoods for ordinary people and helps in bettering their health. However, the horticultural sector in Nigeria is underdeveloped. It is characterized by low adoption of technology, a lack of adequate storage and processing facilities and inadequate infrastructure, hampered by relatively low attention from the government (Ibeawuchi *et al.*, 2015). The benefits of improving the horticultural sector in Nigeria include the potential to reduce postharvest losses and improve the incomes and livelihood of the rural populace, creating broader economic advantages that surpass rural boundaries (Adeyemi and Ogazi, 1983, Ibeawuchi *et al.*, 2015). Nigeria has placed more emphasis in terms of agricultural policies and expenditure on improving the production of food crops, with a neglect of processes after the farm gate. Furthermore the preservation of roots, tubers and grains is ranked higher in order of significance than that of fruits and vegetables (Ugoh *et al*., 2017b).

Despite the high level of citrus production in Nigeria, 30-50% is wasted due to postharvest losses (NIHORT, 2002, FMARD, 2014). Postharvest losses vary by crop type and location (Kader 2005). Postharvest loss management suffers from the lack of adequate data on the estimates and causes of losses along different value chains. Available research is limited and generalised across value chains (Parfitt *et al.*, 2010, Affognon *et al.*, 2015). Research on fruits and vegetables is scarce, accessible information is fragmented and concentrated on the farm (Affognon *et al.*, 2015). The importance of studying specific crop chains is to identify the impact of cultural, political and socio-economic factors on losses within different geographical locations (Ugoh *et al*., 2017a). As a result of the lack of

adequate available research, there is limited room for the provision of relevant, applicable solutions.

The level of citrus losses in Nigeria when compared with the importation of concentrates for local fruit juice production is alarming. Nigeria imports 95% of its concentrates from South Africa, the European Union and South America. This amount to 1 billion Naira (200 million USD) annually (FMARD, 2015). There is a lack of small or large scale citrus processing in Nigeria; therefore there is a significant reliance on direct consumption which has been revealed as the major cause of losses (Ugoh *et al*., 2017c). The consumption of fruit juice is increasing by 10% every year, reaching 550 million litres in 2012 (FMARD, 2015). The Federal Government in 2012 banned the importation of packaged fruits to reinforce processing of fruits in Nigeria. Although there has been an increase in local production of fruit juice, the importation of concentrates has not solved the problem of seasonal gluts and postharvest losses in Nigeria (Olife *et al.*, 2015). LaGra (1990) suggests that governments will not invest in the reduction of postharvest losses unless there is valuable economic gain from its reduction. There is a call for sensitization and advocacy in Nigeria, so the Nigerian populace is aware of high levels of citrus production and losses and the need for investment by the public and private sector (Agbo, 2014).

There is a paucity of postharvest research on citrus losses in Nigeria. Most of the available studies are on the health benefits of citrus, economic benefits of fertilizer application, pests, diseases, and the use of orange peels amongst others (Umeh *et al.*, 2004, Ezeibekwe, 2011, Ibe *et al.*, 2011, Ezejiofor *et al.*, 2011, Bamise and Oziegbe, 2013, Etebu and Nwauzoma, 2014). On postharvest losses, research along the entire value chain has not been undertaken. However, sections of the value chain have been studied. Ekefan *et al.* (2004) and Idah *et al.* (2007) identified poor postharvest handling and packaging materials as a cause of losses during transportation and in local markets. Transportation costs are very high and the losses experienced when citrus fruits are transported to different states results in the highest losses incurred along the chain (Adebamji,

2011). Olife *et al.* (2015) examined the citrus value chain in Nigeria pointing out the need for value addition to reduce the level of losses. This paper explores the journey of an orange from farm to market to identify the causes of losses, hotspots and the intertwined factors that drive postharvest losses.

3.2 Materials and Methods

In Nigeria, Benue State produces the most citrus, estimated at 1 million MT annually (Okigbo, 2012). Nigeria has one concentrate processing facility, Teragro, located in Benue State, that started production in 2012; it has the capacity to process 26,000MT of fruits annually (Teragro, 2016).

Data for this paper were collected from October 2014 – March 2015 in Benue State. Benue has twenty-three LGAs; seventeen of which produce citrus in large quantities. Purposive multistage sampling was employed to locate sixty citrus farmers in eight LGAs (Konshisha, Vandeikya, Ushongo, Gboko, Buruku, Gwer West, Oju and Otukpo). Middlemen were selected from major highways connecting LGAs. There are two types of traders – roadside and market traders. Traders were purposively selected from markets and roadside selling stations in the above LGAs and the state capital, Makurdi. In-depth interviews were carried out with farmers and individual traders, and group discussions were carried out with middlemen and traders. Information sought was on the level of production, causes of postharvest losses, level of patronage, cost price and selling price of oranges.

3.3 Results and Discussion

3.3.1 Respondents' profile

The gender profile of respondents (as seen in table 3.1) revealed major differences in the role of women in agricultural activities in Nigeria. Women were found to be associated with off-farm agricultural activities like processing, preservation and retailing (Ugoh *et al*., 2017b). They also worked on the farms, but the study revealed that the men owned the farms, and so when houses were approached that did not have a man

present, the women were unable to provide the required information (Ugoh *et al*., 2017c). The wholesale sector is male dominated because of the nature of the job; it involves sourcing for vehicles and transporting fruits over long distances. The study noted that men were not comfortable with their wives acting as middlemen and preferred them trading in the market (Ugoh *et al*., 2017b).

Table 3.1 Respondents' profile

	Male	**Female**
Farmers	97%	3%
Intermediaries	90%	10%
Traders	7%	93%

Source: Authors analysis

3.3.2 The cost of fertilizer and pesticides

Ibe *et al.* (2011) revealed the importance of applying fertilizer regularly to citrus trees for improved yield. The use of improved machinery, seeds and fertilizers increase agricultural growth that positively improves the income of farmers. However in Nigeria, the adoption of technology and improved varieties has been relatively slow, and the high cost of fertilizers makes it hard for farmers to afford them. This has resulted in farmers supplementing chemical fertilizers with organic fertilizer (ibid.).

The cost of production was a major challenge for all the farmers because of the increasing cost of pesticides and fertilizers. 93% of farmers used fertilizers regularly while 7% did not because of their cost; however only 48% apply fertilizer to their citrus trees. This is because fertilizers are expensive and culturally they feel it is more important to use the fertilizers on other cash crops like groundnuts or crops consumed at home e.g. yams. Farmers purchased fertilizer that was available and could be used for all their crops. The most common fertilizers used were NPK (15:15:15, 20:10:10, 27:13:13), SSP, Super grow and Urea. There was a scarcity of Urea in Nigerian markets during the data collection but the farmers readily had access to NPK 15:15:15 and 20:10:10 with the average price of

a 50kg bag being N7000 ($35). Farmers combined chemical fertilizers with organic fertilizer like poultry manure, rice waste, waste from a carpenter's workshop and kitchen waste so they could have enough for their crops and to reduce the amount spent on fertilizer. Some farmers managed the cost of fertilizer by practicing alternate buying; they would purchase fertilizers this year and not purchase the following year.

The major pesticides used by the farmers are Best Action, Action 40, and Perfect Killer (the active ingredients are Cypermethrin, Dimenethoate and Chlorpyrifos, imported from Germany, India and China) with prices ranging from N850-N2700 ($4-$14) per bottle. The inability of farmers to use pesticides and fertilizers regularly had impacts on their level of production. The farmers in this study were not producing as much as they should and the irregular use of pesticides and herbicides had negative consequences for total yield, especially because the farmers complained bitterly of the impacts pests and diseases had on their fruits.

3.3.3 Citrus Value Chain

The citrus value chain in Nigeria (figure 3.1) is quite simple – consisting of four main actors: farmer, middleman, trader and consumer. Due to the lack of processing, direct consumption of fruits is relied on. The citrus value chain lacks preservation and processing. As a result of the fruits' perishable nature most of them were lost before purchase by consumers. Teragro produces concentrates that it supplied to Coca-Cola for the production of fruit juice (Teragro, 2016).

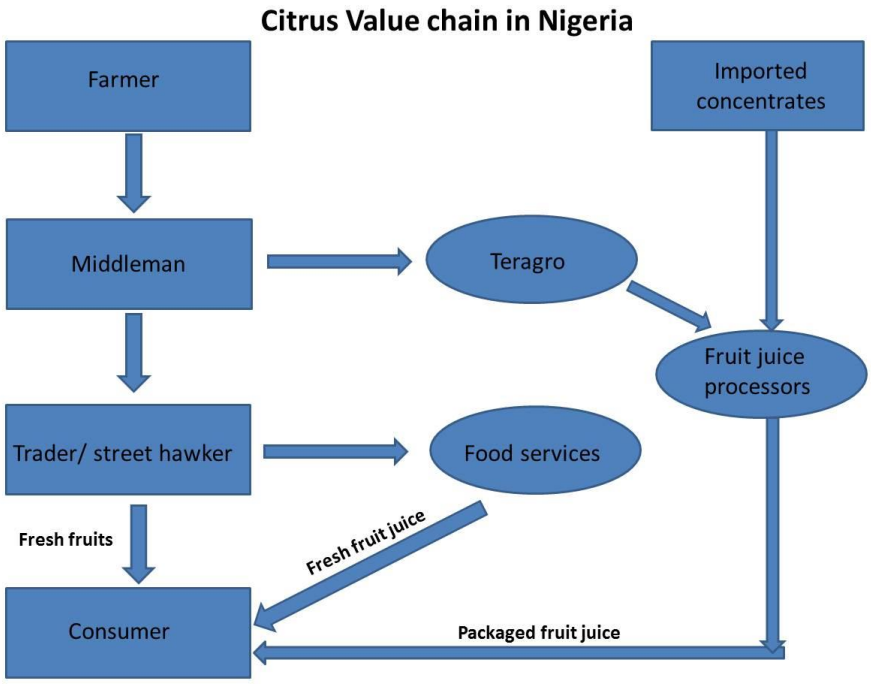


Figure 3.1 Citrus value chain in Nigeria.
Author's analysis.

There are different varieties of oranges produced in Nigeria. The farmers identified produced eight varieties: Ibadan sweet, Valencia, Washington navel, Tangelo, Tangerine, California, King and Agege sweet. Seven of the varieties are harvested between the months of October and March causing a seasonal glut from November to January. Ibadan sweet is the preferred variety because it can be harvested twice in a year, during the seasonal glut and off peak period, therefore it can be sold for higher prices when oranges are out of season (Ugoh *et al*., 2017c).

The farmers had a total of 45,949 citrus tree stands and were producing a total of 25,460 50kg bags of oranges; this figure is less than one third of the expected production from the amount of trees. This may reflect poor record keeping by farmers, which meant that many were unable to account for how much they produced and lost while some were not even aware of the number of trees they had. Also the irregularity of rainfall every year had an impact on the level of production. On average citrus production accounts for 60% of farmers' income. It was noted that in

Benue the farmers rarely go out of their farms to sell their oranges. Instead they wait for intermediaries to approach them for sales with 72% of the farmers in this study selling their fruits this way. This was because of the lack of funds to transport their fruits over long distances. In Benue, fruits are not sold in local markets, rather at the farm gate and along major highways connecting LGAs. During harvest periods, middlemen from different parts of the country travelled to Benue State to locate farmers and purchase fruits. This reliance gave them the power to dictate farm gate prices (Ugoh *et al*., 2017c). Middlemen play an important role in Nigeria in transferring fruits to market; with farmers relying on them for sales they were able to exploit farmers by purchasing the oranges at relatively low prices. However low the prices were, most times farmers were able to sell their fruits rather than leaving them on the trees (Ugoh *et al*., 2017b). The power middlemen have over farmers gives them an exploitative outlook, although they are key components of the value chain (Mitchell, 2011).

The middlemen purchased fruits based on the amount of funds they had available to hire a vehicle for transportation. Sometimes they would wait for their contacts in different markets to request fruits, or if they needed money for household needs they would embark on a journey to deliver oranges. The middlemen identified transported fruits to seventeen different states in Nigeria – eleven of them in the northern part of the country. The northern states were preferred by middlemen because of their distance from Benue and their large market for fruits. The traders purchased fruits based on patronage. Ugoh *et al.* (2016b) revealed that the level of patronage for traders was relative. During the festive seasons they experienced periods of higher sales, especially the roadside traders that benefitted from travellers passing through Benue State. Sometimes the influx of oranges into markets caused them to be saturated and the level of sales was very low. At such times they experienced high levels of losses because of the absence of infrastructure to store the fruits for long periods of time.

The middlemen and traders were unable to estimate their annual income because the level of sales varied and they kept no records of how many bags they purchased and sold. They however, noted the lucrativeness of the business and were determined not to stop selling oranges because no matter how bad the market was, they were able to feed their families and fend for themselves.

Table 3.2 Average prices of fruits during the seasonal glut

	Price (per bag)	**Revenue (per bag)**	**Associated expenses**
Farmer Selling price	N500	N500	Fertilizer (N7000 per bag) Pesticides (N850-N2700 per bottle) Labour
Intermediaries Cost price Selling price	N500 N2500	N2000	Harvesting activities (N400 per bag) Packaging (N100 per bag) Transportation (N25,000–N300,000)[1] Tax (N37,000)
Dealers Cost price Selling price	N2500 N3000	N500	
Traders* Cost price Selling price	N3000 N4500	N1500	Harvesting activities Packaging Transportation (N25,200 – N29,400) Tax

*Data collected from November 2014 – January 2015 in Benue State.

*Some traders purchased their fruits from middlemen in markets and so did not have associated expenses

[1] The price of transportation depends on the destination of the intermediaries

Table 3.3 Average price of fruits during off-peak season

	Price (per bag)	**Revenue (per bag)**	**Associated expenses[2]**
Farmer Selling price	 N5000	 N5000	Fertilizer Pesticides Labour
Intermediaries Cost price Selling price	 N5000 N8500	 N3500	Harvesting activities Packaging Transportation Tax
Dealers Cost price Selling price	 N8500 N9000	 N500	
Trader * Cost Price Selling price	 N9000 N10,000	 N1000	Harvesting activities Packaging Transportation Tax

*Data collected in June and July 2015

*Some traders purchased their fruits from middlemen in markets and so did not have associated expenses

[2] The prices in table 8.2 apply in the off peak season.

Tables 3.2 and 3.3 provide the average price of fruits during the peak and off peak season per bag. During the seasonal glut oranges prices on farms could fall to N200 ($1). When farmers received such prices they were unable to purchase inputs like fertilizers and pesticides; this reduced their production levels. In markets, prices per bag may reduce to as low as N50 ($0.25) due to market saturation and middlemen are unable to sell their fruits to cover their transportation expenses: "*one time I used N300,000 to go to Gombe. I got N15,000 at the end of the sales to come back, some didn't get more to come back*". There are similar stories amongst the middlemen, who seem to suffer significant losses because they transport their oranges over great distances. The traders identified in Makurdi, occasionally travelled to villages purchase their fruits directly from the farmers. Others

purchased their fruits from middlemen. The roadside traders in the villages always travelled into interior villages to purchase their fruits.

Intermediaries reported that in some markets in different states, there are a group of people known as 'dealers' who act as middlemen and control the affairs in such markets. In the sense that they collect all the oranges brought into the market and sell them to the traders. The dealers add a fee of N500 to the bags of oranges before selling them to the traders. In other markets middlemen are able to transact with traders directly, here, the traders decide the price at which fruits are purchased from the middlemen. The power of negotiation lies with the middlemen at the farm and the trader/dealer in the markets. The farmer is however at the receiving end of all negotiations.

3.3.4 Causes of Postharvest Losses

3.3.4.1 Lack of markets

This was described as the major cause of losses because there are no processing facilities. The farmers rely on middlemen for sales and middlemen rely on consumers wanting to consume a fruit. For this reason, reliance on direct consumption by consumers results in saturated markets during seasonal gluts. There is no small-scale processing by individuals. Some food services however, produce fresh fruit juice for consumers, but in Benue just five such services were identified and their level of production was low – from 10 to 30 75cl bottles per day.

3.3.4.2 Transportation problems

Accidents were a main reason for 100% losses, because in most situations middlemen were unable to transport the fruits to their destination. The trucks available for transportation are usually old and worn out and so prone to breaking down during transportation. The cost of transportation was identified to be expensive and this depended on the destination of the middlemen and the size of the truck. Average prices for transportation ranged from N25,000 – N300,000 to transport 21 and 300 bags of oranges respectively (Ugoh *et al*., 2017b).

3.3.4.3 Postharvest handling

Harvesting techniques employed by farmers involved either shaking of trees, or the use of long sticks and hooks that damaged the fruits as they landed from the tree to floor. This increased their susceptibility to spoilage (Ugoh *et al*., 2017c). The oranges are packaged in polypropylene sacks that do not give the fruits room to breathe, thus due to the congestion in the sacks and trucks most of them suffer from mechanical damage, rotting and physical injuries (Idah *et al.*, 2007, Olayemi *et al.*, 2010, Kereth *et al.*, 2013). Therefore, when fruits get to market they are not in a good physical condition. Middlemen did not put in as much effort to preserve their fruits when compared to traders. The traders try to preserve the fruits by covering them with sacks so they do not dry up and to shield them from the weather. Due to the build-up of poor handling methods from the farms, the traders daily discarded bad fruits and kept no records of how much they disposed. (Ugoh *et al*., 2017b).

3.3.4.4 Pests and diseases

The fruit fly, fruit piercing moth, aphids and scales caused devastating effects on the oranges when they were still on the trees. Most of the fruits infected were not sold and resulted in losses (Ugoh *et al*., 2017c).

3.3.4.5 Socio-economic and political constraints

The lack of political willpower by the government was identified by all actors as the main cause of postharvest losses in Nigeria (Ugoh *et al*., 2017a). Evidence for this can be found in the lack of agricultural policies on horticulture, postharvest losses and low expenditure on agriculture in Nigeria. The lack of infrastructure in the form of poor feeder roads, absence of processing facilities and limited postharvest training influence losses. Due to the high costs of transportation, farmers and middlemen lacked the funds to hire vehicles to transport fruits to markets. Farmers' limited access to agricultural credit, market information, and training on improved production methods impact their agricultural practices. For instance farmers assumed that citrus trees did not require regular

fertilizer application. All these have negative impacts on levels of production and increase postharvest losses.

Postharvest losses are difficult to measure (Ibeawuchi *et al.*, 2015). The level of losses from farm to market is estimated to be between 10-100%. The farmers identified lost 10% of their fruits due to pests, diseases and poor postharvest handling, however when there were no sales, the losses incurred were much higher. The availability of a market was the determining factor in the amount of losses the farmers incurred and the same was noticed for middlemen and traders. The middlemen and traders were unable to provide estimates of their losses because no records were kept of what was sold and lost. However, losses for middlemen were as high as 100% in the case of accidents and also for farmers when no sales were made.

3.3.5 Impact of the Losses on Livelihoods

The respondents involved in citrus production and sales need to have a source of income, provide for their families and send their children to school. The income was used to purchase food items that they did not produce. Citrus production was referred to as a "*continuous farming project*" by some farmers because of the longevity of the trees, thus it was always going to be a source of income (Ugoh *et al.*, 2017c). Nevertheless, postharvest losses negatively affect the incomes of all actors in the value chain. The losses are viewed in economic terms – whether they were able to make sales at lower prices or no sales if the fruits are disposed. For the farmers, when they received low prices during the seasonal glut, they were unable to cover their costs of production and had to find ways to manage production of the fruits by using pesticides and fertilizers irregularly, which influenced their total yield. When farm maintenance (e.g. weeding) was reduced by farmers due to the lack of labour the farmers claimed their farms ended up producing fruits that were very hard and could not be sold or consumed.

The women identified in this study sold fruits to add to the income of their households. Some had lost their husbands and used the trade to take care

of their families. Others had started production to put themselves through school and went into the business full time. One of the roadside traders in particular was a graduate and had been unsuccessful in finding a job so decided to sell oranges while she waited for a white-collar job. The low prices of the fruits due to losses or the lack of a market kept the orange value chain actors in a vicious cycle of poverty. When farmers were not making an overall profit, their food security status was stagnant or declined because they were unable to purchase food crops that they did not produce. Ibeawuchi *et al.* (2015) identified the importance of horticultural production to women, it provided them with opportunities to enhance their social and economic status in the home and society and also increased household and nutrition security. The income realised from the sale of fruits was used for essential household needs.

3.4 Conclusion

The citrus value chain in Nigeria is lacking in processing and preservation. Citrus fruits are perishable and need to be preserved after harvest to improve their shelf life and ensure that they get to consumers in good condition. In Nigeria, the major causes of losses are lack of a market, improper transportation and packaging, poor postharvest handling, pests and diseases. The lack of political willpower to provide an enabling environment in the form of adequate processing facilities and infrastructure cannot be understated. With the level of losses Nigeria experiences and the amount of foreign exchange expended to purchase the concentrates of the same fruits wasted, it is apparent that there is a need to advocate for economic resources to be harnessed into creating an enabling environment for the preservation and processing of fruits in Nigeria.

Farming horticultural products is a risky practice for small-scale farmers especially when they are uncertain of markets (Tomlins *et al*., 2016). When value chain actors are unable to receive returns on their investment it has negative impacts on their families and households. The prices oranges are sold at are a very important component of the value chain.

This is because low prices discourage farmers from investing in improving production and intermediaries are not bothered about managing their fruits properly before they get to the consumer. The horticultural sector has a lot of industrial potential that needs to be exploited. The benefits will go a long way to improving the welfare of the rural populace. There is a need for more research and development along fruit crop value chains in Nigeria. A holistic, integrated approach needs to be adopted to manage postharvest losses. This should take into consideration socio-economic constraints that drive these losses.

Publication 4: Commodity chain analysis as an approach for studying postharvest losses

4.0 Abstract

There is renewed interest in the management of postharvest losses in low-income countries due to an increasing population, food security and the importance of increasing the income of small-scale farmers. However, applied research specific to crop value chains in different countries is scarce. In recent years, geographical studies have employed a 'follow the thing' framework to trace the movement of commodities from the global south to the north. This paper argues that 'follow the thing' can be adopted within countries and applied to the study of postharvest losses to explore commodities as a system. I review the agricultural sector in Nigeria and draw on empirical analysis that walked the citrus value chain in Nigeria to analyse 'higher level influences' that control the functionality of the market and influence postharvest losses. The paper concludes that the absence of political will power due to bad governance in the country is a major cause of losses because of the unavailability of processing facilities for citrus fruits.

Keywords: Benue; Nigeria; citrus; agriculture, political will power

4.1 Introduction

Rapid population growth, the spike in food prices in 2008 and 2011, food security, poverty eradication, increasing the livelihoods of small-scale farmers and efforts to promote more sustainable forms of agriculture have created renewed interest in the research and management of postharvest losses (PHL) (Rosegrant *et al.*, 2015). Global estimates of postharvest losses suggest 1.3 billion metric tonnes of food are lost yearly from farm to fork, amounting to 30-50% of global production (Gustavsson *et al.*, 2011). The African Development Bank estimates that the current level of postharvest losses experienced in Africa are equal to the caloric requirements of 48 million people (AfDB, 2016). In countries like Nigeria where proper research and data collection systems are lacking, there is limited data on the extent and causes of losses along various value chains.

The losses however are estimated to be worth about $9bn US dollars (Odiegwu, 2016).

Postharvest loss estimates are critiqued because published figures are reliant on generalised recycled datasets from previous decades, which are based on estimates by experts with a limited understanding of on ground realities, rather than actual measurements (LaGra, 1990, Parfitt *et al.*, 2010). Postharvest losses occur anywhere from farm to market as a result of the lack of adequate storage and processing infrastructure, poor postharvest handling, pests, diseases, lack of transportation facilities, poor research and development, climatic conditions, lack of a ready market/ poorly structured market chains/networks and inadequate policies to address these factors (Mrema and Rolle, 2002, Kader, 2005, Hodges *et al.*, 2010, Gustavsson *et al.*, 2011, Kitinoja and Kader, 2015). In addition, there is a wide variety of factors (social, political, environmental, biological, and economical), that affect various crop value chains within different geographies that are not taken into consideration in postharvest research (LaGra, 1990, Kader, 2005, Hodges *et al.*, 2010, Parfitt *et al.*, 2010, Gille, 2012, Kitinoja and Kader, 2015, Rosegrant *et al.*, 2015).

The high levels of postharvest losses have sparked a global movement by national and international organisations and governments to reduce and manage food that is produced in low-income countries. The history of PHL reduction can be traced back to 1975, when the United Nations expressed a desire to manage PHL and reduce losses by 50% in 1985 (FAO 1981). This led to the creation of the *Special Action Programme for the Prevention of Food Losses* that prompted widespread research and research related activities on postharvest losses in low-income countries (Grolleaud, 2000). In the early 1990s after the Special Action Programme for the Prevention of Food losses ended, the target set by the United Nations had not been achieved and till today its progress has not been ascertained (Affognon *et al.*, 2015). In accordance with renewed interests in postharvest losses, the African Union (AU) and United Nations (UN) have set new targets. The AU is targeting the reduction of PHL by half in 2025 while the UN proposes

reduction of PHL by half in 2030 (AUC, 2014, United Nations, 2015). These targets are critiqued for their lack of context, as with the 1975 resolution (Boxall *et al.*, 1979), and defined objectives that restrict the implementation of practical plans and solutions (Sheahan and Barrett, 2016). In addition, with the different deadlines 2025 and 2030, there is confusion over what time scale respected countries and institutions should work to.

In the history of postharvest research, studies have focused on storage with less emphasis on other aspects of the supply chain. Research on postharvest losses has failed to capture socioeconomic factors, dynamics and relationships beyond the operational stages of supply chains that influence losses (Spurgeon, 1976, Grolleaud, 2000, World Bank, 2011, Gille, 2012, Affognon *et al.*, 2015). Postharvest research has to go beyond the farm gate because that is where activities like sorting, grading, packaging, transportation and retail occur (Parfitt *et al.*, 2010, Affognon *et al.*, 2015). As a result, low-income countries, including Nigeria, have been home to various technology focused developmental agricultural projects at the farm gate level. Most of these directed solutions have not achieved the desired results because, for the most part, PHL related problems have not been understood in the geographical context of the receiving country (LaGra, 1990). Postharvest losses do not occur in a vacuum, they are influenced by social, economic, political and biological factors that vary with the crop and its geographical region (Grolleaud, 2000, Kader, 2005). A shift towards a more holistic value chain (market oriented) approach, by contrast, would facilitate understandings of "*the critical entry points for PHL reduction along the chain, the interactions between players within the chain, and the impact of the external environment*" (Zorya *et al.*, 2011:xiv), acknowledging the process, key technological, environmental, social, economic and cultural factors that impact different parts of the value chain. A report by Gustavsson *et al.* (2011) and meta-analysis by Affognon *et al.* (2015) revealed major gaps in postharvest research and available data, both concluding on the need for more applied research that is crop and region specific.

To provide a holistic approach to studying postharvest losses for a particular commodity within a geographical region, this paper draws on empirical research undertaken at different points along the citrus value chain in Nigeria. It explores the causes of citrus PHL that lie 'beyond the reach' of market actors; factors that shape the functionality of the citrus market system in Nigeria. The main focus of the paper is on the absence of political willpower by the Nigerian Government and the resulting consequences on the agricultural sector and postharvest losses. The rest of this section provides an overview and history of the Nigerian agricultural sector and the production and consumption of citrus in the country. Section 9.2 reviews agricultural policies in Nigeria to determine their role in the management of PHL. Section 9.3 focuses on commodity chains to highlight their importance as a methodological strategy for studying different elements of PHL. Drawing on this analysis, Section 9.4 sets out a market map of the citrus value chain in Nigeria, showing key stakeholders within the citrus community and highlighting a range of factors and services that contribute to Nigeria's significant citrus PHL. This review is limited by the absence of data on the horticultural sector in Nigeria with an emphasis on citrus and concentrates importation.

4.1.1 Nigeria's Agricultural Sector

In Nigeria, little progress has been made in PHL management as a result of the underdeveloped state of the agricultural sector (Flake and Nzeka, 2009). Despite its importance to Nigeria's economy, and the fact that it is the main occupation for about 70% of the population, the agricultural sector has dwindled since the 1960s when it accounted for over 60% of the country's GDP (Onwualu, 2012a). At that time agriculture was the main employer of labour, the key export industry (in 1960s and 1970s) and provided over half of domestic food supply (Abdu and Marshall, 1990). However, the discovery of crude oil in 1956 resulted in a shift towards petrochemicals and a consequent neglect of agriculture, leading to low agricultural production and a dependence on oil as the main source of national revenue (Obeta, 1990, Abila, 2014). In rural areas, agriculture

is still the dominant industry providing food and a means of livelihood for the populace (Onwualu, 2012a). Small-scale peasant farming dominates agriculture with the use of little or no technology. As a result, agriculture has been unable to meet the ever-increasing demand of the rising middle class or play a full role in national development. This has resulted in the importation of processed and semi-processed food and raw materials to bridge the demand and supply gap (Onwualu, 2012a).

In 2011, the Federal Government of Nigeria (GON) produced an Agricultural Transformation Agenda (ATA) committed to developing the value chain of food crops from 'farm to fork'. The focus on the value chain was perceived as an effective way to manage postharvest losses. At the same time, it was seen as a means to provide a source of employment, revenue and income to farmers and the general populace. The value chain is demand driven, so it provides a market that ensures farmers have a duty of responsibility to produce products that are of high quality and acceptable in the markets (Onwualu, 2012a). The government adopted this approach because results yielded by previous policies were unsatisfactory.

ATA emerged in response to Nigeria's excessive imports of products that could be produced nationally, the consequent marginalization of small-scale farmers and damage to the economy, pressure on the currency (Naira) and rising unemployment. ATA took a different approach to agriculture from previous policies in that it viewed agriculture as a business rather than a development project. It also emphasised an integrated approach from 'farm to fork', as well as the need to address food security. The downside to this approach was the focus on staple food crops (rice, cassava, sorghum, cotton, cocoa, maize, dairy, beef, poultry, oil palm and fisheries) that gave Nigeria a comparative competitive advantage in world markets (FMARD, 2011, Adesina, 2012) at the expense of other crops (especially fruit and vegetables) and the farmers who depended on them. In particular, ATA was concerned with the "*development of agricultural value chains…addressing reduction in*

postharvest losses…as well as access to financial services and markets" (FMARD, 2011:11). It also sought to address rural development by providing and improving infrastructure (ibid.). The focus on agriculture as a business sought to increase the incomes of smallholder farmers and rural entrepreneurs- traders, local processors and intermediaries- while the value chain approach attempted to encourage private investment into agriculture by the implementation of adequate policies (Agboma *et al*., 2013).

With this in mind, LaGra (1990) suggests that governments are less interested in managing postharvest losses of crops that do not add significant value to their economy especially in the form of foreign exchange. The relative importance of a crop to a country will therefore determine the level of attention it is given by agricultural policies and monies available for investment. Research and policies in Nigeria have focused on grains, cereals and legumes because of their importance in the daily diets of the populace (Atanda *et al.*, 2011). Much less attention has been paid to horticulture; and within horticulture there is a pronounced hierarchy with crops like tomatoes and peppers receiving priority for research and development. Other crops receive significantly less emphasis, despite their importance to the country as a whole. Citrus is a good example of this as it is a tree crop produced by small-scale farmers that has been identified as a profitable source of income because of the longevity of the trees. Citrus production plays a significant role in augmenting the income of small-scale farmers in Nigeria (Ugoh *et al*., 2017c).

4.1.2 Citrus Production and Fruit Juice Consumption in Nigeria

Nigeria produces about 3.9 million MT of citrus (FAO, 2012), providing 3% of global production (UNCTAD, 2013). Benue State, the food basket of the nation produces about 1 million MT of citrus annually (Okigbo, 2012). Nevertheless, Nigerian citrus is regarded as one of the crops most affected by PHL (FMARD, 2014). Flake and Nzeka (2009) estimate that 70% of all fruits are lost in Nigeria due to the lack of adequate infrastructure, with

losses for citrus estimated at 30% and 40-50% respectively by NIHORT (2002) and FMARD (2014). These discrepancies result from the lack of research on citrus PHL in Nigeria relative to other horticultural crops and particularly to staple crops.

Regarding fruit juice consumption more generally, Nigeria experiences a 10% increase yearly as a result of the rapidly growing middle class that understands the benefits of eating healthily and prefers fruit juice to carbonated drinks. In 2002, 90% of packaged fruit juice was imported and this amounted to 250 million USD. This was because of a lack of processing facilities to produce fruit juice domestically. This prompted a ban by the GON on packaged fruit juice; a reduction in the import tariff for concentrates from 10% to 5% and a 40% rebate on exported fruit juice products (Flake and Nzeka, 2009). The ban was designed to encourage local production of fruit juice and concentrates. From 2002 to 2007 the number of processing facilities increased from five to twelve. However, demand for fruit juice products could not be met by domestic production, causing a reliance on imported concentrates and premixes. At the same time, imported concentrates increased from 1.5 million kg to 30 million kg from 2002 to 2007, costing about 85 million USD. The major concentrates imported are oranges (40%), pineapple (25%), mixed fruit (20%), and apple (10%) from South Africa, European Union and South America (Flake and Nzeka, 2009). Even after fifteen years, the purpose of the ban has not been achieved; largely because of the neglect of fruit and vegetable production, the high level of PHL experienced along the value chain and a lack of domestic processing facilities. As a result, over 95% of concentrates used in Nigeria are imported costing over 1 billion USD while the consumption of fruit juice has increased from 200 million litres in 2002 to 550 million litres in 2012 (FMARD, 2015).

These figures reveal the importance of citrus in Nigeria and show that there is a great potential demand for processed citrus but it is not yet considered important by the Nigerian Government, so there is no investment and PHL are huge. There is an absence of processing facilities

in Nigeria and research on PHL has not begun to attend to perishables like citrus (Olife *et al.*, 2015).

4.2 Review of Agricultural Policies

Before the oil boom in the 1970s, agriculture and agricultural exports were the backbone of the Nigerian economy. Nigeria was a major exporter of cocoa, cotton, palm kernel, coffee, tea, groundnuts, soybeans and rubber (Lawrence *et al*., 2015). The dramatic shift to dependence on the oil sector caused sectoral changes to the Nigerian economy and marginalized agriculture. Agricultural exports fell from 97% to 4% between 1960 and 1980 while oil increased from 8% to 95% in the same period. From 1981 oil contributed about 70% of government revenue and there was a corresponding reduction in the production output of non oil tradeables, as well as a loss in employment shares (Oyejide, 1986). These changes brought about massive economic growth albeit with no social benefits to the masses (Abdu and Marshall, 1990). From the 1970s till now Nigeria's agricultural sector has suffered tremendous decline as a result of the oil boom and dependence on its contribution to economic growth (Oyejide, 1986, Azih, 2008). Consequently, Nigeria moved from being a self-sufficient country to a net importer that spends over 11 billion USD annually on food imports (Osagie, 2013), a situation that has negatively impacted national development (Abdu and Marshall, 1990, Lawrence, *et al*., 2015).

Decades of efforts to revamp the agricultural sector by the GON reflect an attempt to revive the non-oil profiting area of the country; encourage economic diversification and stop overdependence on oil (Oyejide, 1986, Azih, 2008, FMARD, 2016). This can be seen from the development of various agricultural and economic policies that have yielded a stagnant and declining agricultural sector complemented with excessive food imports (Osagie, 2013). According to Iwuchukwu and Igbokwe (2012) and Agber *et al.* (2013) the agricultural policies created over the years have differed in name but varied little in their goals and organisational content. Their key foci have been on national development, production of more

food, modernization of agriculture, self-sufficiency, food security, development of non-oil tradeables, a move away from over dependence on oil, export oriented agriculture, rural employment and improvement of welfare (Oyejide, 1986, Obeta, 1990, Azih, 2008). The policy measures proffered were twofold: one set focused on improving the farmers' environment through research and development, extension services and rural development. The other set related to the price of agricultural imports and exports, with a focus on "*domestic production of agricultural inputs*" (Oyejide, 1986:51).

The flaws of past policies and programmes have been explored at length in a range of studies that lie beyond the scope of this paper (Obeta, 1990, Abdu and Marshall, 1990, Okpanachi, 2004, Onwualu, 2012a, Iwuchukwu and Igbokwe, 2012, Agber *et al.*, 2013). Their failures have been largely attributed to inadequate research and planning, lack of adequate data or feasibility studies, policy instability, poor implementation, intensifying costs, non-existence of appropriate technology, incompetent administration, lack of continuity and corruption against a backdrop of poor administrative and political will power (Abdu and Marshall, 1990, Obeta, 1990, Ogiji, 2004, Azih, 2008, Anyanwu *et* al., 2011, Onwualu, 2012a, Nwachukwu, 2016). Oyejide (1986:53) posits that the gross mismanagement of the agricultural sector is due to the "*lack of political will to resist generalised and special interest pressures*" as the inability of policies and programmes to impact small-scale farmers has resulted in the constant decline of the agricultural sector (Okpanachi, 2004). The stagnation and decline of the agricultural sector is evident from Nigeria's expenditure on agriculture which was approximately 2% from 1961-2009 and maintained a 0.2% growth rate over this period (FMARD, 2011). The Maputo declaration set in 2003 to encourage governments to increase their annual budget allocation to agriculture to at least 10% has not been met by Nigeria, which has had significant impacts on the agricultural sector in reference to proper planning and policy implementation (Lawrence *et al.*, 2015).

To complicate matters further agricultural policies in the country have changed with every administration, resulting in the development of a plethora of policies with negligible impact on the stagnating agricultural sector. This lack of vision and commitment has resulted in conflicting political decisions (Lawrence *et al.*, 2015). The instability of policies and programmes has made it difficult for a form of continuity and the assessment of the effectiveness of policies (Nwanchukwu, 2016). The lack of continuity is identified as a main barrier to the implementation of policies (Anyanwu *et* al., 2011). Examples of policies created include the National Accelerated Food Production Programme [NAFPP] 1972, Operation Feed the Nation [OFN] 1976, Green Revolution 1980, Directorate of Foods, Roads and Rural Infrastructure [DFRRI] 1986, National Fadama Development Project [NFDP] 1990s, National Agricultural Lands Development Authority [NALDA] 1992, National Economic Empowerment and Development Strategy [NEEDS] 1999, and Commercial Agricultural Development Project [CADP] 2009 to name a few. These policies have recorded minimum success in their bid to address and improve production levels, manage postharvest losses or advance transportation processes. The same has been true for the 'support facilities' that were supposed to work alongside these policies such as the eighteen agricultural commodity research institutes, forty-four agricultural input and service units, the National Seed Service and various Universities of Agriculture in different states in the country (Ogurinde, 1988, Azih, 2008, Iwuchukwu and Igbokwe, 2012, Lawrence *et al.*, 2015).

In the case of postharvest losses, the problem lies even deeper in an absence of policies for many important crops. From the various policies and agendas created, only three highlighted the need to reduce postharvest losses – Commercial Agricultural Development Project 2009 (CADP), ATA 2011 (as stated earlier) and Agricultural Promotion Policy 2016 (APP). CADP mentioned postharvest losses as a constraint to agricultural productivity in Nigeria and highlighted measures to address PHL in staple food crops. A range of activities were also detailed for addressing PHL in tree crops including: "*seedling*

multiplication/production, processing, fruit juice production and packaging, quality control and branding" (FMAWR, 2009:8). Although an objective was laid out for how CADP would "*finance post-harvest handling centres and on-farm storage to reduce high postharvest losses among small-scale commercial farmers*" (FMAWR, 2009:8), my research identified no accounts that recorded progress in that regard. The APP carried over themes from ATA such as the value chain approach, targeting the reduction of postharvest losses and improving the market and distribution system for fresh foods. One notable difference is the priority of the crops focused on, APP included bananas as the next most important fruit crop after tomatoes (FMARD, 2016). Again, citrus is absent, despite the high production levels and increasing postharvest losses.

Most of Nigeria's agricultural and development policies have long neglected the rural sector and subsistence small-scale farmers who have, as a result, focused their efforts on increasing output with limited knowledge of activities along other points of the chain. For the most part, these policies have maintained a strongly technical focus; paying little attention to the wide array of socioeconomic differences within the country and amongst the small-scale farmers who produce the bulk of food for consumers in rural and urban populations and contribute greatly to national/global production (Hopkins and Wallerstein, 1977; Abdu, 1990). The top-down approach by agricultural policies has been criticized because they do not take into consideration the realities and local knowledge of farmers and the rural population for whom the policies are intended. As a result, these policies have not played their role in agricultural development (Nwanchukwu, 2016).

4.3 'Follow the thing' framework for studying postharvest losses

The history of commodity chain analysis dates back to the 1970s, in the era of globalisation, where commodities were followed from points of production to consumption (Hughes and Reimer, 2004). This modern trend of following was prompted by Appadurai's (1986) and Harvey's (1990) calls to follow things and lift the veil of commodities respectively.

Commodities are followed to connect producers and consumers as well as reveal actors, relationships, places, cultures, operations and processes that make the "*production, processing and distribution of commodities possible*" (Busch and Juska, 1997:689). This process of following allows food to reveal anything about its "*molecular, bodily, social, economic, cultural, global, political, environmental, physical and human geography*" (Cook *et al.*, 2006:656).

The study of the food system has to be multidisciplinary; the production and transfer of food from farmer to consumer transcends one discipline (LaGra, 1990). Following should "*go where the commodity goes*" (Busch, 1990:9), to capture ideas and connections even if led outside the borders of certain disciplines, which could result in a more coherent study (Sayer 1999). This will also include going beyond people to understand the interactions that occur in the production of consumables and the globalisation of agriculture, that brings out historical and spatial elements (Busch and Juska, 1997, Friedland, 2001).

In 1990, Busch provided rules for commodity chain methodologies that include: production neither starting nor stopping at the farm gate; the ability of science, technology and bureaucratic decisions to create and recreate commodity chains; the histories and geographies of commodity chains and the ways in which power relations in commodity chains change when an actor in the chain attempts to modify it. He emphasised that commodity chains are not independent of social and economic formations and thus must be viewed independently (Busch, 1990).

One of the initial aims of following commodities from areas of production to consumption was to unveil issues surrounding exploitation and dominance within the chain. However, the trajectories of commodities have been followed only from the global south to the global north. Emphasis has been placed on the western consumer and commodities that are consumed in the global north. This is a major critique of 'follow the thing' (Hughes and Reimer, 2004, Gregson *et al.*, 2010), as its emphasis marginalizes small-scale producers in low-income countries that produce

for their local markets (Raghuram, 2004). Despite the fact that food systems are extended beyond local and national levels, and the importance that has been placed on wider, broader, longer commodity systems, local or national commodity chains should not be ignored, as they are equally important in revealing loopholes in systems.

Follow the thing provides a holistic approach for the study of commodities that suits the systems approach proposed for studying postharvest losses by Spurgeon (1976) and LaGra (1990). Due to the variety of elements that influence postharvest losses, following a commodity will reveal the factors that cause losses as the commodity moves from one point along the chain to another. The vertical flow of commodities across nodes from production to consumption can be narrowed down to study an individual commodity system and its community – providing specificity required for postharvest research (Fine and Leopold, 1993, Friedland, 2001). The horizontal view of the chain allows concepts like gender that significantly influence relationships and dynamics along the chain to be studied (Leslie and Reimer, 1999). It also includes interconnected activities beyond the vertical operational nodes of the chain, as well as external factors influencing the way the system works (Grolleaud, 2000, Affognon *et al.*, 2015). This moves beyond basic observations of the chain and measurement of losses to provide an understanding of the causes of losses (Grolleaud, 2000).

Commodity chain studies have sprung out of empirical or social problems (Friedland, 2001). The ability of commodity chain analysis to be commodity specific allows for the dynamics of that sector to be revealed and analysed. The study of the social enables the meaning of culture in relation to commodities to be understood as there is an intertwined link between culture and economy (Collins, 2005). Commodity chain analysis has been applied to different commodities. Busch and Juska (1997) use Actor Network Theory to understand globalisation through the Canadian rapeseed while Dixon (1999) focuses on the importance and power of intermediaries with the Australian poultry sector. Other studies using this

approach include research on tomatoes produced in Mexico and consumed in the United States and Canada (Barndt, 2002); and papaya produced in Jamaica and consumed in the United Kingdom (Cook *et al*., 2004). One of the major reasons for following the food chain is to enable parties like governments, producers, retailers, politicians and consumers to recognise the areas that produce waste so that better efficiency relations are developed (Cook *et al.*, 2006). In the case of PHL follow the thing provides an adequate framework for walking the food chain to reveal entry points of losses along with the various factors that drive PHL that would usually be ignored.

4.4 Nigerian Citrus Value Chain

One of the major challenges with studying postharvest losses is the various ways in which they occur and the range of relevant influencing variables: socioeconomic characteristics, geography, crop, weather, politics, conditions of rural infrastructure (roads), market demand, distance to market, available technology, cultural differences, practices of farmers, intermediaries, level of knowledge and development of the country (LaGra, 1990, Kader, 2005). These factors affect the complexity of commodity systems. As a result, the following of commodities with a systems approach from production to consumption enables these factors to be explored in the commodities' trajectory.

The citrus value chain in Nigeria is underdeveloped. This is because there is no export of fresh fruits and concentrates. The fruits produced are consumed fresh (45%) and about 25% is processed into concentrates (NIHORT, 2002, Bamise and Oziegbe, 2013). It is estimated that 30-50% of the fruits produced are lost due to the lack of a market, pests and diseases, inappropriate handling, poor harvesting techniques, improper packaging and transportation (NIHORT, 2002, FMARD, 2014, Ugoh *et al.*, 2017b, 2016c). Findings from the empirical study of the citrus value chain reveal an intertwined web of social, cultural, political and economic constraints influencing citrus PHL with market actors (farmers, intermediaries and traders) experiencing particularly severe PHL during seasonal gluts. The

main causes of losses in Benue are pests, diseases, improper harvesting techniques, inappropriate packaging and transportation, high taxes during transportation and the absence of a ready market in the form of processing facilities. These losses range from 10 to 100%. Losses are 100% when farmers are unable to sell their fruits, or when intermediaries and traders transporting fruits to markets are involved in accidents, or unable to get to markets due to the breakdown of vehicles. These losses negatively influence their livelihoods because they are dependent on fruit production and sales to earn a living and experiencing high levels of PHL has adverse economic implications. Market actors along the chain highlighted the lack of political willpower as the major cause of losses, mainly because of the absence of processing facilities, the high cost of inputs and transportation (Ugoh *et al*., 2017b, 2016c).

The market map in figure 4.1 captures the movement of fruits from farm to consumer and the factors that shape the value chain in Nigeria and cause losses. Market maps are used by Practical Action (2010) to visualise market systems. The market map is divided into three sections. The market chain and core actors own goods and services at different points along the chain. Inputs, service and finance are needed for the system to function, thus holding it together. The enabling environment acts as the "*rules of the game*" (ibid., p. 10) and includes those factors that shape and control how the market actors, inputs, services and finance function. The enabling environment factors can be positive, negative or ambiguous (ibid.).

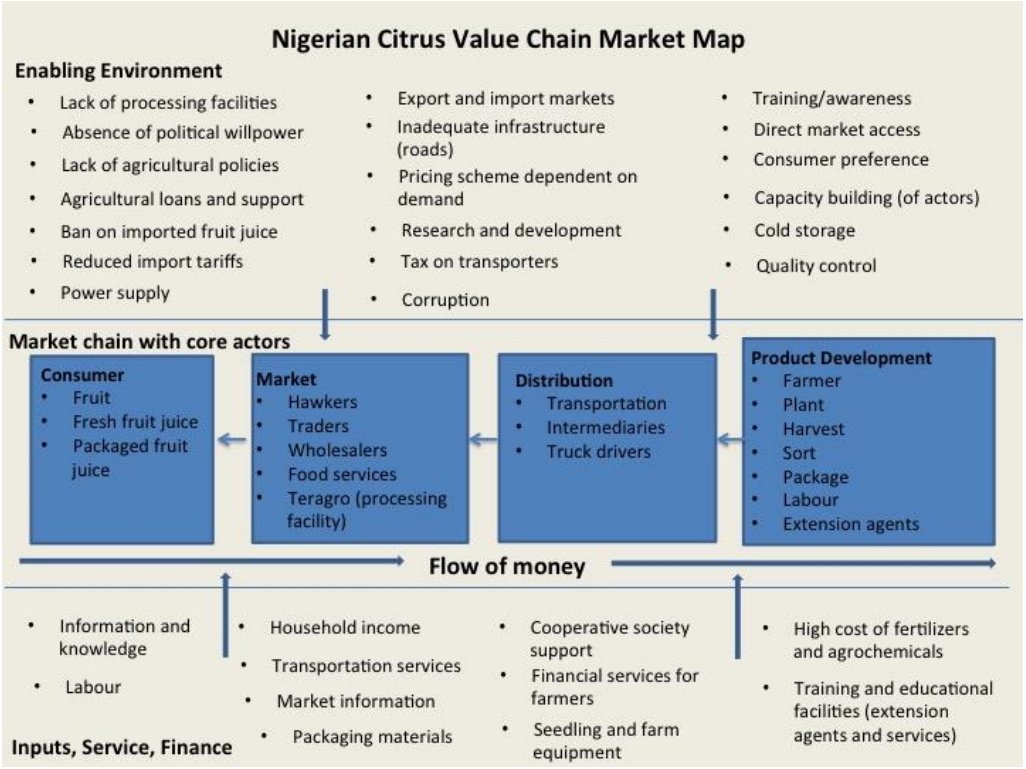


Figure 4.1 Nigerian Citrus Value Chain Market Map.
Author's analysis.

The market map shows that the core actors are farmers, intermediaries, traders and the consumer, revealing the simplicity of the chain. The fruits are not exported, so the domestic consumer consumes oranges as a fresh fruit or in juice form produced at home or in restaurants. Inputs such as fertilizers and pesticides are usually expensive and not used often by the farmers, 48% of farmers apply fertilizers to their citrus trees and 57% apply pesticides. Transportation services are also high and this limits the transfer of fruits to markets. The market map revealed the underdeveloped nature of the citrus value chain in Nigeria and the governance structures in place that control its functionality. The structures identified controlling the citrus industry are: The Federal Ministry of Agriculture and Rural Development (FMARD) and Benue State Agricultural and Rural Development Authority (BNARDA) and food services/consumers (see figure 4.2). FMARD is the main driver of change as it oversees the development of the agricultural sector in Nigeria by producing and enforcing policies via its various agencies, departments and

parastatals and controls the importation of concentrates (FMARD, 2017). BNARDA extension agents played a role in farmer training, where farmers were given advice on the varieties of oranges to produce (Ugoh *et al*. 2017a). Food services and consumers directly and indirectly determine the flow of fruits in market, therefore influencing the level of sales for farmers, middlemen and traders. The enabling environment in this case is largely controlled by FMARD and can be regarded as 'disabling', because most of the factors listed result in postharvest losses and weaken the agricultural sector, with the most significant factors being the absence of political will power, processing facilities and inadequate infrastructure (Ugoh *et al*., 2017a, 2017b, 2017c).

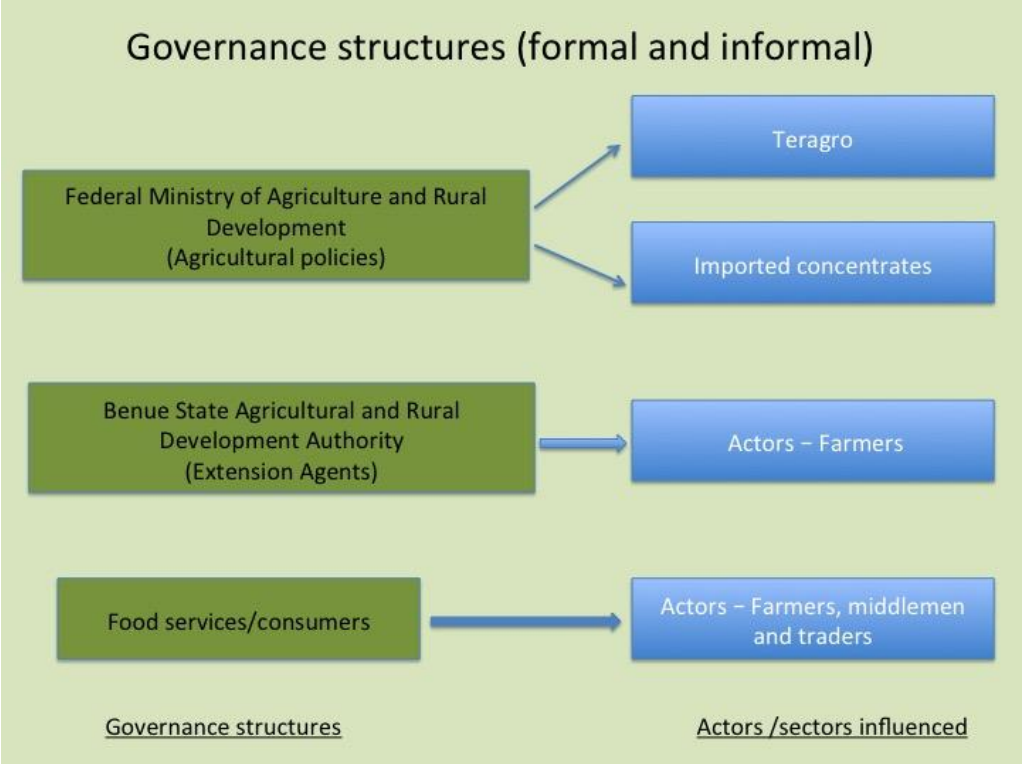


Figure 4.2 Governance structures
Author's analysis

The agricultural sector in Nigeria cannot be discussed without corruption, political will and bad governance mentioned in the same breath. Corruption and sharp practices have been identified by Godson-Ibeji *et. al*. (2016) as the two major constraints to the development of Nigeria's

agricultural sector because they undermine good governance. Governance is becoming a recurring theme in development literature and good governance in Nigeria has become more of a challenge in reference to the development of the Nigerian economy (Adenugba, 2013). Lawrence *et al.* (2015) argue that ever since Nigeria's independence in 1960 its governance has been poor and this has resulted in an inconsistent and unstable government that has birthed an unstable policy system. This has made room for corruption to thrive; where the personal interests of the ruling cabal are placed over the interest of the country mainly through the diversion of public funds and the use of public office for personal gains (Olu-Olu, 2006, Adenugba, 2013, Agbiboa, 2014). Adenugba (2013) suggests that Nigerian leaders have a "*mistaken belief that national government is a superstructure designed to control and exploit, separate and disconnected from the governed*" (p. 780). Resulting acts of corruption and poor governance have severely crippled the political, structural and economic core of the Nigerian economy and are the root cause of underdevelopment (Agbiboa, 2012, 2014). Consequently the agricultural sector has suffered.

As discussed earlier various agricultural policies have highlighted the need to diversify the economy, reduce postharvest losses and provide infrastructure but significant progress has not been made in this regard especially for horticulture. In 2005, a Presidential Initiative on Tropical Fruits Production Programme (ITFPP) was launched to "*boost production to meet increasing demand for fresh fruits and processed products, generate employment and enhance rural income and living standards, as well as earn foreign exchange through export trade*" (Anyanwu *et. al.* 2011:25). The objectives were to:

- "*boost and expand installed and utilization of processing/packing capacities;*
- *address major constraints in the fruits industry, including wastage, storage and preservation; and*

- *expansion of market through the provision of critical infrastructure*" (Anyanwu *et. al.* 2011:26).

The main challenge for this initiative was the release of funds by the Federal Government to embark on the necessary projects. As a result, the set aims and objectives were not achieved (Anyanwu *et. al.* 2011). This is the same story for various policies and initiatives that have been set up. The absence of adequate infrastructure in Nigeria in the form of storage and processing facilities and road networks has been highlighted as the main constraint to agricultural development (Anywanwu, *et. al*., 2011, FMARD, 2016). The main barrier to adequate infrastructure has been identified to be the lack of constant power, which increases operating costs. After infrastructure the next main constraint is finance (Dannson, *et al*., 2004). A review of the Agricultural Transformation Agenda by FMARD (2016) revealed success recorded in some areas such as an improved access to inputs such as fertilizers and seedlings. However, some of the challenges experienced include the high rate of postharvest losses and food imports; the lack of policy coordination between the Federal and State government; the lack of funding; absence of storage and processing infrastructure; and limited research and development (FMARD, 2016). The challenges identified in reference to postharvest losses include the absence of infrastructure- road networks, storage and processing facilities and the lack of finance for such projects. Their review also revealed inadequate knowledge on the lifecycle of crops that makes it difficult for them to be handled after harvest and the lack of coordination between the Federal and State agencies. As a result the capacity to manage postharvest losses is limited (ibid.).

As a result of the constant cycle of policy production, failure to release funds and implement projects, the actors in this study identified the absence of political willpower as the main cause of losses. The review of literature and policies has revealed that the problem of losses is known but there is minimal effort in its management by the Nigerian government. For citrus losses the neglect by the government shows an overall

ignorance of the potential of the citrus industry in Nigeria, despite the amount of foreign exchange expended on the importation of concentrates. On the other hand, it may not be ignorance, but the lack of a desire for change. This is because during political campaigns in Benue state, politicians mention the management of losses and the construction of processing facilities to manage what is produced in the state and create employment. However, after they have been voted into public office, these promises do not see the light of day. That is why a public servant interviewed as a part of this study stated that "*the government is not in the business of doing business*" so they cannot be held responsible for the provision of processing facilities and often provide lengthy excuses for poor infrastructure including feeder roads.

FMARD's (2016) review further highlighted political instability as a major problem with the Nigerian agricultural sector. This has led to the absence of political commitment at the Federal and State level and created a culture that lacks transparency. Poor governance has resulted in the misuse of resources where Nigerian leaders have not shown "a sense of commitment to development" (Lawrence *et al*., 2015:5). A direct consequence is a harsh and volatile business environment with high operating costs that has discouraged investment by potential investors (FMARD, 2015). The ban on the importation of fruit juice was a step in the right direction for the Nigerian economy, but the importation of concentrates at a lower tariff has negated the intended benefits of the ban. With the high levels of fruit juice consumption in the country there is a market for processed goods but domestic production of citrus concentrates and juice is not where the government channels its investment. Fruit juice manufacturers import concentrates because it is cheaper for them to do so than produce concentrates in large scale (Nwaoguji, 2017). This is mainly because of the absence of constant power, which increases operating costs, hampers competitiveness and sends manufactures out of the country (ibid.).

This absence of political willpower is also reflected in the agricultural universities and institutions that are not investing in postharvest research and development or value addition due to the absence of funds. Anyanwu *et. al.* (2011) identified the absence of data and information on tree crops as a barrier to the management of postharvest losses. In Benue State, it was noticed that the agricultural institutions do not carry out research on postharvest losses because it is too expensive and the lack of agricultural policies does not make postharvest losses a priority. Consequently, resources are channelled to on farm activities like increasing production, which results in the provision of more losses. Citrus postharvest losses are not seen as a problem, the image of fruits rotting in markets is no longer an eyesore but 'a common thing'. After all, the mess made by rotten oranges is not as bad as the mess made by other perishables like tomatoes. This is the predicament in Benue State, resulting in oranges being used as footballs for kids.

The core actors cannot manage the bulk of the losses experienced along the chain, because the solutions are beyond them. Citrus fruits are perishable and in their raw states cannot be stored for long periods of time; therefore they need to be processed into other products like concentrates. In 2012, the sole processing facility in Nigeria owned by Transcorp Limited - which is in a public-private partnership with the Benue State Government - was commissioned. Regardless of its presence in Benue, the populace does not feel its impact, as the production of fruits in the state greatly exceeds its capacity (26,000 MT) (Teragro, 2016). Similar facilities were identified in Benue that have been constructed but have failed to thrive because of a harsh environment where operating costs compete with revenue, mainly because of unstable power. This results in the construction of facilities that lie fallow for years.

The citrus value chain in Nigeria includes elements that reflect the wider political economy (steered by power and money); however the analysis of the commodity revealed intricate links and relationships between the actors, institutions and non-human elements that constantly change over

time. In order for PHL to be managed adequately, there has to be a holistic integrative approach in understanding the magnitude and social causes of losses along the entire chain. The interdependence of the commodity system can be seen as such: decisions and actions made at certain points affect the quality and quantity of crops available at other points (LaGra, 1990). A purely technical change will not address the deep-rooted problems of Nigeria's agriculture, there has to be a structural change that addresses good governance and the management of Nigeria's natural resources (Lawrence *et al.*, 2015). As good governance results in proper management of resources and results in a conducive manufacturing and business environment, policy stability, accountability that paves the way for sustainable development (Adenugba, 2013).

4.5 Conclusion and Recommendations

Commodity chain analysis is criticised for its limitation in use – the focus on globalisation and the movement of products from the global south to the north (Raghuram, 2004, Gregson *et al.*, 2010). Following commodities within national borders has the ability to reveal loopholes and problems within commodity chains. Commodity chain analysis has the capacity to be context and crop specific and thus valuable for the study of PHL along crop value chains. It provides an integrative approach to studying food that is not confined to a certain discipline, therefore, offering a comprehensive analysis of the underlying dynamics within the chain and enabling the cultural, social and political factors affecting PHL to be revealed. Postharvest research suffers from the dearth of crop and region specific, such research has to be undertaken if PHL are going to be managed adequately.

The citrus value chain in Nigeria is very simple with very limited actors and governance structures. The high rates of postharvest losses in Nigeria reveal broader structural problems in the country's agricultural sector. Walking the citrus value chain in Nigeria revealed complex factors beyond the reach of market actors that caused losses, with the absence of political will power identified as the main cause. The enabling environment

segment of the market map identified greater influences that disabled the efficiency and functionality of the market. In a country like Nigeria, its centralised power system ensures that the government plays a critical role in a major sector like agriculture. As a result, the government has to be the driving force in restoring the agricultural sector and promoting the importance of managing postharvest losses. They need to be enlightened on the importance and benefit of managing the citrus value chain. The absence of processing facilities results in major losses of fruits that have negative impacts on the livelihoods of actors. There is a need for more research on postharvest losses in Nigeria along various value chains for proper solutions to be provided. Postharvest research will need to be inclusive of the socioeconomic characteristics of market actors in order to understand the causes of losses from their perspectives.

Most importantly the government needs to channel resources from concentrate imports to the provision of facilities, inputs and services that will grow the agricultural sector and improve the income of small-scale farmers. Policies have to be created that encompass the realities of small-scale farmers. One of the major problems with the policies has been their lack of specificity. In particular, questions relating to what will be done, how, where, why, for how long, who will be involved need to be discussed and documented. The majority of agricultural policies developed by the Nigerian Government have failed to solve the major problems faced by small-scale farmers and this includes PHL. The level of losses has become worse because of the lack of attention paid to losses in the form of policies, research or required solutions. There should be set targets and objectives including a statement of mechanisms to achieve these. Generally acknowledging the need to reduce postharvest loss has not helped promote its reduction anyway. Most of the policies implemented in Nigeria include 'import substitution' to encourage mass production of imported products domestically with good quality. The Agricultural Transformation Agenda and its farm to fork approach for staple food crops signified a step in the right direction for the management of postharvest losses. However, there needs to be an expansion to include fruits and vegetables including

citrus. The cost of fruit concentrates runs into over 1 billion USD annually suggesting that the GON does not prioritise fruit production and lacks adequate knowledge on the level of citrus production and losses in the country. Investment in the citrus industry and value addition along the chain will greatly reduce the level of losses incurred and the livelihoods of farmers that rely on tree crops.

Publication 5: Geographies of Consumption: Rethinking consumer preferences and post-consumer waste within low-income countries using Nigeria as a case study

5.0 Abstract

This paper argues that the lack of a uniform definition of food waste has created room for confusion, ambiguity and the marginalization of certain groups. Postharvest loss research has largely focused on low-income countries and consumer waste research on middle and high-income countries. As a result, the study of 'food waste' usually stops before the consumer in low-income countries and starts after the consumer in middle and high-income countries. In light of postharvest losses and food waste management, value chains are not completely studied. The 'Follow the thing' framework follows the movement of food products from production in the global south to the consumer in the global north to reconnect consumers with producers and explore the hidden story behind commodity value chains. This mode of analysis reveals a major gap; research has excluded low-income consumers, emphasizing solely western consumers. The study of national commodity chains is limited in the literature and only crops that travel across international borders are viewed as 'worthy' of following. Commodity chains are not explored from farmer to consumer in low-income countries. Whilst issues of dominance and exploitation are important in globalised agriculture, national value chains and local consumers are equally important and such issues may exist in the national context. This paper focuses on the citrus consumer in Nigeria; I explore behaviours, preferences and issues relating to quality and trust in the purchase of fruits.

Keywords: consumer; quality; orange; Nigeria;

5.1 Prologue

Due to the high demand for orange fruits produced in Benue State, Nigeria there are various roadside stalls or 'selling stations' located at strategic points within the state. Selling stations are usually situated underneath enormous mango trees that provide warm shade and a gentle breeze to protect both seller and produce given the locations along a major highway. One of the selling stations in Aliade, Gwer East Local Government Area

houses a group of fifteen women, who have their oranges beautifully arranged in 5L size 7 buckets, which contain on average 26 oranges – small, medium and large. This is a good location; off the major highway, that links Benue State to the Eastern and Southern states. It is a few weeks before the Christmas season; the roads are extremely busy with people travelling for the holidays. There are four orange varieties available at this time of the year and they are all displayed in different buckets. Each woman has her own space: buckets of oranges closer to the roads and sacks of oranges beside their wooden benches. The women are engaged in conversations, peeling the fruits and cutting them into two unequal halves, awaiting consumers. The traders love this time of the year because they experience enormous patronage from travellers. "*Benue fruits are the best*" says one of the traders "*and so we get plenty customers at this time"*.

Then a car pulls over, all the women run with the peeled and cut oranges in their hands, handing them to consumers to taste. You hear them say "*Uncle take this one, it is very sweet*", "*Aunty try this one", "this one does not have seeds"*. The consumers collect oranges from different traders, to taste and decide which trader has the sweetest fruit that provides satisfaction. The consumer follows the trader to her 'section'. The other traders walk back to their stations and await the next car. The consumer scans the oranges in the bucket in front of her - picking one fruit at a time, rolling it over in her hand, squeezing the sides, deciding if the fruits suit her preferences. She places the desired quantity of cut oranges in a polythene bag and/ or decides on the bucket she wants. Then they begin to argue on the price (the average price of a bucket at this time is N200 -$1), "*Aunty I am giving you a good price,"* says the trader as the consumer looks to bargain some more. After a few minutes a price is agreed on, the consumer picks up her oranges, gets into her vehicle and drives off.

This process is repeated over thirty times in a day (conservative estimate). As I sit down with the traders trying to get their attention, and have them answer as many questions as possible before the next car approaches, I wonder what kind of consumer I am. What are my preferences? How do

these preferences influence the level of sales made by these traders? Every customer that stops to purchase oranges has to taste the fruits first and then screen the entire bucket so they do not purchase bad oranges. Aware of this, the traders constantly sort their oranges to keep the good fruits that meet consumer standards. The oranges are fragile and there are no storage facilities, the polypropylene bags they are packaged in do not provide the best form of protection especially with the hot and humid climate. Whatever the traders have to do, they do, because the consumers expect quality fruits – whatever that word 'quality' means to the consumer.

5.2 Introduction

The initial aim of this study was to identify the causes of postharvest losses along the citrus value chain in Nigeria. It started out following the chain like other food stories (Cook *et al*., 2004, Fischer and Benson, 2006) and stopped before the consumer, as is the pattern with food waste and commodity chain research in low-income countries. The oranges produced in Nigeria are not exported; this limits their interest to many researchers. A review of the literature on commodity chain analysis reveals limited attention to food products produced and consumed within national geographies especially in low-income countries. More emphasis is placed on commodities that travel across international borders (Busch and Juska, 1997, Cook *et al*., 2004). This gap in investigation is what this study seeks to address. In the wider research, we walk the citrus value chain in Nigeria, contextualised into three spaces: the farm, transit and market and the home. Ugoh *et al.* (20167, 2017c) have studied the causes of postharvest losses before the consumer purchases the fruit. This paper focuses on the domestic sphere, picking up from where the consumer purchases the fruit and how it is handled in the home until the point where it is consumed or disposed of. It looks to answer questions such as – What are consumer preferences for citrus fruits? How are issues of quality, trust and hygiene reflected in the purchase of fresh orange juice? How do these preferences influence disposal patterns?

To do so it combines qualitative findings from citrus consumer research collected over four months in Nigeria with theoretical discussions. The data were collected via interviews, online surveys and observations. The fieldwork occurred in two stages; the first stage involved conducting interviews with consumers and observing the purchasing process with roadside and fruit market orange traders in Benue State. This stage also involved the identification of local restaurants in Makurdi (capital of Benue State) that produced fruit juice. The primary focus of this stage was to investigate consumer preferences to determine their influence on citrus losses. The second phase of this study involved online surveys with citrus consumers in various parts of Nigeria, identifying their preferences and the management of oranges in their respective homes. I start by critiquing commodity chain analysis and food waste research. Thereafter, I delve into the results of the study by discussing consumption, consumer expectations of quality, and the transition of oranges to waste.

5.3 Food Waste and Commodity Chain Analysis

In recent years the management of food waste has become a global priority; its urgency sparked by an increasing population and high estimates of food insecurity (Parfitt *et al.*, 2010, IMECHE, 2013, Gille, 2012). This has prompted substantial research in the quantification and identification of the causes of food waste (Exodus, 2007a, Exodus, 2007b, Gustavsson *et al.*, 2011). The study of food waste is spatially differentiated along the lines of the economic and development status of countries in the global south and north, mainly because of the absence of a uniform definition (Gille, 2012, HLPE, 2014). The FAO (1981) defined food waste as "*wholesome edible material intended for human consumption, arising at any point in the Food Supply Chain that is instead discarded, lost, degraded or consumed by pests*" (no pagination). This definition was further broken down to distinguish between losses before consumers (postharvest losses) and losses after the consumer (food waste or post-consumer waste). Accordingly, low-income countries experience high postharvest losses due to the lack of postharvest technology and middle and high-

income countries experience more consumer waste, caused by consumer behaviours and preferences, expiry dates and the influence of retailer cosmetic standards (Grolleaud, 2000, Kader, 2005, Lundqvist *et al.*, 2008, Gustavsson *et al.*, 2011). As a result, the FAO refined its food waste definition to

> "*food appropriate for human consumption being discarded, whether or not after it is kept beyond its expiry date or left to spoil. Often this is because food has spoiled but it can be for other reasons such as oversupply due to markets, or individual consumer shopping/eating habits*" (2013:9).

The spatial distinction of food waste research can be noticed from various widely cited articles. One major trend exists in the study of value chains – they begin with postharvest losses in low-income countries and then cross over to the consumer in middle/high-income countries. The complete chains from farm to fork are not considered within countries, especially in the global south. This can be noticed in reviews that provide estimates and causes of losses in low-income countries and then causes and estimates of waste in middle/high-income countries. (Lundqvist *et al.*, 2008, Hodges *et al.*, 2010, Stevenson and Khan, 2013, HLPE, 2014). This approach raises various questions about the exclusion of local consumers in low-income countries. Raghuram's (2004) critique of Global Commodity Chains (GCC) analysis provides a suitable response, namely that GCC "tends to view the 'Third World' only ever as a site of production… 'Third World' states are positioned as producers for the so-called global market" (p. 124) . The emphasis on western consumers in the literature of commodity chain analysis (Gregson *et al.*, 2010) is reflected in the study of food waste.

The 'following' of commodities was born out of the globalisation of agriculture, to reconnect consumers to producers in order to promote ethical trade and transparent food chains (Friedland, 2001, Cook *et al.*, 2006, Gregson *et al.*, 2010). Harvey's (1990) call to 'de-fetishize' and lift the veil of commodities has been central to food stories as well as Appadurai's (1986) invocation to follow the social lives of things. The commodities trajectory is traced to reveal actors, activities, relationships,

cultures and communities (Cook and Crang, 1996, Raikes *et al.*, 2000, Cook *et al.*, 2006). The dynamic nature of commodity systems allows the following process to explore patterns of production, distribution and consumption (McGinity, 1979, Friedland, 2001). Food stories then have the power to reveal issues of dominance, exploitation and the hidden story of a value chain (Cook *et al.*, 2006). Food stories as well as other commodity chain analyses have focused on commodities that are produced in the global south for western consumption (Cook *et al*., 2004, Gregson *et al.*, 2010) whereas, in reality, small-scale producers are usually also consumers of the commodities themselves (Raghuram, 2004) and they produce for a local market - the 'global south consumer'.

Consumer waste in low-income countries is relatively low. Gustavsson *et al.* (2011) reported very low levels of waste at the consumer end in Sub-Saharan Africa, from 1% in cereals to 5% in fruits and vegetables. For this reason, there is a view that low-income countries are too poor to waste food, therefore, involving the consumer in food waste studies is unnecessary (Hodges *et al.*, 2010). Sheahan and Barrett (2016) claim that this is because the producer and consumer of the farm products are the same. However, products are transported to farther distances away from the farmer to consumers in Nigeria (Adebamji, 2011, Ugoh *et al*., 2017b, 2016c) and other low-income countries (Mashau *et al*., 2012, Kereth *et al.,* 2013). Analysis of crop value chains in Nigeria involving oranges, cassava and maize have not previously considered consumption; they all stop at the marketing stage of the process (Oguntade, 2013, Oguntade *et al.*, 2014, Olife *et al.*, 2015).

This paper in no way claims that consumer losses in low-income countries are significantly high; it however argues that consumers in these countries are worthy of being studied. Commodity chain analysis and food waste research have excluded and ignored local consumers (Cook *et al*., 2004, Parfitt *et al.*, 2010, IMECHE, 2013). National value chains are important to the economic and social development of a country and following the chain

from production to consumption has the same ability to reveal their hidden stories.

5.4 Consumption

Consumption literature has explored consumer behaviour in economics, culture, commerce and more recently theories of practice (Ryynanen, 2010, Brembeck, 2013). Consumption is weighted with "value and meaning" and as a result has become a "*moralized topic*" (Brembeck, 2013:50,51). This is especially because of the inefficiencies that occur in the global food system, that have resulted in what Raj Patel refers to in his book *Stuffed and Starved*, (2007) where part of the population has too much to eat and others lack food to meet their basic requirement. Consequently, consumption is "*generally considered bad…it is about overspending, overeating, destruction of natural resources, mountains of sugar, our bodies clogging up inside, brimming over their bodies*" (Brembeck, 2013:50).

Human activities involve consumption in one form or another; in relation to food these activities are "*mundane and routinized*" (Watson, 2013a:158). Alan Warde views consumption as a "*moment in every practice…whereby agents engage in appropriation and appreciation*" (Warde, 2005:137). Thus, consumption goes beyond demand and purchase but includes the using up of commodities and production of waste (Warde, 2005, Watson, 2013a). According to the life-cycle metaphor consumption is production-use-discard (Brembeck, 2013). Practice is defined as:

> "*a routinized type of behaviour which consists of several elements, interconnected to one another: forms of bodily activities, forms of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge*" (Reckwitz, 2002:249).

This knowledge is the basis for how the world is understood and interpreted. According to Schatzki (1996:89), practices emanate from "*doings and sayings*". When it comes to food these doings are dependent on background knowledge and know-how (Watson, 2013a). Schatzki

1996:13) also states that "*social order and individuality…result from practice"*, meaning that individuals will interact with food differently in their homes, reflecting the intentionality of practices that result in "*wanting or desiring certain things and avoiding others*" (Reckwitz, 2002:254).

5.4.1 Citrus consumption in Nigeria

Citrus fruits are of national importance to the Nigerian economy, with about 3.9 million metric tonnes produced annually (FAO, 2012). Nigeria does not consider citrus to be one of its major crops although citrus production and distribution is an important source of livelihood to smallholder farmers and traders (Ugoh et al., 2017b, 2017c). Consequently, there is limited research focusing on the consumption of fruits in Nigeria, including citrus. Emphasis has been placed on other perishables like tomatoes and peppers along with staple crops that are considered major crops and thus more important. Research along the citrus value chain in Nigeria has concentrated on postharvest losses (Jolaoso *et al.*, 2011a, Olife *et al.*, 2015), with limited research on orange consumption. A study by Adebamji and Omotola (2009) considered how often fruits were purchased amongst university students, staff and the elderly in Osun State. The analysis revealed that the purchase of oranges was relatively low (34% purchased fruits weekly); this was dependent on the availability of disposable income and the consumer's mood. This study also identified that the diets of the respondents contained oranges weekly (31.4%) and every other day (20.9%). Consumption was based on their moods and the seasonality of the fruits. Citrus fruits were in season and readily available from November to March at lower prices (Ugoh *et al* 2017c). The respondents of the survey were from different economic classes: 57% of the respondents had an above average income, 18.6% average income and 24.4% with low-income. Despite the income differences orange consumption amongst the groups was mainly weekly and every other day.

Citrus fruits are either processed into other by-products like fruit juice and jams, or consumed fresh by consumers (Okwu and Emenike, 2006). In Nigeria, about 45% of the oranges are consumed fresh (NIHORT, 2002, Ezejiofor *et al.*, 2011, Bamise and Oziegbe, 2013). Data is not available on how this has increased or decreased over the years. The consumption of fruits in Nigeria occurs more in areas of production and is determined by their availability and the status of the consumer (Adebamji and Omotola, 2009). The consumption of fruit juice on the other hand increases by 10% every year (FMARD, 2015, Olife *et al.*, 2015). Orange juice is consumed freshly prepared or in concentrate form, and fresh orange juice is traditionally prepared in the home (Okwu, 2008). Processed fruit juice is distributed mainly through traditional/open markets (60%), supermarkets/convenience stores (20%), hotels/food service outlets (15%) and others (5%) (Flake and Nzeka, 2009).

5.4.2 Consumer expectations of quality

Consumers choose to consume fruits due to the pleasure they derive from them, not necessarily the accompanied nutrients they provide. Therefore, the onus of choice is not on the consumer alone but is influenced by various factors such as availability and desire for food (Lee, 2013). For this reason, fruits and vegetables are marketed in a way that attracts and satisfies consumers (Shewfelt, 1999, Poole and Martinez-Carrasco, 2007). The social, psychological and physical stimuli exuded by marketers influence buying behaviour, as consumers respond differently to stimulus (Modi and Jhulka, 2012). During the purchase of fresh fruits consumers use physical attributes to judge whether the fruit will provide satisfaction based on their preferences (Poole and Martinez-Carrasco, 2007). These preferences are what they use to determine the quality of the fruit.

The subjectivity of a consumer makes the measurement of 'quality' a difficult task (Alonso *et al.*, 2002). Quality is specific to individual produce due to the heterogeneity of fruits (Poole and Martinez-Carrasco, 2007). This is because there are two views to quality – product oriented (quantifiable attributes from harvest to distribution) and consumer

oriented (satisfaction) (Shewfelt, 1999). Product oriented quality is influenced by the views of various actors along the chain from farmer to packer: the person bagging the fruits, intermediaries, and traders who all have concepts and ideas of quality (Abbot, 1999). Alonso *et al.* (2002:31) refer to quality in fruits as a "*multidimensional concept*" because there are various factors that determine quality for a consumer. Shewfelt (1999:197) defines quality as the "*absence of defects or a degree of excellence*" while to Morris and Kamarulzaman (2014) consumers define quality in terms of the satisfaction they recover from a product. The perceptions consumers have of the quality of fruits come from experience of identifying certain intrinsic and extrinsic attributes of quality (Poole and Martinez-Carrasco, 2007). Intrinsic attributes include taste, sweetness, acidity level, juiciness and extrinsic attributes include physical appearance (shape, size, colour, smell, absence of defects); texture (firmness and freshness); variety, price and origin. These characteristics including nutritive value are used to determine the quality of fresh produce (Shewfelt, 1999, Kays, 1999, Kader, 2001).

Quality attributes can be divided into two: search and experience. Search refers to what the consumer can gather from physical inspection like appearance and texture (Kader, 2001). The intrinsic characteristics of the fruit are determined after consumption – experience – such as flavour (Kader, 2001, Poole, 2007). Usually, consumers use the physical appearance of fruits as the main criterion for purchase (Kays, 1999). They also use attributes like taste, texture and flavour to determine quality, but this assessment occurs only after the fruit has been consumed. To determine the quality of fruits consumers use intrinsic attributes; unfortunately, these cannot be determined until after consumption, therefore extrinsic attributes are relied on. Their inability to determine the intrinsic characteristics of the fruits before purchase inhibits optimum satisfaction (Poole and Martinez-Carrasco, 2007).

A study was carried out by Poole and Martinez-Carrasco (2007) on consumer satisfaction and fruit quality perceptions with different

mandarin varieties. In the initial phase of the study, respondents identified the three most important mandarin attributes as physical appearance, firmness of the fruit and price. In the second phase after they tasted the mandarins juiciness, sweetness and acidity were recognised as the most important characteristics that provided satisfaction. This showed the difference in the search and experience attributes used by consumers to purchase fruits and the attributes that actually provide satisfaction.

In this study, consumers purchasing from the roadside traders (as noted in the above prologue) tasted the fruits first before purchase. Therefore, they were able to combine experience and inspection in selecting fruits that were physically similar to the ones tasted, based on the experience of satisfaction they derived. This is however, not the case for all orange traders; the act of tasting the fruits before purchase appears to be predominant in purchases involving roadside traders but not fruit market traders. In the fruit market visited as part of this research (located in the capital of Benue State- Makurdi) fruits were displayed beautifully in basins and buckets and consumers had to rely on their own knowledge and past experience to decide on what fruits to purchase; market traders did not offer tastings.

The consumers observed in this study were asked to identify quality attributes that influenced their purchasing decisions for fruits. Four main characteristics were identified: fresh, ripe, physical appearance and clean environment of the seller. Adam stated further: "*I will usually not buy oranges because we get them from the village (as gifts), but if at all I do, I do not intend to see sand, insects, flies, just fresh and neat*". The price and colour of fruits were recognised as the least important factors. The word *fresh* was recurring, and indicated a fruit that was not about to spoil while ripe was likened to sweetness. The definition for the word fresh according to Jackson (2013c:85-86) is "*complex and contested and stands at the intersection between scientific concerns about food safety and more subjective judgements of quality and taste*". Food safety comes into the equation with the use of inorganic pesticides and preservatives. This is

more of a contested issue in middle and high-income countries. Freshness is a desirable attribute in fruits and vegetables (ibid.). For physical appearance, phrases like "*no blemish*", "*no bruises*", "*no handling marks*", "*no signs of pests and diseases*", "*spotless*", and "*whole*" were mentioned. It included the overall physical aesthetic quality of the fruit that was spotless and whole. These desired attributes show that quality is beyond taste for consumers and has other meanings (Milne, 2013a). This is similar to findings on consumers in high-income countries shopping for food where they rely on know-how to determine quality (Fuentes, 2013).

When consumers want to determine the quality of oranges they use features such as juiciness, freshness, acidity and texture (Poole and Baron, 1996). For this study, the respondents were then asked to describe the perfect orange guided by three main attributes – texture, size and colour. For size, 42% preferred medium sized oranges. Other specific responses were "*size of a tennis ball*" and "*bigger than a golf ball but smaller than a baseball*".

As for texture, the two main attributes were "*soft*" and "*juicy*" which were used interchangeably because if an orange is soft it is perceived to be juicy. The sweetness of the fruit and the smoothness of the rind were identified as somewhat important to the consumers. Ease of peel, no bruises, spotless and ripe were the least important attributes considered by the consumers. However, spotless, no bruises and ripe were considered important characteristics for fruits in general. For the oranges it was noticed that when the fruits were soft or felt juicy when touched it meant the fruit was ripe which may be a reason why the word ripe was not used to indicate preference. Comfort stated:

> "*you know I don't like peeling small oranges that have light skin [thin rind], so anytime I see oranges with light skin they don't really interest me that much, so they stay there until sometimes they get bad*".

For the colour, consumers preferred yellow and orange oranges because there was an expectation that oranges are supposed to be orange or

yellow. Some specific comments were "*green with a touch of yellow*" and "*yellow with a tinge of green*". In reference to all three attributes Adam said:

> "*I prefer the green ones. As per being soft and hard, a knife should just be able to go through it, because I will probably cut it into four and I prefer cutting it into four than peeling and squeezing it*".

The preferences of consumers dictate the type of oranges they purchase. For others like Comfort, who receives oranges as gifts, the fruits that do not suit her preferences – small and thin rind – are not consumed but go to waste. Some of the criteria for colour are based on expectations and not reality. The colour of fruits is a major criterion for quality assessment and this varies for fruits. Consumers expect oranges to be orange and green oranges are viewed as unripe. Due to the variety of cultivars not all oranges are orange and some cultivars mature at dark green (Kays, 1999). Citrus fruits in tropical areas do not usually attain an orange or yellow colour due to high temperatures (Murata, 1997). Some of the Nigerian orange varieties (Valencia and Ibadan sweet) will change from a dark shade of green to a lighter shade of green with patches of yellow when mature. The King variety remains army green even when mature. Ironically, the Ibadan sweet variety is identified as the most preferred orange because of its sweet taste (Ugoh et al., 2017c).

Consumer attitudes, perceptions and beliefs drive a consumer's purchase of fruits. Since the attributes consumers rely on to determine quality are intrinsic, they have problems determining what fruits should be purchased based on physical appearance (Harker *et al.*, 2002). As a result, the purchase of fruits is a practice, involving complex mental and physical activities where the consumer relies on past experiences, memory, background and available knowledge. This process is repeated constantly such that it becomes a routine (Harker *et al.*, 2002, Reckwitz, 2002, Modi and Jhulka, 2012, Emerole *et al.*, 2013).

As fruits move from points of production to market their quality reduces (Shewfelt, 1999). Pre-harvest factors, mechanical damage during harvesting and transportation that result in physical injury, exposure to harsh elements (high temperatures) during marketing and physiological changes during handling, distribution and storage influence the physical appearance and quality of fruits (Shewfelt, 1999, Kays, 1999, Ugoh et al., 2017b, 2016c). In high-income countries an acceptable level of quality is maintained by producers so they can be accepted by retailers (Kader, 2001), although in some countries over-perfection driven by strict supermarket standards is currently a contested concept (Gustavsson *et al*., 2011). In low-income countries there is less emphasis on quality assurance and control. The absence of such regulations means that all types of fruits are brought to market –blemished or imperfect. As a result, there is a general sense that in tropical countries, consumers are more price conscious than quality conscious and they are more willing to reduce self-imposed quality standards for lowered prices and settle for produce of lower quality (FAO, 1981). However, the consumers in this study showed that individual quality preferences dictate which fruits are purchased and rejected. Quality versus price is a constant debate for consumers, as some will choose price over quality and others quality over price (Harker *et al.*, 2002). In this study the price of oranges was identified as not important; this may be because the oranges are readily available at relatively low prices (Ugoh et al., 2017b, 2016c). The consumers may not consider price as an important attribute because they are able to negotiate with the traders on a suitable price.

The transportation of citrus fruits from farm to market in Nigeria usually involves a few processes that damage the physical appearance of the fruits, many of which beyond the control of the actors. For instance, oranges are packaged in polypropylene sacks (because they are cheap and the main packaging materials available) and heaped in trucks for transportation in a hot and humid climate. By the time the fruits arrive the markets some of them are rotten, so the traders have to constantly sort them (Ugoh et al., 2017b). The traders were aware that appearance

attracted consumers so they displayed fruits in a way that would appeal to the consumer. For instance, the roadside traders that peeled and cut the fruits did not purchase the Washington navel variety because after peeling, it did not 'shine' therefore it was not attractive to consumers.

Consumer satisfaction is underlined by the quality of products. If the quality of fruits decreases consumer satisfaction drops, resulting in a reduction in the price of the product. For instance, a consumer complained about purchasing oranges at the beginning of the season that were not juicy. She was angry about wasting her money on "*juiceless oranges*" and vowed not to purchase from that trader again. Therefore, losses experienced by traders are indirectly impacted by consumer satisfaction (Morris and Kamarulzaman, 2014). This is not to exclude the influence of seasonal gluts or the lack of a market on the prices of fruits (Ugoh et al., 2017b).

5.4.3 Local fruit juice production

Nigerian respondents indicated that they preferred freshly prepared orange juice (92%) to packaged fruit juice. Fresh orange juice was favoured because it was more "*natural"* with no preservatives or processed sugars. Other words used to highlight this preference for natural were "*undiluted*", "*fresh*", "*healthier*" (had all the nutrients intact), "*better taste*", "*cheaper*" (when it was homemade), and "*refreshing*". The need for *fresh* and *natural* juice was continuously repeated. As Sandra said, "*nothing beats fresh and natural*". According to Jackson (2013c) the words fresh and natural are used in similar contexts and the desire for fresh products is ironic because Friedberg's *Fresh: A Perishable History* (2009) noted that freshness was dependent on technology such as refrigeration to maintain quality. More Nigerian consumers (51%) prepared orange juice in their homes; 49% prepared the juice at home and purchased from local restaurants. Despite the preference for fresh orange juice, packaged juice was purchased because of accessibility and availability. Nigerian consumers were disaggregated in different economic groups (low, average and above average) and there was a preference for fresh orange juice over

packaged juice. The same was noticed when explored by age group; there was a preference for fresh orange juice over packaged juice. These preferences were still prevalent for the types of packaged juice purchased. For packaged fruit juice they purchased the brand that was identified to be a close substitute to natural juice in terms of taste and nutritional value. For packaged juice however, all categories of consumers preferred mixed fruit juice to orange juice and still wanted the brand that was closest to being natural.

Four restaurants were discovered in Makurdi that produce and sell fresh orange juice. Apart from orange juice they produced other fruit juice including watermelon, pawpaw and pineapple. The four restaurants noted that the demand for fresh fruit juice was very high. Andrew (manager of restaurant A) described the demand as "*crazy, and cannot be met*", stating "*orange juice is more profitable than water because consumers want something fresh*." This demand along with the abundance of oranges in Benue fuelled the decision to produce fresh fruit juice. The restaurants sold orange juice for N250-N300 ($1.3 - $1.8) for a 750ml bottle (see figure 5.1), about the same amount for a bottle of beer so they felt it was affordable. Andrew's restaurant was the only one to sell for N250 and he made the most sales at 20-30 bottles a day. This was raising his profit margin to about 60%. The other restaurants recorded sales between 10-20 bottles a day.



Figure 5.1 Orange juice for sale in a restaurant in Makurdi, Benue State
Author's photograph. 18th December 2015.

During an interview in restaurant B, a customer walked in complaining about the use of recycled bottles to package the juice. She went on bitterly about how they had been in the business for a long time (over 10 years) and had not improved their packaging process, stating that it was high time they started producing their bottles and sealing the contents. All the restaurants use recycled water bottles to package the orange juice. The water bottles used by their customers and neighbouring stores are collected, washed and used to package the juice. When the customer was complaining there was no apology from the manager or staff, in fact the interviewee said it was a cheaper option and further stated that: "*it's not a factory thing; it's just something that you wake up, squeeze oranges, pick bottles rinse them and pour it (the juice) inside.*"

She however went ahead to get a bottle of juice for herself – that may be the reason why they have not bothered to change the system of using recycled bottles. Restaurant B clearly does not see anything wrong in using recycled bottles, if they continue to experience good patronage with

a few consumers complaining they may not see a reason to change the system. Andrew was not satisfied with the use of recycled bottles but said it was the only option he had when he started selling orange juice. He was looking to produce his own bottles in the future when he could afford it, "*because the patronage (for fruit juice) depended on presentation and packaging, and consumers had to trust his source before they patronised him*". As a result, he made sure that the juice was prepared in sanitary conditions to avoid food poisoning to his consumers, even though it was produced manually.

Restaurant B outsourced their production and so had no control over the preparatory process. When asked how they ensure the health and safety of their consumers and that the production was carried under sanitary conditions the interviewee said:

> "*That's the big risk we [are] taking here, at times a costumer will come and say how are you sure this is fresh? Someone will come and say something about us not producing the bottles. We believe that it is fresh because we have been with these people for the past 10 years, and once in a while we have complaints with customers, then we tell them (the producers) that we have issues with customers so please be careful with how you package yours. I cannot guarantee how clean it is because they are not here*".

Restaurant C had outsourced its production in the past but due to consumer complaints about the juice not being fresh they had to start producing juice in-house and use an electric juice processor to ensure health and safety standards.

When respondents were asked about their feelings towards the purchase of fruit juice from external sources, 77% indicated that they were bothered about the health and safety standards of local restaurants. However, 57% still purchased orange juice from the restaurants. The main reason why the other consumers did not purchase fresh fruit juice was because of a lack of trust in the preparatory process, the hygiene of the manufacturers because it was made manually, and the health and food safety of the process. Others claimed they doubted the juice was fresh,

because it may not be prepared every day and as the price of the juice was expensive, it was cheaper to make it at home. The overall fear was the lack of trust in the quality of the preparatory and storage process especially because of the irregularity of power supply. Adam said:

> "*I don't think they are hygienic. My wife has made me believe they are not really hygienic, if she isn't sure of the source. I mean the picture in my head is that they are squeezing it manually, I'm not sure they've washed their hands, I'm not sure if they are sweating, I'm not sure they washed the oranges properly, I'm not sure if they've diluted it – the source of water*".

Trust and food according to Milne (2013b:230) are "*inextricable*". People have to be sure that what they are eating is unadulterated, thus making trust individual and emotional. Consumers have to have that confidence that the food products they are purchasing are safe (Brom, 2000). As a result, trust has become an integral part of consumer purchases because they want traceability. Halk (1993) reveals that consumers do not suspect the food but rather the actors involved in its production and processing (see Kriege-Steffen *et al.*, 2010). From Adam's quote we can see that he doubted the act of producing the juice. This is because in Nigeria the monitoring of restaurants and fast foods by food safety officers is almost non-existent; as a result, many food handlers are ignorant about the basics of food hygiene when it comes to preparation and storage. This is compounded by limited access to safe and clean drinking water (Onyeneho and Hedberg, 2013). With questionable food practices there could be a transmission of food borne pathogens and diseases (Sheth *et al.*, 2011).

5.5 Storage of fruits and the transition from food to waste

The management of oranges is one of the key problems faced in Nigeria due to high temperatures (reaching 37˚C) and humidity. Along the citrus value chain, from farm, during transit and in markets, keeping the fruits at a conducive temperature is a challenge (Ugoh et al., 2017b, 2016c). The management of fruits in the home is also a problem, because of their fragility and temperature management. As a result, respondents in this

study stored their fruits either in the refrigerator or open ventilated spaces depending on the fruit. There is limited research on the storage of oranges in the home. According to Etebu and Nwauzoma (2014) oranges will last for up to 12 weeks if stored in optimum conditions but details of these 'conditions' are not provided. Kader and Arpaia (2002) suggest that fruits be stored between 4-8°C with relative humidity of 90-95% while Jolaoso *et al.* (2011a) suggest that oranges can be stored in ambient conditions for about three weeks, but the shelf life is dependent on temperature and moisture levels. When weather conditions are dry, the fruits experience loss of moisture. Consumers reported that the fruits were not able to last for long periods of time before microbial deterioration. Others claimed that the fruits became dry and hard and thus were disposed.

As a result, 52% of the survey respondents stated that they typically disposed of some of the oranges they purchased. Consumers also used the oranges for fruit juice, smoothies and baking, or fed them to animals when they noticed that the fruits were in the process of getting spoilt. A majority of the consumers (74%) however, disposed of the fruits as soon as they noticed signs of deterioration. These signs of deterioration link back to the characteristics consumers felt fruits should possess before purchase. However, due to their inability to store the fruits properly and or consume them immediately, over time the desired characteristics are lost and the fruits had to be disposed of. In addition, the activities that occur earlier on along the chain determined how long the oranges lasted in consumers' homes.

It should be noted that the orange has a physical life that will "*age, decay and deteriorate*" (Gregson *et al.*, 2007:188). The consumption of the fruits at home was determined by the mood of consumers and their preferences if the fruits were received as gifts. John indicated that his family usually received sacks of oranges as gifts from the village, but were never able to consume all the fruits because of the quantity. He noted that his mother loved orange juice so it was constantly prepared, however a good number

of the oranges usually dried up before they could be consumed. He further pointed out that the fruits were kept in an aerated store; noting that this was the best method of storage because the quantity of fruits will not fit into their refrigerator.

As stated earlier, social order and individuality are a result of practices. Therefore, the way individuals will interact with the orange in the boundaries of their homes is highly dependent on their background knowledge of the uses of an orange, their cooking and eating habits, socioeconomic status, level of education, culture and how they understand an orange should be engaged with (Murcott *et al.*, 2013). Consumption practices do not border only on the acquisition and utilization of certain objects in certain ways but also their divestment in certain ways (Gregson *et al.*, 2007). Mary Douglas provides an analysis of 'dirt' and social order that can be related to households and the divestment of food. "*Where there is dirt there is always a system. Dirt is the by-product of a systematic ordering and classification of matter, in so far as ordering involves rejecting inappropriate elements*" (Douglas, 2002:44). In this case an orange becomes dirt when it loses the characteristics that made it part of the social order in the first place. This is subjective, as dirt "*is in the eye of the beholder*" (ibid., p. 2). Mary Douglas' definition brings out the idea of 'rejecting inappropriate elements'; social orders then have a set of boundaries that determine whether elements are 'fit enough' to be in the system or out. In this sense food waste -a bad orange- is 'polluting the domestic social order' (Gregson *et al.*, 2007) and will be disposed of.

5.6 Conclusion

Walking the citrus value chain in Nigeria from the farmer to consumer has sought to demonstrate that local consumers in low-income countries exist and are worthy of being studied. Commodity chain analysis and food waste research need to adopt a holistic approach that includes the global south consumer. Focusing only on contexts where the western consumer is involved devalues the role that national commodity chains play. Walking the chain from farm to consumer provides a comprehensive assessment of

the chain in Nigeria and has revealed a rich story, which varies with place, perception and context.

Nigerian consumers had their preferences for fruits that ranged from the desire for ripe and juicy fruits to more specific attributes in colour and size. These preferences dictated what quality meant to individual consumers, which influenced purchase decision-making and played a role in the transition from good orange to bad orange. The disposal of fruits was partly because consumers did not have proper knowledge on how to store the oranges at home due to high temperatures. With the regularity of consumption dependent on their moods there was no way the fruits were able to last until they were all consumed, resulting in waste. Postharvest research in the global south has identified improper storage of fruits and vegetables, as a major cause of losses but the storage of fruits at home has never really been a topic of discussion. The management of fruits at home is of utmost importance in low-income countries as the weather increases microbial deterioration not only in farms and markets but the home as well.

The concept of hygiene and trust are issues that transcend national borders, as all consumers want to be confident of the source of food that they purchase. As a result, some consumers did not purchase fruit juice from restaurants because they were unsure of the preparatory process and uncomfortable with the use of recycled bottles for packaging. This study has shown that there are similarities between consumers in the global south and north, where preferences dictate the types of fruits purchased and consumption practices influence management and disposal at home.

Chapter 6: Connecting the dots: citrus, postharvest losses, post-consumer waste and Nigeria

6.0 Introduction

This chapter pulls the entire thesis together; it summarises and discusses the main findings. Then it discusses the main contribution of the thesis, recommendations, its limitations and suggestions for further study. In chapter 1 it was identified that there was a lack of research on citrus in Nigeria. For postharvest losses, there is more emphasis on losses that occur on the farm with a neglect of activities that occur beyond the farm gate. This mirrors postharvest research in other low-income countries. None of the available studies on citrus have walked the chain from farm to fork with a focus on postharvest losses. With this in mind, this thesis adopted a commodity-centred approach to walk the citrus value chain in Nigeria from farm to fork to understand the processes that result in losses, identify the immediate actors, explore their relationships and highlight the causes of losses along the chain from the perspective of the actors. It also aimed to tease out the social, political, cultural, environmental and economic factors that influenced these losses. Accordingly, the following objectives were set:

1. To provide a critical analysis of the citrus value chain in Nigeria with particular emphasis on the roles played by key actors and how these roles are gendered;
2. To identify the key causes and entry points of orange losses along the chain, and explore the impacts on actors;
3. To identify broader institutional factors and constraints to the management of postharvest losses;
4. To explore the concept of post-consumer waste in Nigeria and identify consumer preferences and everyday behaviours that result in the disposal of oranges in the home;

5. To recommend a framework for the study and understanding of postharvest losses.

The process of following the orange revealed that the main actors are farmers, intermediaries, traders and consumers. For this reason it seemed adequate to break down the chain into key spaces - farm, transit and market, and the home. This allowed me go behind the scenes to have a proper understanding of the negotiations, relationships and background activities that reflected high postharvest losses. In the next section, I provide a summary of the empirical chapters (6-10).

6.1 Overview of empirical chapters

6.1.1 Summary of publication 1

The farmers in this study experienced between 10-100% PHL. Infestation by pests and diseases reduced the market value of oranges. This resulted in farmers either selling the fruits at lower prices or disposing of them on their farms. Poor postharvest handling of the fruits caused losses on farms, during transportation, in markets and consumers' homes. The shaking of trees and use of sticks with hooks as harvesting methods increased microbial deterioration that led to spoilage. The farmers in this study produced 25,460 50kg bags of oranges; this amount was less than one third of their expected production. It was identified that there was very limited records keeping by farmers, so they were not sure how many citrus trees they owned and consequently the amount of fruits they produced, sold or lost. The low production may be a result of some farmers feeling that citrus trees do not need fertilizer to produce fruits, because the trees had the ability to produce fruits even if they are not fertilized.

The absence of processing facilities was identified as the main cause of losses for farmers because they had to depend on middlemen to purchase their fruits and transfer them to markets. This act gave middlemen power over farm gate prices because they knew farmers were desperate to sell their fruits and there was no alternative. This resulted in bags of oranges

(that contained about 1075 fruits) being sold for $1.5 - $5 during the seasonal glut (November – December), or lower. The farmers depended on middlemen because they lacked funds to hire vehicles to transport fruits to market and also because they felt they should be approached for the sale of their fruits.

6.1.2 Summary of publication 2

There are two sides to the role intermediaries' play in Benue State. They were viewed by actors, especially farmers, as exploitative because they had the power to purchase fruits at relatively low prices, take them to market and sell at higher prices to make a profit. On the other hand, the middlemen played a very important role in the system, by transporting fruits [that will otherwise have gone to waste on farms] from farms to markets in other states in Nigeria, to ensure that consumers had access to oranges. It was identified that the intermediaries transferred fruits from Benue to seventeen states in Nigeria out of the thirty-six.

During transportation, intermediaries experienced losses because of poor packaging. The oranges were packaged in polypropylene bags that offer no form of protection to fruits from mechanical damage or harsh weather elements. Under high temperatures, the rate of microbial deterioration was increased during transportation because fruits were congested in bags and not given room to breathe. Most of the vehicles used were not in good condition, therefore, vehicles broke down during trips causing intermediaries to lose all or some of their fruits. The high cost of transportation, along with the taxes paid to government and security personnel discouraged vehicle drivers and intermediaries from transporting fruits. Two types of traders were identified in this study – roadside and market traders. Those who purchased their fruits directly from farmers experienced the same transportation losses as middlemen.

During the seasonal glut, the markets were saturated resulting in low prices. Here, traders had the upper hand and were able to reduce prices to as low as N50 ($0.25) for a truckload of oranges. In such cases, the price received did not cover the cost of transportation for middlemen. However,

when there was a scarcity, a bag of oranges was sold for N900 – N10,000 ($45-$50). Traders had to rely on consumers purchasing fruits and with oranges being perishable the absence of storage and processing facilities. This resulted in high amounts of orange waste in markets. The traders and intermediaries did not keep accounts of how much they purchased, sold or lost. For intermediaries if they had accidents or mechanical problems during transportation losses could be 100%. For traders they sorted their fruits daily and disposed of bad oranges.

6.1.3 Summary of publication 3

This chapter combined results of chapters 6 and 7 and explored the gender divide along the chain. More farmers and middlemen were male (97% and 90% respectively) while women (93%) were engaged in trading. This is because traditionally men inherited farmland from their fathers and the act of transporting fruits interstate involved significant periods working away from home and was widely considered to be less suitable work for women. Men also preferred their wives trading in local markets rather than putting themselves at risk by acting as intermediaries. From analysing the cost of oranges and the income received at different points along the chain it was noticed that farmers received the least revenue. This was not enough to cover their purchase of fertilizers and pesticides; as a result farmers did not use them as often as required. Some farmers' mixed chemical fertilizers with organic matter such as rice waste to reduce the amount of money required for its purchase. The seasonal use of pesticides and fertilizers impacted their yield.

6.1.4 Summary of publication 4

This chapter explored the declining state of the Nigerian agricultural sector since the oil bloom in the 1960s. The review recognised a lack of awareness of the importance of managing PHL as the bulk of previous research on agriculture focused on the drive to increase food production. For many years the Nigerian government has created policies to improve the agricultural sector. These policies have sought to move away from the dependence on oil, i.e. diversify the economy, and revive the declining

agricultural sector to improve national development and the livelihoods of small-scale farmers. Regardless, the policies have rarely had an impact on small-scale farmers because they have failed to take into consideration the realities of small-scale farmers and the problems they face.

With the abundance of agricultural policies generated by the government, only two mentioned managing PHL, with the Agricultural Transformation Agenda (ATA) working towards its goals, unlike the Commercial Agricultural Development Plan (CADP). The Agricultural Transformation Agenda proposed the value chain approach for the management of postharvest losses and the addition of value to food products as they moved from farm to fork. A limitation of ATA was its focus on staple foods that the government felt it had comparative advantage in, with a noticeable absence of fruits and vegetables.

The chapter further argued that commodity chain analysis can be adopted to study postharvest losses as they fit the systems approach of studying losses that takes into consideration the prevailing factors that influence losses at various levels. It proposes that entire value chains in low-income countries should not be ignored as the vertical flow of commodities and the horizontal interactions with actors reveals areas where losses occur and how the system functions. Using the market map concept higher-level factors were identified that disable the function of the chain. With the Federal Ministry of Agriculture and Rural Development controlling all the higher level factors identified, the primary cause of losses is the lack of political willpower, which is a direct consequence of bad governance and corruption. This discussion revealed that despite the various policies that have been created the ruling elite are not committed to improving agriculture. Therefore, the failure to release funds for projects has led to the lack of adequate infrastructure (roads, processing facilities), low research and development, poor implementation of the policies created.

6.1.5 Summary of publication 5

This chapter started off addressing the gaps in food waste research. It identified that reports on food losses usually explore the causes of PHL in

low-income countries and food waste in middle/high-income countries, therefore, revealing a divide/gap where entire food chains were not studied. 'Follow the thing' research is similar, where a commodity is traced backwards from a western consumer to where it is produced in the global south to reconnect western consumers with the producers of their food. This divide stems out of the economic and development undertones that underline the way food waste has been studied for years, with the global south viewed mainly as a production zone and their consumers as too poor to waste food, so unworthy of being studied. Emphasis has also been placed on crops consumed in western countries. This article proposed that entire food chains be studied from farm to fork in low-income countries and follow the thing provides an adequate framework to go beyond the farm gate for postharvest research to capture consumption and everyday practices in the home.

The consumers in this study were disaggregated into low, average and above average economic groups. There was a preference for freshly prepared orange juice amongst all the groups (92% of the respondents) when compared to packaged orange juice. Consumers purchased fruits based on the qualities they identified that will bring them satisfaction – such as taste, colour, size and texture. In homes, oranges were used to prepare orange juice, smoothies and in baking to ensure that the fruits were consumed. However, consumers did not have proper knowledge on how to store their fruits at home and since they were consumed based on their moods, 52% of respondents disposed of fruits that showed early signs of deterioration. Some consumers went out of their way to purchase orange juice from four restaurants in Benue. The restaurants stated that there was a high demand for fruit juice. The choice to purchase the juice was hinged on issues of trust and hygiene. There was a sense that the preparatory process was unsanitary and unhygienic as most of it was produced manually and recycled bottles were used for packaging.

6.2 The bigger picture

The agricultural review in publication 4 of the Nigerian agricultural sector revealed the absence of political will power as the main cause of citrus losses in Nigeria. This is because along the citrus value chain – the shortage of processing facilities resulted in the actors incurring major losses that are estimated to range from 10-100%. With the absence of processing facilities all the fruits produced in Benue had to be consumed directly by consumers either whole or in the form of juice. This demand for fruits was dependent on the mood of consumers to consume fruits. That was the main reason for seasonal gluts and high losses in farms and markets. With the absence of storage facilities and the perishable nature of the orange, it could not be preserved for long periods of time before purchase. Likewise, with no processing facilities, excess fruits on farms and markets became waste. The oranges that were lost along the chain ended up in different places. The farmers harvested the oranges they were not able to sell and used them as manure by dropping them under their citrus trees. Intermediaries and traders that lost fruits during transportation left them by the roadsides. Roadside traders dug pits behind their selling stations and threw the oranges away. In markets, traders emptied their bad oranges in the skips provided by the waste collection facilities where all the market waste was disposed. This ended up in landfills at the entrance to the city.

Citrus trees were introduced into the Nigerian economy in 1920/1921 because they were identified to be of economic importance (Anon, 1920). Farmers, middlemen and traders were involved in citrus production because of its economic benefits but the losses incurred had significant impacts on their livelihoods. The revenue received by farmers was low, and they were unable to purchase fertilizers, pesticides and hire labour to ensure high yields. They received minimal profits but put in the most efforts in producing fruits. Direct consequences were the inability to send their children to school, or have enough disposable income to purchase all the items needed in their households including food. This influenced their

food security status and has been a major reason why the management of postharvest losses on the farm is particularly important (HLPE, 2014).

The trading of fruits was a major source of income for women, as they added this to the income of their households. Clarke *et al.* (2011) identified the trading of fruits as a significant source of income for women and had a positive influence on household food security. Some of the traders identified had no husbands and were the sole providers for their families. Despite the level of losses incurred by the traders they all claimed to be happy with the sales of oranges. This was a surprise finding, but the traders shared the view that the revenue generated had met several needs that had sprung up in their homes. Some traders had trained themselves through school with orange sales; others had been able to train all their children from the profits they received. This view was however not shared by the farmers, as they complained bitterly about the impact the losses had on their livelihoods.

Generally speaking, postharvest losses are focused on the farms and when it comes to the impacts on livelihoods, the small-scale farmers comes to mind first. With the absence of storage facilities in markets, losses incurred by traders and their impacts are also considered. However, the influence of losses on intermediaries rarely comes up in conversations or literature because they are viewed as exploitative, despite the significant role they play. They are filling up a gap the government has neglected, making it possible for farmers to sell their fruits albeit at lower prices and ensuring consumers have access to these fruits. When intermediaries incur losses, they lose the capital invested in purchasing the fruits and hiring the vehicles, which ultimately influences their livelihoods. On the other hand, they had more good days than bad days and recovered from their losses quickly, which was why they could afford to decide not to transport oranges during the seasonal glut where the profit made was relatively low compared to when oranges were not in season. The farmers, intermediaries and traders however agreed that the welfare and

livelihoods of the Benue populace would be increased if there were functional processing facilities.

It was identified that there was a market for fruits but the problem was the process of getting access to this market, in other words there was no value addition. According to Olife *et al.* (2015) the lack of value addition restricts the potential of the citrus value chain from being harnessed. The restaurants processing oranges into juice for consumers did this because they identified the demand as an untapped market for fruit juice. This demand is evident from statistics that show the quantity of fruit concentrates imported and the consumption rate of fruit juice. The rate of fruit juice consumption increases by 10% every year, in 2015 Nigeria consumed 50% of the fruit juice consumed in Africa (550 million litres). Nigeria produces fruits in abundance but the poor management of the horticultural sector has resulted in high postharvest losses and parallel importation of fruit concentrates amounting to 200 million USD yearly (FMARD, 2015). At the same time, the production value of citrus fruits produced in Nigeria is 1.7 billion USD (FAOSTAT, 2012). These are the reasons why the absence of political willpower is designated as the main cause of citrus postharvest losses. Further analysis reveals a shocking ignorance of the potential of this industry in three ways. First, this can be seen from the ATA and the APP value chain approach that excluded fruits and vegetables and the constant focus on only tomatoes and peppers in the perishables sector. Second, the exclusion by ATA and APP may result from the absence of research and development on postharvest losses in Nigeria. The National Horticultural Research Institute (NIHORT) was created to spearhead citrus research and development in Nigeria but they have not lived up to their expectations. As a result, there are conflicting figures on the level of production and loss estimates. Although NIHORT identified citrus as one of the crops significantly affected by postharvest losses (Onwualu, 2012b), there is very limited research on citrus postharvest losses in Nigeria. In other research institutions like the University of Agriculture in Benue, there was a shocking dearth of data on citrus postharvest losses, especially because Benue is the hub of citrus

production. This was and is attributed to little or no support from the Government in the form of funds for such research to be carried out.

Third, the lack of political willpower is the cause of the failure of the ban in 2002 on the importation of fruit juice. This ban was supposed to boost the growth of the horticultural sector by promoting the production of concentrates and fruit juice in the country. However, fifteen years down the line, Nigeria still imports 95% of its concentrates and has a rapidly declining horticultural sector masked by high postharvest losses. These are consequences of a harsh, hostile and political environment that pushes local and foreign investment away (Flake and Nzeka, 2009). This is worsened by the absence of stable power, where factories have to rely on the constant purchase of diesel to run their plants. This makes it difficult for them to operate and make a profit. This is why fruit juice producers will rather import concentrates at a lower tariff and process them into juice (Nwaoguji, 2017). That is why there are various facilities that have been constructed in Nigeria but are not functional.

6.3 Contribution to knowledge

Chapter 2 identified the lack of a uniform definition of food waste as a significant problem. This is because the study of food waste has become divided along lines of economics and levels of development, separating the FSC between the global north and south (Gille, 2012). Accordingly, postharvest losses are studied in low-income countries and post-consumer waste in middle/high-income countries. In the same way, commodity chains have taken the approach of tracing the trajectory of food from the western consumer to areas of production in low-income countries to reveal the hidden story behind the chain. In other words, whole value chains are not analysed; research starts with PHL in low-income countries, stops at the distribution phase, crosses over to a high income country and picks up food waste at the retail sector and then the consumer end. There is no room for post-consumer waste and the low-income consumer to fit into global food waste debates. Therefore, national value chains and crops that do not cross international borders are not

studied. Hence, there is more data on postharvest losses in low-income countries and no research on post-consumer waste. Likewise, there is more research on post-consumer waste in middle/high-income countries.

The wasting of food along supply chains is an inefficient use of resources, an integrated approach to the study of the food chain will require that stages are not studied in isolation but as a whole (HLPE, 2014). Lundqvist *et al.* (2008) suggest that efficiently managing one stage of the FSC does not manage the whole chain and the efforts will be negligent. That is why postharvest research has to go beyond the farm gate where other postharvest activities occur (Affognon *et al.*, 2015). In addition, when entire food systems are not studied, there is no explanation for why farmers do what they do (Oguntade, 2013).

With this in mind, this research aimed to address these gaps in literature. First, by walking the citrus value chain from farm to fork in Nigeria, it provided crop and region specific research on postharvest losses that included the consumer. The case and context specificity of commodity chain analysis allowed the horizontal and vertical aspects of the chain to be explored. In particular, the role of gender in activities actors performed was examined. The orange value chain was studied as a system; it revealed the key spaces, actors, relationships, activities, governance structures and the combination of factors and processes that caused losses. The simplicity of the chain allowed all aspects and actors to be engaged with. The process of following allowed the processes along the chain to be examined. It also captured socio-economic characteristics of the actors as well as the cultural and political elements that influenced the chain and market system. This research further showed the importance of studying national value chains as the globalisation of the food system has created longer food chains that side-line shorter chains, building on suggestions from Hughes and Reimer, 2004, Raghuram, 2004, Affognon *et al.* 2015.

Second, postharvest research has focused more on farmers with less emphasis on intermediaries and traders. This thesis used the 'follow the thing' approach to trace the journey of the orange beyond the farm gate: in

transit, market and the consumers' home. This showed that major losses were occurring after the farm gate and they had impacts on the livelihoods of the actors in those spaces. It also identified the synergistic/cumulative effect where activities on the farm combined with factors in transit to reduce the shelf life of the oranges in markets and the home. This thesis further proposed that follow the thing be adopted as a method for studying postharvest losses, because it followed the orange to reveal its 'community', providing applied research that is absent in the scholarship on postharvest losses.

Third, it addressed a crop that is widely grown but has received minimal attention in research. The focus on grains and tomatoes in Nigeria has resulted in the exclusion of other crops. This analysis showed that citrus is an important economic crop to actors and the economy and the citrus industry is an untapped opportunity. Fourth, it explored post-consumer waste by focusing on consumer preferences for fruits. This aspect of the research investigated a novel area and showed that consumers in low-income countries are no different from western consumers, where their preferences for certain quality attributes dictate shopping and waste patterns. Walking the chain to the consumers' homes contributed a significant aspect to the story behind the citrus value chain.

This thesis relayed the journey of an orange in the form of stories, it attempted like Cook *et al.* (2006) and Clapp (2012) suggested telling the story in a way that is attractive to consumers. To follow the journey of the orange from farm to fork, this thesis adopted a multi-method approach and used questionnaires, interviews, online surveys, observations, photographs and a research diary. The methods chosen were influenced by the aim and objectives of the study (Grolleaud, 2000). This also impacted the sample selected from farmers to consumers. The thesis was targeted at understanding the causes of losses; as a result I needed to capture social, economic, political and everyday practices that drove losses. This could only be achieved with a mix of the above methods, as they provided an exhaustive understanding to the research problem.

6.4 Recommendations

Based on the findings detailed in the empirical chapters, the following recommendations are suggested for the management of postharvest losses in Benue State and Nigeria in general.

6.4.1 Increased political and institutional will power

The study revealed that the absence of political will power was the main cause of losses. This was because of the absence of processing facilities and the neglect of the horticultural sector, especially citrus fruits. To address the issue of postharvest losses in Nigeria there has to be a radical shift in the way the Federal Government views and handles agriculture; in the sense that there has to be more commitment to improving the agricultural sector. First, agricultural policies have to be created that include realistic targets and objectives for the management of postharvest losses. Qualified personnel ought to be placed in areas of power to ensure that at the Federal, State and Local Government level all hands are on deck to improve value addition along the chain and reduce postharvest losses. In addition, annual budgets should increase the allocation of resources to agriculture to encourage the effective implementation of policies.

Second, the Federal Government must provide infrastructure in the form of road networks, storage and processing facilities, or encourage public-private partnerships with the private sector. There is a need to also revive moribund industries in Benue and other states in Nigeria for the management of postharvest losses. The government will need to make drastic changes in restructuring the manufacturing industry to provide an enabling environment for businesses to thrive such as working towards the provision of stable power and the removal of strict policies (i.e. provision of foreign exchange) that create high manufacturing costs. At the same time, the import tariff on concentrates and premixes should be increased to discourage the importation of concentrates, so that the intended benefits of the ban in 2002 will be materialised. The funds currently expended on importing concentrates can be diverted to revive

the horticultural sector in Nigeria, to improve the livelihoods of small-scale farmers, rural development and national development.

The current recession in Nigeria (caused by the low prices of oil since 2014) (Martin, 2016) has caused the Federal Government to consider diversifying the economy away from oil dependence and improving other sectors like agriculture. This renewed interest in agriculture should carefully consider the management of postharvest losses, as previous policies have failed to consider reducing PHL. Resources should not be assigned only to increasing production but the management of losses from farm to market.

6.4.2 Increased funding for research and development

The policies on postharvest losses need to be guided by research that takes into consideration the various factors affecting losses in Nigeria. This study revealed that there was minimal research and development on agriculture in Nigeria, resulting in a dearth of postharvest research where production levels, amounts sold and lost are unknown. Baseline studies need to be conducted to trace commodity paths, in order to ascertain how much was produced, sold and lost at different points along the chain. Postharvest losses should be studied as a system, within national value chains and take into consideration socioeconomic, cultural, environmental and political factors that influence losses. Available data is focused on improving agricultural production but there has to be an expansion to accommodate the study of postharvest activities beyond the farm. There is also a focus on grains or tomatoes and peppers, ignoring other crops like citrus that are widely produced by large proportions of small-scale farmers.

This thesis also identified that agricultural institutions were unable to study postharvest losses because it was too expensive to carry out such surveys. Agricultural institutions have to be properly funded to carry out required activities and research such as baselines surveys. These surveys should be community based and consider local knowledge from the actors

directly involved and experiencing losses so that adequate solutions are provided.

The government needs to support the creation of a national database for agricultural research. This study suffered from the lack of available data on Nigeria, this is largely because of the absence of data collection. This study revealed that actors involved were willing to provide the required information; therefore the research culture in the country needs to be improved. This will include agricultural institutions demanding that adequate data is collected for various crops at different points along the chain, so that reliable information is available. At the same time, available data in paper formats ought to be converted to electronic versions so that there is a national collection of agricultural research.

6.4.3 Public education and sensitisation

It is recommended that the Nigerian populace including government officials are educated on postharvest losses: what they are, how and why they occur and the importance of their management. This is very important, as an attitudinal change is required to stop individuals from seeing excess rotten fruits as a normal thing but rather a problem that needs to be managed. For government officials as well, they will be able to walk commodity chains and identify areas of inefficiency within the food system. For farmers, intermediaries, traders and consumers they should be educated on how to manage food produced and purchased for consumption, at different points along the chain. The media will play an important role here, as public education can be carried out via radio stations and on television programmes. This is how waste management officials are able to educate Nigerians about floods and so can be explored for disseminating agricultural information. In addition, the curriculum in primary and secondary schools should include entire food systems and not focus on only production.

6.4.4 Inclusion of low-income consumers and entire value chains into food waste and commodity chain research

On a broader scale, this thesis indicated the importance of studying entire value chains and the inclusion of low-income consumers into food waste and commodity chain research. This allows for entire value chains to be studied in order for losses and waste within geographical locations to be explored. Postharvest loss research will benefit from the exploration of losses using the 'follow the thing' approach to capture and accommodate all enabling factors that cause losses. As Hughes and Reimer (2004) and Raghuram (2004) proposed, the study of commodities chains must not be focused on globalised agriculture as low-income countries produce for their own consumption. Entire food chains within national contexts have to be studied to avoid viewing production and consumption as two separate themes, but rather as various points in a system and to recognise that low-income country consumers are worthy of being studied.

6.4.5 Agreement on a uniform definition of food waste

The absence of a uniform definition of food waste was identified as a major problem with food waste research as it enabled the study of postharvest losses and post-consumer waste as two separate discourses. It also makes the comparison of available data difficult. As stated earlier, the food system needs to be studied as one, with greater emphasis placed on areas with higher losses and waste rather than as two separate themes in the global north and south, because losses occur along the value chain from farm to fork in various countries. Therefore, researchers have to agree on a uniform definition to promote more informed food waste research.

6.5 Limitations of the study

In Chapter 2, questionnaires and surveys were critiqued for their use in postharvest research, as they require chain actors to remember past events and activities that may not give a true picture of the problem. These methods were however used and the challenge of having actors not remember past events was experienced. The farmers, intermediaries and

traders did not keep written records of how many trees they had or how much was produced/purchased, sold and lost.

Although the quantification of the losses was not the primary aim of the research, being able to adequately capture the quantitative losses would have boosted the credibility of the figures. As a result, the quantitative results have to be cited with caution in relation to the research. The research methods also restricted the sample size of the actors, as a larger sample may have provided more views on postharvest losses. The identification of farmers, intermediaries and traders was very challenging; there are no maps to pinpoint their locations so we had to drive round the LGAs to locate them, which was challenging and time consuming. This was particularly difficult for intermediaries, who did not have constant waiting points. In addition, the use of online surveys for the consumers did not adequately capture their behaviours.

The language barrier may have also played a part in the quality of data. My research assistant was more fluent in Tiv and communicated with the farmers that did not speak good English. As a result, I missed out on some of the conversations that would have aided the analysis of transcripts. The translation of the interviews to English may not have captured the intended meaning in the original conversation.

6.6 Further research

During the course of this research, two declarations were made by the African Union in 2014 and United Nations in 2015 in regards to postharvest losses. The former is aimed at reducing losses by half in 2025 and the latter by 2030. Postharvest loss research as pointed out in this thesis is critiqued for lacking research on various crop value chains in different geographical regions that take into consideration prevailing conditions such as socio-economic, cultural and political factors. As a result, future research will benefit from focusing on understanding why losses occur across a variety of supply chains to avoid generalizations. Postharvest literature comprises more of quantitative data that reveals

gaps on where losses occur, in the sense that there is emphasis on certain crops, or on the farm, with less research on nationally important crops or the quantification of losses during transportation or in markets. One aspect this research could not provide was adequate data on the magnitude of losses. Previous research had debateable figures on the level of losses and production and this thesis was focused on understanding the qualitative causes of losses. Accordingly, research that will quantify the magnitude of losses along the citrus value chain and other crops is required to bridge literature and data gaps. With the absence of reliable baseline data and estimates on losses, it is very difficult to see how these declarations can be achieved.

Another important area that is under researched is the end life of oranges. This research revealed that the farmers used the oranges as manure, while intermediaries and traders disposed of the bad fruits by the roadside or in landfills. With the large quantities of fruits wasted, it will be beneficial for research to highlight other potential uses of the fruits that may result in a source of income for different actors along the orange value chain.

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Appendices

Appendix 1

BENUE STATE CITRUS FARMER QUESTIONNAIRES

Date:

SECTION A – IDENTIFICATION

1. Zone: ……..
2. Local government: ……..
3. Village: ……
4. Respondents phone number: ……

SECTION B – DEMOGRAPHIC/ SOCIOECONOMIC CHARACTERISTICS

5. Gender
   a) Male [ ] b) Female [ ]
6. Age group
   a) < 20 [ ] b) 20 -29 [ ] c) 30 -39 [ ] d) 40 – 49 [ ] e) 50- 64 [ ] f) > 65 [ ]
7. Marital status
   a) Single [ ] b) Married [ ]
8. Level of education
   a) No formal education [ ] b) Primary [ ] c) Secondary [ ] d)Tertiary [ ]
9. What is the size of your farm?
   a) < 1 hectare [ ] b) 1 – 4 hectares [ ] c) 5 – 9 hectares [ ] d) > 10 hectares [ ]
   i. How many tree stands do you have on your farm?……
10. How did you acquire your farm land?
    a) Inherited [ ] from who? …… b) Purchased [ ]
    b) Leased [ ] d) Others [ ] Please specify ……..

11. What crops do you grow?

……..

SECTION C - PRODUCTION

12. How long have you been involved in orange production?
    a) Years …… b) Months ……
13. Why did you decide to produce oranges?

……

……

14. What varieties of orange do you produce?

……

……

15. Why did you decide on the above varieties?

……..

16. Did you get advice on which varieties to produce? Yes [ ] No [ ]
    a) If yes from who?

    ……

17. If you weren't growing oranges what commercial crops will you grow?

……..

18. What is your annual income?

……...

    a) How much of this comes from orange production?

    ……

19. What is your source of labour?

……..

20. Do you irrigate your orange trees? Yes [ ] No [ ]
    a) If no why?

……

……..

21. Do you apply fertilizers to your crops? Yes [ ] No [ ]
    a) If yes what types?

    ……

b) What crops do you apply them to?

……..

c) How much do they cost?

……..

d) Where do you get them from?

……..

22. Have you considered organic certification? Yes [ ] No [ ]

23. Do you apply pesticides to your crops? Yes [ ] No [ ]

a) If yes what types?

……..

b) What crops do you apply them to?

……..

c) How much do they cost?

……..

d) Where do you get them from?

……..

24. Are you aware of any orange growing cooperatives? Yes [ ] No [ ]

a) If yes which ones?

……

25. Are you aware of any orange production policies? Yes [ ] No [ ]

a) If yes which ones?

……

26. How do you determine when oranges are mature for harvest?

……

……

27. How do you harvest your oranges?

……

……

28. Estimate the amount of oranges produced on your farm

a) Sacks 100kg [ ] 50kg [ ] how many?

……

b) Others [ ] please specify…… How many?

……

29. Estimate the number of orange fruits contained in one of the units stated in Q 28 ……

30. Do you harvest the same quantity of oranges every year? Yes [ ] No [ ]

    If no why?

    ……

    ……

31. What do you do with oranges harvested from your farm?

    ……

    ……

32. If sold, where do you sell them?

    ……

    ……

33. If sold in markets how far is it?

    ……..

    a) How do you transport the oranges?

       ……

    b) How much does it cost?

       ……...

    c) Do you sell all the oranges taken to market?

       ……...

    d) If no what happens to what remains?

       ……

       ….……

34. For how much do you sell the unit of measure in Q 28 when production is high? ……...

    a) Does the price depend on the variety?

       ……..

35. For how much do you sell the unit of measure in Q 28 when production is low? ……

    a) Does the price depend on the variety?

       ……..

SECTION D – CAUSES OF POSTHARVEST LOSSES

36. Do you encounter losses? Yes [ ] No [ ]

a) If yes where do these losses occur?

……

……

……

b) What causes the losses?

……

……

……

……

c) Estimate the amount of losses based on your production

……

……

……

d) What happens to the losses?

……

……

……

e) Where do you dispose of them?

……

……

……

f) Is there a difference in the amount of losses when production is high or low?

i. Yes [ ] No [ ]

ii. If yes, why?

……

……

g) How do you prevent the above losses in subsequent seasons?

……

……

37. How do you store your oranges after harvest?

……

……

38. How long do the oranges last with the above storage method?

……

……

39. What other problems do you encounter with citrus production?

……

……

……

……

Appendix 2

INTERMEDIARIES INFORMAL INTERVIEW QUESTIONS GUIDE

1. How long have you been in this business?
2. Where did you get the oranges from?
3. How long have they been here?
4. How are the oranges packed? What size of bag?
5. Do you know how many orange fruits fit inside the above bag?
6. Where are you taking the oranges too? What other states do you transport oranges?
7. How much do you buy oranges for from the farmers when production is high and low?
8. What is the price difference with the varieties?
9. How much do you sell the oranges for at your destination? When production is low and when production is high?
10. What is the least amount you've sold oranges for in market?
11. What kind of vehicle do you transport them in?
12. How much do you pay for transportation?
13. How long does it take to get to your destination?
14. Have you had problems of your car breaking down while transporting the oranges?
15. Do you encounter losses?
16. What do you do with the losses?
17. What do you think can be done about this waste?
18. Which of the markets is the most profitable and why?
19. What other problems have you encountered in this business?
20. Have you heard from Teragro? If yes have you supplied to them or considered supplying to them?

Appendix 3

CITRUS TRADER QUESTIONNAIRES

Date:

SECTION A - IDENTIFICATION

1. Zone: ……..
2. Local Government: ……..
3. Village: ……
4. Market: ……

SECTION B – DEMOGRAPHIC/ SOCIOECONOMIC CHARACTERISTICS

5. Gender
   a) Male [ ] b) Female [ ]
6. Age group
   a) < 20 [ ] b) 20 -29 [ ] c) 30 -39 [ ] d) 40 – 49 [ ]
   e) > 50 [ ]
7. Marital status
   a) Single [ ] b) Married [ ]
8. Level of education
   a) No formal education [ ] b) Primary [ ] c) Secondary [ ]
   d)Tertiary [ ]

SECTION C- SALES

9. What crops do you sell?
   ……..
10. How long have you been selling oranges?
    ……..
11. What varieties of orange do you sell?
    ……..……
    ……..
12. Why did you decide to start selling oranges?

……

……

13. Do you sell oranges all year round?

……..

14. Where do you get your oranges from?

……..

a) How far is it? ……..

b) How often do you get oranges for sale?

……

……

c) How many oranges do you get at a time?

i. Sacks [ ] how many?

……

ii. Others [ ] how many?

……

iii. Estimate the amount of oranges in the above unit

……..

d) How are they transported?

……..

e) How much does it cost?

……..

15. How do you store your oranges?

……..

a) How long do they last with the above method?

……..

16. How much is the above unit when production is high?

……..

17. How much is the above unit when production is low?

……..

18. Are the above prices based on variety?

……..……

……..

SECTION C – CAUSES OF POST – HARVEST LOSSES

19. Do you incur losses? Yes [ ] No [ ]
    a) What causes the losses?

       ……

       ……

    b) Where do they occur?

       ……

       ……..

    c) What happens to the losses?

       ……

       ……

    d) Where do you dispose them?

       ……

       ……

    e) How do you prevent the above losses?

       ……

       ……

20. Do you sell all the oranges you receive before they get bad? Yes [ ] No [ ]
    a) If no what happens to what remains?

       ……

       ……

21. What other problems do you encounter with the sale of oranges?

    ……

    ……

    ……

    ……..

22. If you weren't selling oranges what crops would replace them?

    ……..

Appendix 4

ACADEMIC/FRIENDS INTERVIEW QUESTIONS GUIDE

1. What are your thoughts on the level on postharvest losses in Benue? What about horticultural losses – to be more specific oranges?
2. Benue is the number 1 producer of citrus in West Africa and Nigeria the 9th highest producer of citrus in the world. Despite the amount of oranges produced in the state a whole lot of oranges go to waste – what infrastructural and political frameworks can be put in place to manage the losses and ensure that most of what is produced actually gets consumed?
3. The lack of a market for citrus fruits is one major problem faced by citrus farmers, middlemen and traders –how can a market network be created so that farmers easily have access to consumers and vice versa. And how can moribund industries in the state be revived?
4. Transportation is one very important phase of the value chain – how do we improve the transportation sector? For example you travel from here to Abuja you see so many bad trucks on the road heaped up with sacks of food – perishables go bad before they get to their destination. What can be done about this?
5. Also issues of corruption and payment of produce on the way is something that has come up with transportation – how can this be curtailed?
6. How can the citrus value chain in Benue be improved, i.e. How do we add value to our oranges as they travel from farm to fork?
7. How can agriculture be made appealing to youths?
8. How can research and development in the agricultural sector be promoted so that there is an account of how much is produced, consumed and also wasted?
9. What baseline measures can be put in place so farmers are rewarded adequately for their labour and minimize the secondary problems associated with middlemen?

10. Do you think the externalities of food production are something we should be worried about with the level of postharvest losses in the country/world? We talk about increasing food production in year 2050 with the use of finite resources and right now we waste about 40% of what we produce in the post handling phase. Do you think we should be talking about increasing food production or managing what we have now to feed the coming generations? Linking with managing the whole value chain as one – do you think food waste at the fork is something we should be worried about in Nigeria?
11. How can we boost our economy with agriculture? The fall in oil prices over the past months has shown that we cannot rely on oil anymore so what measures can be put in place to take agriculture to the level where it ought to be so that farmers and the entire populace is benefitting from agriculture?
12. What role can the private sector play in all of this – in what way can we be involved to manage postharvest losses?
13. What grassroots approaches can be used to revamp the agricultural sector and how can political willpower be increased for agricultural advancement in Benue and Nigeria?

Appendix 5

INTERVIEW QUESTIONS FOR THE COMMISSIONER FOR AGRICULTURE

1. What is your role as the Commissioner for Agriculture?
2. The Benue State blueprint has a goal to improve food security, create opportunities for gainful employment, and reduce poverty in the agricultural sector. To what extent has that goal has been achieved?
3. Tractors and fertilizers were distributed to farmers in Benue state, how were they selected?
4. The Benue State blueprint also states more food-processing factories are going to be established has any of that been done?
5. On a lower level, if you go to the markets there's a lot of waste, with fruits like oranges, mangoes and tomatoes readily disposed, how has that been managed by this administration? And what could be done to reduce the level of losses.
6. Its so hard to get data on the amount of food that is produced and wasted, how can this issue
7. As for food security how do you think we can address the access to food to the local man?
8. What advice do you have for the next Commissioner for Agriculture?

Appendix 6

INTERVIEW GUIDE FOR TERAGRO

1. Tell me about Teragro. Company size? Who is the market? Production capacity – plans to expand? Export oriented? Have they thought about fruit juice in the future?
2. What is the vision of the company?
3. How does that fit into the vision of development, food security and managing postharvest losses in Our Benue Our future blueprint?
4. Where oranges are sourced from (local governments)? What are the company standards based on the types of oranges? The amount that is bought and how it favours farmers? Daily production – how oranges are stored and forecasted?
5. How the cold chain is managed before it gets to customer?
6. Competitive advantage over California fresh?
7. What are the by-products from production? How the waste will be managed? Where it will be disposed/what will be done with it?
8. What health and safety standards exist and how they are enforced? What certification to have to operate?
9. What can be done about the amount of food waste in Benue? Moribund food industries – government failed projects?
10. On a broader scale what can Benue do to curb food insecurity in the state and Nigeria?

Appendix 7

CONSUMER INTERVIEW QUESTIONS GUIDE

1. What is the consumers' gender? Age group? Occupation? Religion?
2. Does your diet include regular consumption of fruits and vegetables? How often do you purchase them?
3. Where do you purchase your fruits and vegetables from?
4. Tell me about a shopping trip for fruits, oranges.
5. What are our expectations of the quality of fruits and vegetables?
6. Describe the perfect orange to me – colour, shape, size. How often do you purchase oranges? All year round?
7. If Muslim – how does the Ramadan fast affect your fruits purchase? Oranges?
8. For Christians – do the Christian holidays impact the level of fruits purchased? Oranges?
9. How do you store fruits and vegetables? Oranges?
10. What do you do with oranges at home?
11. How long do they last when you purchase them? Do you normally consume all of the oranges that you buy? Other fruit veg???
12. If not consumed what happens to them? If not consumed where are they disposed?
13. Do you go out of your way to purchase orange juice or smoothies from restaurants? Why?
14. Are you aware that Benue produces a lot of oranges? Have you noticed the level of losses in the state? Does it bother you? What do you think we can do about it? Private and public roles? Do you worry about the impacts on farmers and traders?
15. Do you ever throw food away in your home? If yes, does it bother you? Why/ what characteristics influence this act? Where do you dispose of food?
16. Do you think about the impacts of food waste on the environment when you get to throw food away?
17. Do you think of the economic implications of your waste?

Appendix 8

RESTAURANTS INTERVIEW QUESTIONS GUIDE

1. When did you start producing fresh orange juice for sale? Why did you start? Apart from orange juice what other juice do you sell?
2. Do you make orange juice and smoothies everyday? Is it on demand? Or produced and stored in the fridge? If yes how do you manage the power situation?
3. What is the preparatory process like?
4. How do you package the fruit juice?
5. Is it all consumed at the end of the day? If not what happens to what remains? How would you describe patronization?
6. How do you sell the orange juice? Per cup? Bottle? And how much is it?
7. What is the quantity of oranges you purchase and how often? How much do you purchase a sack? Basket? How do you forecast demand? Where are they purchased? How are the oranges stored?

Appendix 9

FRESH FRUIT AND FRUIT JUICE CONSUMPTION IN NIGERIA

SECTION A – SOCIOECONOMIC CHARACTERISTICS

1. Gender
   a) Male [ ] b) Female [ ]
2. Age group
   a) < 20 [ ] b) 20 -29 [ ] c) 30 -39 [ ] d) 40 – 49 [ ] e) 50- 64 [ ] f) > 65 [ ]
3. What is the highest level of education you have completed?
   a) Primary [ ] b) Secondary [ ] c) Tertiary [ ] d)Postgraduate [ ]
4. What is your occupation?
   a) Unemployed [ ] b) Student [ ] c) Civil servant [ ] d) Business man/woman [ ]
   e) Self employed [ ] f) Retired [ ] d) Other [ ] Please specify ……
5. What is your occupation?
   a) Low (≤ N50,000/month) [ ] b) Average ≤ (N100,000/month [ ]
   c) Above average > 100,000/month [ ]
6. In what state do you live? ……

SECTION B – CONSUMPTION OF FRUITS

7. How often do you include oranges in your diet?
   a) Daily [ ] c) Weekly [ ] e) Monthly [ ]
   b) Every other day [ ] d) Fortnightly [ ] f) Other ……..
8. What other fresh fruits do you consume (in order of preference)?
   ……
9. How often do you purchase fresh fruits?
   a) Daily [ ] c) Weekly [ ] e) Monthly [ ]
   b) Every other day [ ] d) Fortnightly [ ] f) Other ……..
10. Where do you purchase fresh fruits?
    a) Fruit markets [ ] c) Roadside traders [ ] e) Other …….
    b) Supermarkets [ ] d) Hawkers [ ]

11. What qualities (at least two) do you look for when purchasing fruits?

    ……

12. Describe the perfect orange (colour, size, texture)?

    ……

    ……

13. How do you store your fruits at home?

    ……

14. Do you consume all the fruits you purchase? Yes [ ] No [ ]
15. If no, what happens to the leftovers?

    ……

SECTION C – FRUIT JUICE CONSUMPTION

16. Rank the drinks below in order of preference

	Most preferred	Like	Neutral	Do not like
Water				
Soda or carbonated drinks				
Fresh fruit juice				
Packaged fruit juice				

17. What fruit juice is your favourite?
    a) Orange [ ] c) Pineapple [ ] e) Mixed fruit [ ]
    b) Apple [ ] d) Mango [ ] f) Other ……
18. Do you prefer fresh orange juice to packaged orange juice?
    Yes [ ] No [ ]
    a) Why? ……
19. What brand of orange juice do you purchase?
    a) Chi Limited [ ] c) Coca-coal (5-alive) [ ] e) Other …..

b) Dansa [ ] d) Fumman [ ]

20. Why do you prefer the above brand?

……

21. How often do you purchase orange juice?

a) Daily [ ] c) Weekly [ ] e) Monthly [ ]

b) Every other day [ ] d) Fortnightly [ ] f) Other ……

22. Do you prepare fresh orange juice at home? Yes [ ] No [ ]

23. How do you store it and for how long?

……

24. Do you purchase fresh orange juice from external sources (e.g. fast foods, supermarkets and hotels)? Yes [ ] No [ ]

If no why?

……

25. Do you consider the health and safety procedures attached to the production of fresh orange juice from external sources?

a) No – I do not think about it

b) No – I think about it but do not care

c) Yes – I think about it and it bothers me

d) Yes – I think about it and it does not bother me

26. Do the holidays/festivities impact the quantity of fruits/fruit juice purchased and how?

……

……