South-South Cooperation: An analysis of agricultural knowledge-transfer implementation influencing smallholder food losses

An analysis utilising the case of Kenya and Ghana

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Abstract

As climate effects and concerns increasingly grow, so the difficulty in providing adequate food security to an exponentially growing global population increases. Whilst in the Global North rates of high food waste by consumers grow, in the Global South and Sub-Saharan Africa in particular food losses post-harvest from farm to market grow exponentially. This dissertation develops a workable definition of food loss, explores food losses and agricultural knowledge-transfer implementation, highlighting the limitations, implications and recommends for further research. The research methods consisted of a wide review of relevant literature from numerous sources on food loss and South-South cooperation in Kenya and Ghana, along with the collection and analysis of the literature. The findings from this research show that food losses are significant in sub-Saharan Africa, and South-South interventions are not targeting these African issues, appearing more self-interested. This dissertations holds that central to effective agricultural knowledge-transfer implementation is the synthesis of the top-down and bottom-up approaches, and training courses which are of benefit to smallholders in terms of mitigating food loss in both countries. This dissertation suggests such an approach, through development in basic infrastructure (roads and electricity).

Key words: South-South cooperation, Food loss, Agricultural knowledge-transfer implementation, agricultural governance, agricultural globalisation, smallholders, Kenya, Ghana

1. Introduction

1.1 Background

Post-Harvest food losses (PHL) in on the African continent are of increasing concern with a rapidly growing population, in Kenya and Ghana they comprise of an estimated 30-50% of production at various points in the value chain (United Nations, 2015, xxi). Most of these losses occur mainly at early stages of the food value chain on smallholder farms. However, few smallholders in the chain possess the required knowledge to mitigate the prevailing losses. The issue is complicated further due to the fact smallholders consume what they produce, therefore, food losses and waste are interlinked. The prevalent method consists of a combination in some states of both Kenya and Ghana of differing levels of commercialisation domestically and South-South cooperation.

In an annual assessment of global hunger in 2013 the Food and Agriculture Organisation (FAO) of the United Nations reported:

> *"The world produces enough food to feed everyone" (EIU, 2014). However, it is estimated that at the same time some 870 million, suffer from chronic undernourishment (EIU, 2014). Most food losses primarily occur at the beginning of the food supply chain (food supply chain). This is at the production, post-harvest and processing stages, where food intended for consumption is destroyed degraded or otherwise unused (EIU, 2014).*

Losses have a significant negative effect on food security, reducing the availability of nutritious food. At the very minimum food losses represent a wastage of precious resources, such as land, water, labour and power. In addition to this, they represent serious structural deficiencies in the food supply chain.

Weaknesses in food supply chain's mean food is less accessible physically and economically, it is often the most vulnerable who are affected (EIU, 2014). Very often the most vulnerable on the continent are smallholders. The Ministry of Food and Agriculture Sector Development Policy (FASDEP II), claim that family-operated smallholder farms account for nearly 80% of Ghana's total agricultural output alone (Arthur et al, 2017).

At a basic level, food loss indicates serious structural agricultural infrastructure needed for food security. Agricultural governance in Kenya and Ghana is primarily top-down in terms of government programmes, increasing agricultural knowledge is being globalised. There is limited bottom-up or vertical interaction, however, these often come in the form of civil society, and private sector agribusiness programmes. Nonetheless, Policy announcements across the continent support the broad commercialisation of the agricultural sector as well as more targeted policies including crop diversification and improved grain sector management (UN, 2017).

Since this research observes that Post-harvest food losses in Kenya and Ghana consist of around 30-50% of production by case study analysis. This research holds that a synthesis of ‘top-down’ government led and ‘bottom-up’ smallholder, private agribusiness approaches are required in order to decrease losses for smallholders in Kenya and Ghana. This research holds that this will lead to a decrease in PHL and the effect can accurately be measured by percentages.

1.2 Research Focus

There are many uncontrolled variables which influence agricultural governance in both countries the main ones being; agricultural globalisation and outside state involvement, increasing climate change pressures, and desertification. The main focus of this research are agricultural globalisation, more specifically the globalisation of agricultural knowledge-transfer implementation through the framework of South-South cooperation and its influence on smallholder food losses. Developing countries such as Kenya and Ghana have a choice of opening up agricultural markets through globalisation, and attempting to synthesise top-down and bottom-up domestic policy approaches, however, they have nominal control over policies enacted from outside their borders. Developing countries also can also protect their markets allowing disjointed governance approaches. Allowing for two unique outcomes.

1.3 Research aim and individual research objectives

The central research aim is to examine smallholder food losses from a new perspective. At present, most studies have focused on what technologies can be implemented in sub-Saharan Africa to reduce food loss in the context of South-South cooperation. In this research study, the focus shifts to whether the how the policies are implemented (top-down, bottom-up or synthesis of the two) and whether the knowledge transferred is suitable for individual countries. Is it manageable? Does it solve inherent food loss problems that exist for smallholders?.

2. Literature Review

2.1 Introduction

This literature review will examine the main issues surrounding the mitigation of Smallholder Post-Harvest Food losses in sub-Saharan Africa, impediments to successful knowledge-transfer implementation in relation to agricultural governance and the transfer of new knowledge that is being transferred from other states in the global South, namely China, Brazil and India. The trio are widely involved in agricultural knowledge-transfer implementation across the sub-Saharan Africa. For a comprehensive analysis this research will focus primarily on Chinas' role within the framework of South-South cooperation.

The study within this literature review primarily focuses on objective 1, 2 and 3 below. Objective 3 and 4 will be met by empirical data collection and analysis, objective 5 is derived as a result from the findings of all 5 objectives.

The five objectives:

1) Defining Food loss and Food Waste
2) Defining and discussing Implementation
3) Critically analysing the globalisation of agricultural knowledge, knowledge-transfer and governance
4) Exploring Food Losses, and the drivers and barriers
5) Emerging issues and the need for empirical research.

By taking an exploratory approach of the above objectives, a significant contribution will be made to the research. Discussing how food loss and food waste is defined is critical to understanding food security. This research will undertake a critical analysis of the current literature that exists around the globalisation of agricultural knowledge, agricultural knowledge-transfer in the context of South-South cooperation, and agricultural governance.

Comparably, an assessment will be undertaken of current food loss literature in the two countries. The forces driving food losses in sub-Saharan Africa will be examined, such as the presence of knowledge gaps from state to state within countries and the dissemination of knowledge between smallholders and decision makers. Predominantly, an assessment of South-South cooperation in the context of the globalisation of agricultural knowledge-transfer and governance will be conducted, with relation to the domestic implementation of agricultural knowledge on and its analysis on smallholder post-harvest food losses.

The aforementioned literature areas will provide a structured, substantial discussion and critical analysis of smallholder post-harvest food losses in Kenya and Ghana.

Furthermore, this review will outline and analyse how agricultural knowledge is transferred.

At the end of this literature review it is anticipated that a critical understanding of the key issues will have been presented, furthermore, it is expected the reader will be better informed in these areas and that a clear focus will emerge, and importantly that there will be justification, for empirical research in the field of post-harvest food losses.

2.2 Defining Food loss and waste

Many definitions of food loss exist, the majority of which includes terminologies that differ markedly, however, all of which are being used by various actors and stakeholders in the global food system. In some cases the definitions are the same, but different terms are used, or sometimes the terms are the same, but their meanings can slightly different (ThinkEatSave.org, 2015). It is important that throughout this analysis, these definitions are acknowledge and kept in mind. Food waste is a part of food loss, however, there are additional complexities such as the fact there is no sharp distinction on just where the jurisdiction resides.

Three definitions of food loss are identified in the literature. First, Barrett and Sheahan (2017) find that in most work on the topic, food loss refers to anything lost by producers or in distribution (Sheahan and Barrett, 2017, cited in Bade Gorter, 2014). However, new work by Bellemare et al. (2017) challenges these existing definitions using a food life cycle approach (Barrett and Sheahan, 2017, cited in Bellemare et al, 2017).

The second definition is rather broad as the FAO defines food loss “the decrease in quantity or quality of food” (FAO, 2014). Whilst being succinct this definition lacks the needed complexity to define food loss. A major shortcoming of this definition is the context, insofar that the definition can be applied too broadly, for example; at the point of consumption by consumers. At certain stages in the food supply chain, a food waste definition would be more apt.

Four definitions of food waste can be found in the literature. First, de Gorter (2014) states that food waste refers to anything lost at the consumer level (Barrett and Sheahan, 2017, cited in de Gorter, 2014). Indeed, whilst this definition is simple to conceptualise and has the benefit of brevity, this definition is categorised as anything lost at consumer level. Rural smallholders in SSA routinely function as both producers and consumers, the jurisdiction between the two is problematic.

A second more comprehensive definition covers all points in the food supply chain and is provided by the Food and Agriculture Organization (FAO) which defines 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 (FAO, 1981). This comprehensive definition is well rounded and covers producer and consumption losses at smallholder level, which smallholders face in both cases presented.

A third definition in extension to that of the FAO is that of Stuart (2009) stating that food waste should also include edible material that is intentionally fed to animals or is a by-product of food processing diverted away from the human food chain (Papargyropoulou et al, 2014).

Finally, Smil (2004) suggests that food waste covers the definitions above, but adds over-nutrition, the gap between the energy value of consumed food per capita and the energy value of food needed per capita (Smil, 2004).

In terms of the Kenya and Ghana cases, Stuart's definition is the most comprehensive due to it being applicable to producers and consumers, which we identified smallholders as categorically. Furthermore, it takes into account edible material that smallholders often feed their livestock. Around 50% of the total labour force in Kenya is engaged in livestock production alone, mixed crop-livestock farming, livestock and crop production are an integral component (Ayako et al, 2015). However, it is important to note that there are differences between food loss and food waste, even if they are somewhat obscure.

2.2.1 Defining and discussing Implementation

Defining policy implementation is highly contested, and unlike food loss where the main differences are with terminology and categorisation, the very deed of what counts as policy implementation is contested. The definitional contestation exists due to a conflict, and natural evolution of perspectives through time, for example; an actor may hold a view that policy is primarily implemented from the top-down, bottom-up or indeed they may hold a synthesis of these perspectives.

Indeed, such contestations and evolution are clear from Pressman and Wildavsky's (1973) seminal piece, as they initially defined implementation as a process 'to carry out, accomplish, fulfil, produce, complete' (Pressman and Wildavsky, 1973, p.xxi). Key issues were identified right from the beginning such as the emergence of unexpected decisions, and the necessity of two decision paths in order to achieve the program goals; and within each path, the agency found that the number of decisions and clearances required was constantly growing (Pressman and Wildavsky, 1973, p.112). In this case, there was no study or inclusion into the policy implementation process of bottom-up actors, even the factoring of unintended consequences as Pressman and Wildavsky have discussed was limited in the initial policy (Morris, 2018). Such concerns have largely been ignored by decision-makers in China, and academic researchers.

After the example of implementation failure in Oakland; Pressman and Wildavsky initially concluded that implementation required a top-down system of control, communications and resources to do the job (Morris, 2018). However, in the late 70's and 80's, Wildavsky in conjunction with Majone and Browne, put forward a more developed theory. This saw implementation as more of a learning process, that evolves through time rather than being wholly sequential and was less top-down orientated.

Another prominent top-down definition is that of Mazmanian and Sabatier (1983) who define implementation as 'the carrying out of a basic policy decision, usually incorporated in a statute but which can also take the form of important executive orders or court decisions' (Mazmanian and Sabatier, 1983, p.21).

All the present definitions for implementation put forward in this literature review, share a commonality insofar that policy implementation can be considered the process of carrying out a government decision (Berman, 1978, cited in Mugwagwa et al., 2015). Often enacted from the top-down, where civil society has limited input in the policy process. Other definitions focus on the bottom-up approach or try to synthesise the two together.

Van Meter and Van Horn (1975) put forward a definition of the bottom up approach as 'Those actions by public or private individuals (or groups) that are directed at the achievement of objectives set forth in prior policy decisions' (Van Meter and Van Horn, 1975, p.447-8). At this level (often termed 'street-level'), discretion or principal-agency is often a feature of implementation. The most influential definition of discretion at implementation is Davis': 'A public officer has discretion wherever the effective limits on his power leave him free to make a choice among possible courses of action and inaction' (Hill and Varone, 2017, p.228).

Most knowledge-transfer in the framework of South-South cooperation in Kenya and Ghana is top-down. However, there are increasing investments made in the international system to shift the policy discussion from its top-down trajectory. Nowhere, was this more apparent than at the annual CFS plenary session in October 2011 titled "How to Increase Food Security and Small-holder-Sensitive Investment in Agriculture" (FAO, 2011).

2.3 Critically analysing the globalisation of agricultural knowledge, knowledge-transfer and governance

At a macro level, the globalisation of agricultural knowledge and knowledge-transfer has increased markedly over the past decade. Again, there are many competing definitions of the globalisation of knowledge, we concur with Carson and Robinson (2015) with their explanation on the broader definition of globalisation within agriculture, and its (including the dissemination of knowledge) characteristics as including the worldwide spread of modern technologies of production, particularly

including in communications but also into farming, the agricultural supply sector and food processing (Robinson and Carson, 2015). We also find that knowledge and its subsequent transfer is increasingly interlinked, and interdependent. In addition to this, according to the FAO, Food and Agriculture Organisation of the United Nations (FAO), globalisation broadly in the agricultural sector has moved unusually rapidly in recent times because the cumulative breakthroughs in basic science have allowed an extraordinary acceleration in the reduction of transfer costs (FAO, 2003).

The turn of the 21st century saw an increase in South-South cooperation, and its framing as a set of practices for mutual benefit and solidarity among the disadvantaged of the world system (Gray and Gills, 2016). There are numerous debates as to the drivers behind increased South-South cooperation. However, the two key debates focus on, the extent to which South-South cooperation constitutes a new paradigm of development more relevant to African needs, or a disguise for a new form of imperialism (Amanor and Chichava, 2016). Recent debates in the literature indicate that there may be a deeper, more critical third driver for this increased cooperation, utilising the basis of self-interest and arguing that South-South cooperation is no different to acting in one's self-interest, adding that South-South cooperation favours the larger powers. Owen and Melville (2005) find that it is salutary to recall that "South-South cooperation" may be more efficient and less wasteful than the west's grand gestures – but it is no less self-interested (Owen and Melville, 2005).

Owen and Melville (2005) also find that Chinese commercial interests dominate the relationship of South-South cooperation, and that the strain of avoiding entanglement in ethically and politically complex questions increases (Owen and Melville, 2005). However, there is recognition that these forms of development cooperation and knowledge-transfer can both facilitate and complement other sources of aid, and with the case of Brazil trilateral initiatives are increasingly common within agricultural governance and knowledge-transfer (Amanor and Chichava, 2016).

International relations disciplines have approached South-South cooperation and transfer with considerable difference. Realist and neo-realist scholars have conceived states as homogenous actors in an endless process of power struggle for survival and domination (Jules, 2008). Consequently, from the realist perspective, South-South cooperation could be a strategy used by the South to secure power; however, such countries would be very prone to being either silenced or manipulated by hegemonic states (Jules, 2008).

On the other hand, scholars of liberalism defend that the possibility that cooperation was real. They conceived states as rational (but still homogenous) actors that made decisions on the basis of their preferences, taking into account trade-offs and second-best options (Jules, 2008). Cooperation could take place if there were incentives in place and constraints to conflict (Jules, 2008). Therefore, South-South

cooperation would flourish if states of the South considered it to be the best option among others—one that would maximize their interests (Jules, 2008).

Hegemonic power is an important consideration in throughout this research. Hegemonic status is most commonly defined as the possession of structural power, particularly the control of economic and military resources, enabling the hegemon to shape the preferences and actions of other states, typically by promoting willing consent rather than through the use of force (Heywood, 2011, p.221). Structural theorists hold that where a hegemon has significant power over smaller states, there is a potential for cooperation to turn into domination and control. Whilst growing rapidly and challenging the unipolar world which sees the United States as a current global hegemon. Unipolarity is best described as one-sidedness; a policy determined by the interests and objectives of a single state, unconstrained by other states and bodies (Heywood, 2011, p.222).

Pressman and Wildavsky identified that the policy process was unidirectional where policies were first designed or formulated by leaders and then carried out through intermediary implementers (Pressman and Wildavsky, 1973). Indeed, in terms of agricultural knowledge-transfer implementation, South-South cooperation follows this framework. Evidence in the literature demonstrates that when a policy moves further from decision maker to implementer, from international to local, the presence of a deficit occurs. A decision makers rationality may be bound, particularly the further decisions are from local level. This is a problem for China as most decisions are taken in Beijing, thousands of miles from where they will be implemented in different environments.

2.4 Exploring Food Losses, and the drivers and barriers

The literature revealed smallholder post-harvest food losses in Kenya and Ghana comprise of an estimated 30-50% of production at various points in the value chain (United Nations, 2017, xxi). It is important to note that losses are very much dependent on the specific conditions and local situation in any given country (FAO, 2003).

In the working paper titled "*Food Loss Assessments: Causes and Solutions*" produced by the FAO, the paper consists of four small-scale case studies in the agriculture and fisheries sub-sectors (FAO, 2014). The case studies utilised are that of Banana, Maize, Milk and Fish. The case studies provide a snapshot of what is happening in the food supply chain at a specific time or season. It is well established that we know the causes of food losses, and we know that food loss reduction will be of great benefit to all actors in the food production and supply chains, to food security for poor people, and to the environment (FAO, 2014).

The research undertaken by the FAO identified a knowledge gap; in which it was identified that it is not clear which causes of food losses are the most important, what

is the impact of solutions and which solutions are viable and cost-effective, in economic, environmental and food security terms (FAO, 2014). However, they identified that the solution to food loss should not be more expensive than the food loss itself, should not place a higher burden on the environment and greenhouse gas emissions, should make more food available to the people that need it most, and should be socially and culturally acceptable (FAO, 2014). In the two cases analysed, these findings are held as applicable to losses in any situation.

The Kenyan agricultural sector is complex, its complexity arises from the existence of a traditional subsistence sector alongside a commercial sector that includes both large-scale and small-holder production systems (FAO, 2014). Production in Maize oscillates between 2.9 million ton and 3.4 million ton with the highest production of 3.4 million ton in 2010 (FAO, 2014). In the literature six critical loss points are identified these are Harvesting, Shelling, Drying on Farm, Storage: weevil damage, Storage: discolouration (quality loss), and Posho milling (FAO, 2014). In the Maize sub-sector in Kenya the highest critical loss point is at storage due to weevil damage, with losses in the state of Lugari at 8.0%, and Trans Nzoia 10.7%. At smallholder points these three important main roles and characteristics of Maize in the food supply chain apply. First, the grain is not graded or dried to achieve a lower moisture content (FAO, 2014). Second, smallholders often have no access to marketing information on prices and transportation costs (FAO, 2014). Finally, no pre-arrangement is made with vendors or traders in selling their maize (FAO, 2014).

The literature indicates that the key drivers behind maize losses in Kenya are down to ineffective communication, lack of technology and issues of ineffective knowledge-transfer. Highlighting the variations that occur significantly from state to state, that commercialisation and Mechanisation is low in Lugari. However, in Trans-Nzoia the ability to own tractors trailers that collect cobs during harvesting at the pace of the harvests contribute to the difference noted (FAO, 2014). Choice of seed varieties and timely harvesting are also not shared effectively from state to state. Significant variations occur from state to state.

Opit et al (2014) assess Maize Postharvest losses in the middle belt of Ghana. In Ghana, these losses total annual Maize production is estimated at 2.1 million MT and consumption is 1.7 million MT, most of the Maize production in Ghana is in the Middle belt and Northern Ghana (Opit et al., 2014). Smallholder Annual grain PHLs of up to 50% along the value chain were reported by contacts made in Ghana (Opit et al., 2014).

Postharvest losses present the greatest challenges which Evans Nsiah of Pens Food Bank Enterprise confirms and states “Food production in Ghana has never been a problem, for almost 70% of the population within the maize growing areas do farming, but how to manage post-harvest is the greatest challenge” (Opit et al., 2014). Information gathered during the PHL assessment trip suggests that on-farm

maize PHLs in Ghana are approximately 30% (Opit et al., 2014). Similar to the Kenyan case, in Ghana lack of proper grain drying of Maize accounts for significant losses due to moulding and an increase in aflatoxin levels. The literature states that significant mitigation of PHL in the maize value chain could be achieved if losses that occur between harvesting and drying to targeted moisture content of 12-13% could be minimized by timely drying (Opit et al., 2014). However, many of the stakeholders that were interacted with suggested that the highest losses occur during pre-drying in the field stage of the postharvest system of maize (Opit et al., 2014).

The crucial drivers of these losses are; the lack of appropriate technology for mitigating losses, more specifically, the lack of affordable and adequate numbers of mechanized maize harvesters particularly in the Lugari region (Opit et al., 2014). There is a lack of dryer, shellers, cleaners and moisture meters (Opit et al., 2014). Additionally, there is lack of knowledge on using technologies already in place such as pesticides, and using the correct application of storage infrastructure.

2.5 Emerging issues and the need for empirical research

The study of relevant food loss literature in sub-Saharan Africa revealed that food loss is a complex and deeply interdependent field. Food loss in sub-Saharan Africa has a deep connection with Food waste, as often smallholders are the largest producers in the food supply chain in addition to being both are consumers and producers. The definitions of all Food Loss and Waste are extremely contested with no universally agreed definition. Stuart's definition covering food loss and food waste the most comprehensive and applicable to this research, but are under no illusion that this is not a definition that fits all circumstances. The reader must bear in mind that the definition portrayed is one that is found as most relevant to these cases.

Implementation is also highly contested with many competing definitions, although there are many differing variations, one was produced, and however, that it is suggested in this subsection that ideally a definition recognising the synthesis of approaches would facilitate efficient knowledge-transfer. However, in the literature identified policy in these cases is are administered in a largely top-down configuration that is administered in a largely top-down format, making this a top-down definition more relevant, in explaining and exploring what is happening in the cases portrayed.

The review of literature indicated that globalisation of agricultural knowledge and implementation and its transfer from country to country, at present is largely top-down. However, the literature stressed that there is increasing awareness and moves to adjust this trend. The policy discussion on "How to Increase Food Security and Small-holder-Sensitive Investment in Agriculture" in October 2011 is an example of this (Mckeon, 2015, p.168).

The review of the literature stressed the need for joined up transfer of knowledge domestically between states and involving increased bottom-up interaction. To a great extent, this is impeded by increased South-South cooperation which is in effect, another layer of governance from top-down. To accommodate this shift, all actors in the food supply chain from smallholder farmers, NGOs, national governments, and other interacting states require efficient means of communication, communication infrastructures are broad but significant. By improving these infrastructures actors from at the local level can better influence policy for more efficient outcomes.

The globalisation of agriculture knowledge has moved rapidly in recent years. The literature highlights this increase.

The next chapter details the Research Methods used to capture empirical data, including the research strategy adopted, data collection techniques, and the role of the researcher.

3. Methodology

3.1 Introduction

This research has a number of interconnected objectives set within agricultural governance and food loss.

1) Defining food loss and food waste
2) Defining and discussing implementation
3) Critically analysing agricultural globalisation, knowledge-transfer and governance
4) Exploring food losses, and the drivers and barriers (focus)
5) Emerging issues and the need for empirical research.

A valuable aspect to this research work relates primarily to objective 3: critically analysing agricultural globalisation, knowledge-transfer and governance, all topics that have generated an increasing discourse in the early 21st century. Objective 4, also focuses on the collection of empirical data obtained through the context of food losses. Central debates focus on the gains from globalisation such as increases in net income, which facilitate decreases in levels of poverty and may thereby increase levels of food security and reducing food losses (FAO, 2003). Carson and Robinson (2015) acknowledge the increasing advance of globalisation in recent decades, and go on to further state that, it should be recognised as a complex, uneven and fragmented set of processes producing considerable geographical variation (Robinson and Carson, 2015). Therefore, understanding the complexities and the interlinking between knowledge-transfer and governance ought to contribute significantly not only to the exploration of food losses, but to a deeper understanding into the impact of South-South cooperation knowledge-transfer on smallholder food losses.

Chapter 2 '*Literature Review*', identified a gap in existing research in that there was ample evidence of hierarchal structures within agricultural governance in Kenya and Ghana, but none in the context of South-South cooperation with commercial interests dominating. Major contributions to this research work will be the study and analysis of qualitative literature. Objectives 1 and 2 were the primary focus of this chapter, with the fundamental definitions in the literature outlined and discussed.

This methodology will first contribute details of the research strategy adopted to address the research issues identified and the justification for the chosen strategy. The second section 3.2 titled '*Research Strategy and Justification*' underlines the main research question and objectives, including the means of collecting data for analysis. Section 3.2 also clarifies the qualitative research method that will be implemented, dismissing research strategies that are unsuitable. Finally section 3.2

identifies, acknowledges and discusses the criticisms of using the case study approach.

Section 3.3 will outline data preparation and collection methods performed throughout the research. Section 3.4 '*Data Collection Techniques'* expands on the collection methods and outlines the data collection techniques. Section 3.5 '*Framework for data analysis*' outlines and discusses the cross-case synthesis technique chosen for this research. Section 3.6 '*Limitations and potential problems*' explores and outlines the limitations and potential problems.

The literature review findings clearly identify the need for empirical research, and the methodology identifies this throughout. Finally, throughout this methodology the study and analysis of the empirical data will lay the foundations to provide a justification on South-South cooperation agricultural knowledge-transfer implementation considering smallholder food losses.

3.2 Research Strategy and Justification

Saunders et al. (2000) summarize the use of research strategies thus: 'what matters is not the label that is attached to a particular strategy, but whether it is appropriate for your particular research...' (Saunders et al., cited in, Biggam, 2015, p.283). Objective 3 sets out to critically analyse agricultural globalisation, knowledge-transfer and governance. Objective 4 of the research sets out to explore food losses, and the drivers and barriers. Both objectives will be implemented through the analysis and collection of empirical data. The research strategy used to execute this empirical research is that of a multiple case study.

Many competing definitions of a case study exist. For Creswell (2013) defines a case study:

> "*The case study method "explores a real-life, contemporary bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in depth data collection involving multiple sources of information… and reports a case description and case themes*" (Creswell, 2013, cited in, Hyett et al., 2014).

The FAO provide a definition related to the food supply chain, stating a case study as a one-moment recording of what is happening in a specific food supply chain in a specific season; next season and in a different location the situation can be very different (FAO, 2014). According to this definition, a case study is a snapshot of what is happening in a food supply chain in a specific season.

In terms of defining a purpose for a case study, Cohen and Manion (1995) define it as:

> "*The purpose of such observation is to probe deeply and to analyse intensively the multifarious phenomena that constitute the life cycle of the unit (Cohen and Manion, 1995, p.96)."*

Consequently, the case study approach facilitates this researcher's drive to probe thoroughly into South-South agricultural knowledge-transfer and implementation with consideration to smallholder food losses in Kenya and Ghana.

However, there is some variation as to what constitutes a case study and its purpose. Yin (2003) defines a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2003, p.13). Yin argues that an *experiment* separates phenomenon and context, whereas *historical* research, although integrating phenomenon and context, normally deals with non-contemporary events; *surveys* can investigate phenomena and context together, but lack the in-depth investigation of a *case study* approach (Biggam, 2015, p.172).

Essentially, the core benefit of a case study is that it is not as time-consuming as multiple case studies (Gustafsson, 2017). The term multiple is defined in the Oxford English Dictionary (OED) having or involving several parts, elements, or members (Oxford English Dictionary, 2009). This research holds the definition of the word several to mean more than two but not many (Oxford English Dictionary, 2009). Therefore, utilising two case studies only one of the key drawbacks of the multiple case study, the absence of depth, is avoided. The case study approach chosen can richly describe the existence of phenomenon. With the literature provided, a case study approach is justified because it allows better analysis of a unit or groups.

This empirical research is concerned with two case studies, and is in principally qualitative in nature.

3.3 Data Preparation and Collection

The case study method is central to this research and will generally be considered to be a descriptive and analytical qualitative study and is thus focused on seeking insights more than a statistical view of the world.

Various crops form the backbone crop this research will focus on is that of Maize. Maize production is high on smallholder farms in both countries and increasingly the cooperation with the South is on how to develop more efficient Maize production.

The case studies are not intended to be inclusive of most or all issues concerning South-South cooperation and smallholder food losses. Such a research study would require a multiple case study analysis. A multiple case study would also, in order to produce results of meaning, be exceptionally time-consuming, protracted and perhaps never-ending. Instead, two countries form the focus to give a more limited

and fixed set of issues. Specifically, the focus is on agricultural knowledge-transfer implementation in the context of South-South cooperation, and how this influences postharvest losses at the critical loss points. The focus is primarily on maize in terms of crop production in Kenya and Ghana.

The opportunity to implement an in-depth case study using two countries to critically analyse agricultural globalisation, knowledge-transfer and governance is invigorating. Empirical research in agricultural governance often takes the form of primary research, or through focus groups and interviews with various actors. Empirical studies in agricultural governance also involves the recognition of variables which provide a better understanding of the interactions in food chains (Monteiro et al., 2012). This focus on primary research results in literature dominated by quantitative data, rather than by in-depth, probing qualitative data. However, this is not true for all subsectors, taking the case of Brazilian agribusiness for example; Monteiro et al., (2012) find that 66% of the studies are based on secondary data, 24% use primary data, and 9% use both forms of data collection (Monteiro et al., 2012).

It should be noted that whilst a focus group is a form of qualitative research it was noted in this section due to the major drawbacks inherent. Acocella (2011) states:

> *The presence of other people can inhibit an individual and influence the way a judgment is formulated or an answer is given, thus pushing participants to express more socially desirable and stereotypical answers (Acocella, 2011).*

Acocella goes on to further state that:

> *FG technique does not always permit to study a phenomenon in depth or to gather innovative answers. At the same time, it is too much to consider FG as a technique always capable of providing sufficiently detailed information in a short amount of time and at a low cost (Acocella, 2011).*

As focus groups lack the means to provide the required amount depth, in a relatively short amount of time they are unsuitable for this type of research. This empirical research will attempt to delve deeply into agricultural globalisation through South-South cooperation, knowledge-transfer and governance and the influence these factors have on food loss in Kenya and Ghana but implementing a case study and concentrating on analysing qualitative literature from various sources. It is hoped this will provide the reader with a true three-dimensional perspective of understanding on agricultural governance and food loss in the two countries, and be adequately relatable.

As the major focus of this research is to gain a deep understanding of how South-South cooperation in practice is influencing smallholder food losses, in whatever form, by selecting Kenya and Ghana as both case studies present an opportunity to

identify knowledge gaps, and to identify the knowledge provided through South-South cooperation that disseminates down to national governance and at the local smallholder level.

If agricultural governance is viewed as central to these case studies, then in order to achieve a three-dimensional perspective South-South cooperation.

3.4 Data Collection Techniques

Qualitative data will be obtained primarily through an analytical review of secondary literature. This consists of data that has already been collected and used earlier, and published at a variety of sources. These published sources consist of government publications, journal articles, and newspaper articles, etc.

Identifying the correct sample size is critical to some varieties of qualitative research. A sample too large, may waste time considering tight time constraints and a sample too small may lead to inaccurate findings where a survey is a chosen method. Sample size identification is largely irrelevant for a qualitative case study, as the focus is on description and in depth analysis, rather than attempting to obtain a random sample of cases. In theory, a sample size should be large enough for reasons of accuracy and for the removal of bias.

Denzin (1978) identifies four basic types of triangulation these are, Data, Investigator, Theory and Methodological (Denzin, 1978, p.295). Denzin also identified three Data triangulation subtypes: (a) time, (b) space, and (c) person (Denzin, 1978, p.295). As this research is absent of the layer of validation that employing a specific sample size provides, triangulation has been employed to decrease bias and increase validation throughout. Cohen and Manion (2000) define triangulation as an "attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint." (Cohen and Manion, 2000, p.112). It is this definition that best sets out the collection techniques that this research will undertake throughout in order to increase validation optimally.

The secondary data and case data will assist in providing a rich picture of South-South agricultural knowledge-transfer implementation and how this influences smallholder food losses.

3.5 Framework for data analysis

This section describes how this research intends on analysing the data that has been collected.

Analysis of case study evidence is difficult because the strategies and techniques are not well defined (Yin, 2003, p.109). Yin states five case specific techniques for analysing case studies, these are pattern matching, explanation building, time-series analysis, logic models and cross-case synthesis (Yin, 2003, p.109).

The framework this research will build on is that of the cross-case synthesis, whilst it is accepted that having more than two cases could strengthen the findings further, time and resource constraints mean that any additional cases could not be studied.

The cross-case synthesis technique was chosen because it allows for flexibility and the opportunity to hit the four principles which are core to a high-quality analysis. This technique can be performed whether the individual case studies have previously been conducted as independent research studies (authored by different persons) or as a pre-designed part of the same study (Yin, 2003, p.134). However, in either case the cross-case technique treats each individual case study as a separate study. This is particularly useful in the countries this research will present as both countries differ markedly.

This research allows for intersubjectivity throughout thereby increasing validation and decreasing the potential for bias, this research holds the philosophical definition of intersubjectivity as an agreement existing between conscious minds (OED, 2018). Similarly, Thomas Scheff (2006) defines intersubjectivity as the sharing of subjective states by two or more individuals (Scheff, 2006, p.41).

3.6 Limitations and potential problems

There are known limitations to this empirical research, as well as issues related to implementing a case study where one is employed. However, by having a robust research strategy, possessing tried and tested research collection techniques, and a robust research strategy some of these limitations can be minimised.

Limitations mainly surround the issue of the case study method itself. Three main criticisms of the case study method are identified. First, Case study research has sometimes been criticised for lacking scientific rigour and providing little basis for generalisation (i.e. producing findings that may be transferable to other settings) (Crowe et al., 2011). By drawing on the conceptual framework outlined in the literature review. In addition to the conceptual framework transparency throughout the research process will aim to address this criticism. Transparency will be achieved in *Section 3 Methodology* by describing in detail the steps involved in case selection, data collection, and the reasons for the particular methods chosen (Crowe et al., 2011). Generalisability has been sacrificed for depth of study, however, with substantial relationships within South-South cooperation it is unlikely a multiple case study would achieve the depth of study required for a complex topic.

Second, Yin notes that too many times, the case study investigator has been sloppy, and has allowed equivocal evidence or biased views to influence the direction of the findings and conclusions (Zainal, 2007). Through the research strategy of limiting the case studies to two this allows for a more in-depth focus and less of a possibility that the investigation will be conducted unsystematic manner. In addition, to the research strategy, and the data collection techniques employed throughout this research

(such as triangulation, explained further in *Section 3.4 data collection techniques*) are aimed at reducing the chance of bias.

Third, case studies are often labelled as being too long, difficult to conduct and producing a massive amount of documentation (Zainal, 2007). This often occurs with case studies of a longitudinal nature which these cases do not. However, the information in this research has been managed and organised systematically to avoid this shortcoming. Research has been collected in line with research questions, whilst being flexible and allowing different paths to be explored (Crowe et al., 2011).

Potential problems surrounding this research are primarily related to the absence of multiple cases which is able to analyse the data within each situation and across different situations. The context of holding South-South cooperation a constant and smallholder losses would require vast amounts of time and would likely be unreadable. However, it is important to note that this does depend on the issue in question, there are instances where a multiple case study is not justified such is the case with this research.

Documentation is a significant source of evidence throughout this research. There is a question of reliability when using this research strategy. Though documents are useful, there are not always accurate and may not be lacking bias.

The data samples throughout this research are limited in number due to the time constraints.

Whilst this research aims to achieve satisfactory data triangulation, the researcher is aware that the variety of participants in terms of the focus on smallholders has a negative effect on data triangulation. However, this is necessary to make the research more manageable, with the time constraints. The research will attempt to overcome this limitation by using different sources of information from other actors in the case studies, such as NGOs, agribusiness actors and other researchers

4. Case Study Findings: Analysis, Synthesis and Evaluation

4.1 Introduction

This chapter sets out to describe and discuss the findings of this research, and will also reveal the results of the analysis of the case study described in chapter three.

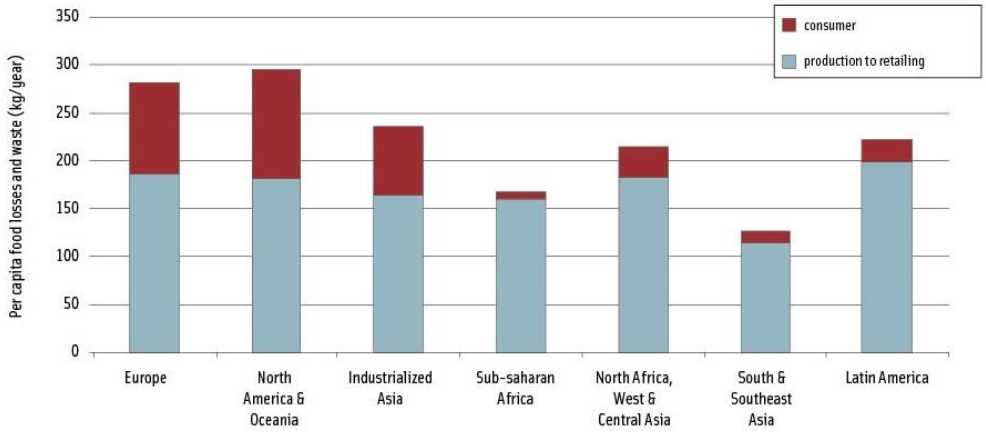

Figure 1 depicts per capita food losses and waste across seven different regions.

Figure 1 shows food losses in Sub-Saharan Africa are highest from production to retailing at around 160 kg/year and consumer losses are minimal (Marsh, 2011). It is important to keep in mind that lines are often blurred for rural SSA households who often function as both producers and consumers (Barrett and Sheahan, 2017, cited in Bellemare et al, 2017). Therefore, what is depicted in *Figure 1* may not be wholly accurate and open to variation. The literature finds that incomes of smallholder farmers is generally low inside the both countries, with annual incomes of around $2,527 in Kenya (Rapsomanikis, 2015). In Ghana, the annual income figure of smallholder farmers stands at around

With post-harvest food losses (PHL) in Kenya and Ghana consisting of around 30-50% of production and an annual rate of population growth increasing at a rate of 2.6% between 2010-2015, tackling food losses is therefore of paramount importance (United Nations, 2017, xxi). Most of these losses occur mainly at early stages of the food value chain on smallholder farms. In Kenya, maize estimated losses were 20% likewise in Ghana 30% or more (Campbell, 2014, p.12). These two case studies explore government approaches, agribusiness and contract service offerings focusing of the distribution of and implementation of knowledge between smallholder farmers.

Whether coming from national, international, non-governmental organisations or commerce, policy and knowledge-transfer is rarely implemented in equilibria, or anything bordering on a synthesis of approaches. Naturally, even policies that are designed to focus more on a synthesis of approaches end up being enacted most commonly from the “top down” or the “bottom-up”. Agricultural knowledge-transfer policies transferred from other countries are no exception to this, and how the

approaches these policies are aligned to can have significant effects on smallholder food losses, which this section will describe and analyse in considerable depth.

The great Beijing Summit of November 2006 education and training commitments were made by China to double long-term scholarships for African students from 2,000 per year in 2006, to 4,000 a year by 2009 (King, 2009). Other human resource commitments involved sending 100 senior agricultural experts to Africa and the establishment of 10 special agricultural technology demonstration centres in Africa (King 2010). With this came an increase in South-South cooperation not only from China but other larger, developing powers such as Brazil and China.

As with other African countries, there are two interwoven political aspects of China's engagement with Kenya. The first derives from the long history of friendship and South-South cooperation and the other draws on Chinas role as a key member of the global community with growing commitments to development assistance (King, 2009). King identifies first through the strong assertion of the importance of a two-way symmetrical accord between the two developing countries, through the framework of the strategic partnership' (King, 2009). The emphasis this strategic partnership hinges on is the foundation of 'political equality and mutual trust, economic win-win cooperation and cultural exchange' (King, 2009). Such an emphasis is a direct challenge to northern normative development aid. However such an emphasis is not without contestation, Amanor and Chichava's (2016) assessment of the narratives surrounding South-South cooperation depict the Organisation for Economic Cooperation and Development (OECD) as imposing conditionalities based on unequal international relations and the legacies of colonialism (Amanor and Chichava, 2016). As this research finds, such narratives may increase as South-South cooperation deepens.

4.2 Critically analysing the globalisation of agricultural knowledge

China's recent rise was kick-started by a shift in its development strategy in 1978 when China's leader, Deng Xiaoping, initiated a process of reform of the state-planned socialist economy (Brown et al., 2014, p.19). This policy change that brought about the opening up of the Chinese market was profound, ending long isolation and allowing global forces both to shape the Chinese economy and, in turn, to be shaped by China's own rapid economic advance (Robinson and Carson, 2015, p.11). It is self-evident that through the opening up of other markets, particularly in the agricultural sectors in sub-Saharan Africa the potential for significant change increases, regionally, nationally and at a local level.

Global influences can shape the whole of the agri-food sector when allowed to permeate a previously highly protected and controlled economy (Robinson and Carson, 2015). The parallels between China, and Kenya and Ghana on the other hand are striking when viewed from this perspective.

The need to feed China's 1.3 billion population is having global impacts as Chinese interests purchase land and food processors in different parts of the world, especially in the last decade in East and West Africa, as a potential source of additional food that can be exported to China (Cotula, 2013, cited in Robinson and Carson, 2015). As will be expanded on later on in these cases studies, short and long term courses are being increasingly provided by China targeting smallholder farmers in both countries, particularly in Kenya. A lot of these agricultural knowledge-transfer policies are implemented from the top-down, (decision-making is taken in Beijing) thus widening the gap between smallholders and decision makers.

4.3 Smallholder food losses in Kenya

Food security in Kenya is no recent problem, with many interlinked forces driving food losses. However, many of the current food loss issues are the same across the continent and can be attributed to several key factors such as knowledge gaps between groups of smallholders within a country, the dissemination of knowledge and climate change. The problem of food security and reducing food losses has become more urgent in recent times as it is estimated that four million Kenyans are at present in need of food aid (Staff, 2017).

The FAO identified seven roles and characteristics of smallholder producers in Kenya, five of the most important are analysed here. First, smallholders usually sell part of their maize to traders or neighbours with food shortages. The amount sold varies by size of maize fields, amount harvested, and food requirement per household (FAO, 2015). This fits into the comprehensive definition provided by the FAO which describes 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 (FAO, 1981). Such trading at early levels in the food chain can negatively affect the prices of food higher up the food chain, as supply can fail to meet demand. This is backed up by the FAO who identify the affected stakeholders as farmer traders, the impact of the loss being economic and leading to a reduced market value of around 65% (FAO, 2015).

Table 1 illustrates that the most critical losses occur at storage due to weevil damage (FAO, 2014).

Critical Loss Point	Product	% loss Lugari	% loss Trans Nzoia
Harvesting	Maize on cobs	3.3	1.0
Shelling	Grain	1.6 - 3.2	0.4 - 2.0
Drying on farm	Grain	3.0	
Storage: weevil damage	Grain	8.0	10.7
Storage: discoloration (quality loss)	Grain	8.8	8.5
Posho milling	Whole meal flour	3.5	

Table 1: Depicting critical loss points in the Kenyan maize supply chain

Second, smallholders sell maize in small amounts mainly in the period 2-3 months after harvest depending on household cash needs (FAO, 2015). Reaffirming an emerging issue stated in section 2.5 that smallholders are both consumers and producers, trading directly to neighbours and on the open market. Third, the grain sold is not graded nor dried to achieve a lower moisture content (FAO, 2015). Resulting in an economic loss of around 3%, or a reduced market value of 3% (FAO, 2015).

Fourth, usually have no access to marketing information on prices and transportation costs (FAO, 2015). The losses here are negligible (FAO, 2015). The report ignores the perception of stakeholders due to insufficient research.

Fifth, smallholders often bargain by comparing the previous prices offered by small traders or neighbouring farmers (FAO, 2015). However, bargaining is notoriously complex, a seller can charge a higher price to a buyer who is more eager. The costs of bargaining can exceed the financial gain.

Finally, smallholders do not make any pre-arrangement with vendors or traders in selling their maize (FAO, 2015). Inadequate linkages between vendors and traders, poor transport infrastructure is responsible for part of this. Grain dealing centres provide harvesting, transport, shelling, drying and bagging services in rural areas (FAO, 2014). These centres suffer from patchy electricity supply and rely heavily on unreliable diesel generators, consequently high losses occur at this stage.

It is for those reasons that Stuart's definition of food waste is most applicable to the case of Kenya.

4.4 Major Findings of South-South agricultural knowledge-transfer implementation in Kenya

Chinas cooperation with Kenya is similar to other African states involving the transfer of knowledge. King (2010) identifies elements of cooperation in Kenya including; support to short and long term training of Kenyan's in China; development of Confucius Institutes; development of education or training projects and institutions within Kenya; project-related training; and enterprise-based training (King, 2009).

This research focuses primarily on the past 20 years, however, a clear and concise historical background of China-Kenya cooperation is needed to understand Chinese involvement in Kenya. Little is known about the first Kenyans to study in China, King holds they were probably in the period immediately after visits in 1960 and 1964 made by Kenya's then vice-president, Oginga Odinga, who led the first Kenyan mission to China as early as 1964 (King, 2009).

King identifies four significant intertwined issues that run through the character of the approach to aid or development cooperation made by China in Kenya. First, China is not at ease with the discourse of aid (King, 2009). Rather it prefers the discourse to

be framed in the way of the largest developing country helping a continent with largest number of developing countries in the framework of South-South cooperation. Second, despite the Pan-African umbrella of the Forum for China-Africa Cooperation (FOCAC) China's cooperation falls clearly into a series of bilateral commitments to individual African countries, including Kenya (King, 2009).

Third, China prefers to view its cooperation commitments as demand-driven, rather than as a set of Chinese development priorities for Africa. The absence of conditionalities is attractive for many countries in Africa who previously, were only given assistance or aid with terms and conditionalities attached. Fourth, there is a strong emphasis on the strategic relationship with Kenya, including the importance of political, economic, social, cultural and human resource exchange (King, 2009). King explains this as being well captured in the well-worn-phrase of 'win-win' cooperation (King, 2009).

In terms of scale, Chinese support for knowledge-transfer through formal education including agriculture in Kenya appears to be very slight and/or decreasing. King states that China is not giving anything close to the £11 million sterling a year to formal education the United Kingdom does, to the Kenya Education Sector Support Programme (KESSP). It is worth noting that whilst it is the goal of the KESSP is to provide basic education and improve the quality of education to all children by 2010 (World Bank, 2006). The programme does also focus on providing opportunities for further education and training in agriculture. This includes support of agricultural education opportunities through institutions such as the Jomo Kenyatta University of Agriculture and Technology. King finds that the two largest components of support were rural telecommunications and power distribution in 2005, and from November 2005 this included the first of Africa's Confucius Institutes – in Nairobi University (King, 2009).

By the time of President Kibaki's visit to China in August 2005, the FOCAC had met for the second time and as a consequence long and short-term scholarships and training had increased substantially (King, 2009). For instance, the first 20 years from 1983 to 2003, China provided short-term training for just 63 people from Kenya; but from 2004 to 2008 the number was 697 (King, 2009). King finds the FOCAC increased short-term training, and doubled long-term training, which was reinforced at the November 2006 Beijing summit. By 2009, China was offering an exhaustive range of short-term courses such as hybrid rice technology for developing countries, pollution-free tea production, cotton breeding and management, Chinese acupuncture and moxibustion, and medicinal plants (King, 2009). The globalisation of this knowledge-transfer is significant in the framework of South-South cooperation allowing for a reduction of transfer costs which benefits Chinese interests.

Indeed, the short-term courses noted are more tailored to the demands of the Chinese market and do not target present smallholder farmers, so debates regarding

whether this is new form of imperialism are not totally unfounded. King states this illustrates a particular form of bilateralism in which the more developed country offers access to technologies and process in which it has some comparative advantage (King, 2009). It is important to consider that such courses in fact parallel short-term training that was available through Western donors in the 1970s and 1980s (King, 2009). This runs somewhat counter to the Chinese narrative of South-South cooperation agricultural knowledge-transfer implementation in Kenya, it appears less cooperative, but no less self-interested as Owen and Melville argue. Crucially this form of bilateralism appears more top-down in its implementation. However, at present there is no complementarity expected of Kenya, in the sense of Chinese coming to short-term courses hosted by Kenya (King, 2009).

Owen and Melville find that Chinese commercial interests dominate the relationship of South-South cooperation (Owen and Melville, 2005). Political entanglement is a potential future concern for South-South cooperation, leading to arguments that these commercial interests are accelerating into a form of renewed colonialism. King explains that most Chinese development assistance is handled by the Ministry of Commerce, and that most of the aid projects at present would cover several FOCAC, for Kenya and the whole of Africa. Most of these are thus handled by the Economic and Commercial Counsellor's Office in Nairobi. However, some commentators see these as views that disregard African agency and fail to examine how that agency can transform emerging bilateral relationships into 'win-win' relationships (Gray and Gills, 2016). Cheru (2016) shows how this has been the case with regard to the Ethiopian developmental state's successful harnessing of relations with emerging Chinese donors and the production of its own national policy space (Gray and Gills, 2016).

Commercial interests places the notion of South-South cooperation at risk, opening the risk of unilateralism, where agricultural knowledge-transfer policies are unidirectional, thus directly effecting effective agricultural knowledge-transfer implementation. Pressman and Wildavsky in their seminal conceptualised the policy process as being unidirectional (in which policies were first designed or formulated by leaders and then carried out through intermediary implementers) with no input from actors at the bottom end of the scale (Nangpuhan II, 2011). However, the statement that Chinese commercial interests can place South-South cooperation at risk is therefore not without challenge.

Implementation of policies is conducted in a top-down manner with much of the decision-making taken in Beijing. For instance King suggests, that there is evidence of the Chinese Ministry of Commerce, which is ultimately responsible for short-term training, increasing the length of several of these agricultural courses and also reviewing their quality (King, 2010).

4.5 Smallholder food losses in Ghana

As in Kenya concerns surrounding food security and food losses at smallholder level are not new developments. Considerable assessments of smallholder food losses in Ghana have been conducted. The country's main agricultural commodities include cocoa, cassava, yam, banana and maize, as well as other cereals and fruits (FAO, 2015). A summary report titled "A Report on Assessment of Maize Postharvest Losses in the Middle Belt of Ghana" was provided in partial fulfilment of a grant with USAID (Opit et al., 2014). This research is focused primarily on Postharvest losses encountered by smallholders cultivating maize.

As in Kenya, Losses in Ghana are primarily from handling and transportation, and moulds, insects and rodents (Opit et al., 2014). The definition provided by Stuart on food loss encapsulates Ghanaian smallholder agriculture appropriately.

4.6 Major Findings of South-South agricultural knowledge-transfer implementation in Ghana

The major findings outlined in the summary report produced by Opit et al., were first, there are multiple tactics in use for monitoring insects and grain moisture at both the on-farm storage level as well as in warehouses, and that many of these are not effective or reliable (Opit et al., 2014).

Second, farmers are resistant to investing in new technology to produce quality grain when there is no economic reward for increased input and management costs (Opit et al., 2014).

Third, the team identified a potential working model that could assist farmers adopt new technologies while addressing the microfinance issue on a small scale – this model is currently being used by Farmer Based Organizations (FBOs) and delivering positive results (Opit et al., 2014). Fourth, the report found increased training is needed on stored-product pest identification and correct pesticide use (Opit et al., 2014). Finally, the report identified that there is a lack of shelling, drying, and storage facilities for Maize that is in close proximity to communities (Opit et al., 2014).

Regarding training, knowledge and educational needs, the report found that smallholder farmers were poorly educated on the safe handling and use of insecticides especially on the fumigation using Phostoxin and on proper stored maize management (Opit et al., 2014). There appears to be no research conducted into whether this knowledge exists at state level, and whether it is being transferred efficiently. In addition, they identified the need for smallholder farmers to be educated to view farming as a business and stored maize as an investment that needs to be fiercely protected (Opit et al., 2014).

Amanor and Chichava find that the main Chinese interventions in Ghanaian agriculture have been in the rice sector (Amanor and Chichava, 2016). The

Ghanaian government has continually sought to promote the commercial production of rice, and initially in the early 2000s turned to US companies for technical and managerial innovations in the rice sector (Amanor, 2015). However, such initiatives stagnated, owing to poor regulatory frameworks, land disputes with farming communities and the difficulties of realising financial support (Amanor, 2015).

Amanor and Chichava find that at present the main Chinese interventions in Ghanaian agriculture have been in the rice sector (Amanor and Chichava, 2016). Further, Chinese companies are beginning to formulate interventions within this framework, linking up both large production sites involving contract farming schemes with the construction of infrastructure, and the building of research facilities in hybrid seed technology within Ministry of Foreign Affairs (MOFA) facilities and among MOFA staff (Amanor, 2015). It is the latter that appends to the realist theory that self-interest is a driving factor, and is powering China in order to meet its immense rice consumption which in 2016/2017 stood at 141,448 metric tons (Statista, 2018). It is too early and outside the scope of this analysis to make any assessment of the correlation with any interventions, including any future supply relationships that China may demand.

China has established itself as a regional hegemonic power in sub-Saharan Africa with increasing structural power. This can be best observed in Dijbouti with the opening of the first overseas Chinese military base, which some commentators see as a testing ground for the mixing of Chinese commercial and military interests abroad (Wang, 2018). Such bases allow Chinese international economic soft power to be projected more efficiently.

Chinese interventions in the Agricultural sector in Ghana are implemented primarily from the top-down. Chinese construction companies play an important part in rehabilitating and extending irrigation facilities, most notable the Afife/Weta irrigation project is one such example, while the ministry of agriculture has maintained control over extension (Amanor and Chichava, 2016). As of 2016 one of the largest Chinese construction companies working in Ghana, ChinaGeo was interested in investing in irrigation and food crop cultivation (Amanor and Chichava, 2016). However, it experienced difficulty in bidding for contracts, in gaining sufficiently large areas of land with secure land rights and it has little interest in working within framework of public private partnerships, which dominate the irrigation sector in Ghana (Amanor and Chichava, 2016). The smallholder approach in Ghana has been at variance with the Chinese approach since the mid-1970s (Amanor, 2015).

A second focus for Chinese investors is agrochemicals, particularly herbicides, which form the most widely used input in smallholder agriculture (Amanor and Chichava, 2016). Amanor and Chichava find that at present agrochemical markets are dominated by small agro-dealers situated around markets in urban and rural areas (Amanor and Chichava, 2016). This makes them increasingly vulnerable to outside

agro-chemical producers, whilst opening markets has benefits and can lead to an increase in consumer sovereignty, a reduction of bureaucracy and the associated costs, the motivational influence of free enterprise and an increase towards an optimum allocation of resources. Little evidence in the literature exists of any of the benefits of the agrochemical markets of opening up to Chinese producers, instead Amanor and Chichava find that Chinese herbicides completely dominate these markets and have displaced other agrochemical products (Amanor and Chichava, 2016).

In a developing country such as Ghana, unequal power balances and increasingly freer markets pose a significant threat. Most accounts of power portray it as a relationship (Heywood, 2014, p.211). This is explained as Relational power which is best understood in terms of actions and outcomes, the effect of one actor or actors in a manner not of their choosing (Heywood, 2014, p.211). For example; increased involvement may bring about environmental degradation or exploitation of workers. It should be noted that there is little evidence in the literature to prove this at present. Certainly, with increasing globalisation of agriculture Ghanaian markets will open naturally. The advance of agricultural globalisation in recent decades reveals itself to be a complex, uneven and fragmented set of processes producing considerable geographical variation (Robinson and Carson, 2015).

Further Amanor and Chichava suggest that intense competition between agrochemical producers led to Wynca Sunshine, the dominant company, establishing an assembly plant in Kumasi, which enables it to undercut it rivals to control the market (Amanor and Chichava, 2016). This account demonstrates that Chinese agribusiness has made big in-roads in agrochemicals, where they dominate markets throughout the country (Amanor and Chichava, 2016).

Such an increased dependence on raw materials and agrochemicals from Asian countries is a major challenge that will only increase along with Chinese investment in Ghana. However, Chahoud suggests that high level dialogues between the G8 and the leading countries could help considerably to ensure benefits that are derived from closer South-South cooperation and the conceivable risks are discussed openly (Chahoud, 2007). The considerable power China is able to wield though the top-down approach enables them to set the agenda in any South-South cooperation negotiation. Power is dynamic and ever-changing, and is in a constant state of flux. Economic slumps, food insecurity, or natural disasters may shift power relations within the South-south framework.

4.7 Limitations, implications and recommendations for further research

The interventions made by China in the framework of South-South cooperation in both Kenya and Ghana face a number of limitations, having both a direct and indirect effect on terms of agricultural knowledge-transfer implementation. In Kenya and

Ghana, political entanglement features as a significant impediment for future successful South-South cooperation.

In terms of South-South multilateralism however, there are limited examples in the literature of countries in the alliance pursuing a common goal on agricultural interventions. For example in Ghana, the main Brazilian bilateral agricultural programme has been More Food International (MFI), which aims to provide access to relevant technologies to enhance smallholder production (Amanor and Chichava, 2016). On the other hand the main interventions in Ghana by China have been by a construction company called ChinaGeo which at present interested in irrigation and food crop cultivation (Amanor and Chichava, 2016). Such Chinese interventions are far from just aid but also good business for many Chinese state-owned enterprises, which are often on their own learning curve and making their own tentative steps into overseas markets. Examples such as these prove that there are divergent goals between the countries inside the South-South model which affect agricultural knowledge-transfer implementation for smallholders substantially. Brazil's MFI focuses on relevancy to enhance smallholder production, whereas Chinas example may become entangled as many enterprises are state-owned like ChinaGeo and unilateral interventions. The limitations of unilateralism have the potential to limit agricultural knowledge-transfer in both countries, as well as fracture South-South relations.

In the realist framework outlined above, real cooperation is unlikely or severely limited, international organizations are seen as dominated by the interest of hegemonic states and peace is only conditional upon an international balance of power (Jules, 2008, cited in Mundy, 2007). In fact, this is still how numerous analysts and diplomats view South-South cooperation attempts (Jules, 2008). Which are viewed as political strategies employed by regional powers (i.e. China, India, South-Africa, Brazil) to have weaker states under their control, thereby elevating their influence (Jules, 2008). Political strategies such as these will undoubtedly affect agricultural governance at national and a local level for smallholders in both Kenya and Ghana.

Self-interest is another limitation and requires further detailed research. The dangers of self-interest are that other states in the region may resent cooperation or other states in the South-South framework may resent the model. This could lead to future conflict in the case of power imbalances, more conflict may be seen through interventions at the international institutions, or even worse militarily.

5. Conclusion

The analysis and evaluation of agricultural knowledge-transfer implementation (in the context of South-South cooperation) influencing smallholder food losses in Kenya and Ghana has shown that post-harvest food losses in Kenya and Ghana consist of around 30-50% production and the annual rate of population growth had increased at rate of 2.6% between 2010-2015. This research has thus shown that tackling food losses at level is of significant importance, with most of these losses occurring mainly at early stages of the food value chain on smallholder farms.

Despite the framing of South-South cooperation as a win-win situation for all countries, this research has shown that there is some justification to the arguments that self-interest may be motivating factor for Chinas involvement in Kenya and Ghana. One argument for such is the insufficient focus on the principal issues that affect smallholders and the Kenyan and Ghanaian economies. For example in Kenya, China is offering short-term courses such as hybrid rice technology, pollution free tea production, Chinese acupuncture and moxibustion.

None of these target the main issues for smallholder producers in Kenya such as knowledge gaps between groups of smallholder within a country, and the dissemination of knowledge. Further for smallholders, storage losses is an issue with high a percentage of losses in both Lugari and Trans Nzoia. None of the short-term courses provided by China focus on reducing losses in Kenyan agriculture.

In Kenya, further infrastructure development (roads, electricity) is required from the public sector to reduce smallholder food losses and better facilitate the dissemination of knowledge provided through the South-South framework. In Ghana, the agrochemicals markets need some form of regulation nationally, and China needs to allow for more competition in the market and local actor input for successful cooperation.

A fully comprehensive policy analysis is beyond the scope of this research, especially when factoring in ever present, pressing international relations concerns. However, the main Chinese policy interventions that the current literature has illustrated have been analysed and evaluated. The literature shows little consideration appears to have been given to actors who implement agricultural policies at ‘street-level’, nor does there appear to be any attempt to synthesise implementation approaches by China.

A more extensive policy analysis is thus required to understand the desires, the travel of Chinese interventions in Kenya and Ghana, and whether these interventions are based on self-interest. However, this research concludes that through current Chinese interventions, the Beijing consensus is no less self-interested then the Washington consensus. Particularly, when this concerns agricultural governance. One line of argument suggests that this interest in agriculture in Africa is to supply

Chinas large, and growing population. As Cotula suggests, the need to feed China's 1.3 billion population is having global impacts, as Chinese interests purchase land and food processors in different parts of the world.

King illustrates that South-South cooperation is a particular form of bilateralism in which the more developed country offers access to technologies and processes in which it has some comparative advantage. This is similar to the training China is offering which is in its own self-interest. Based on this, Owen and Melville are correct to state that South-South cooperation may be more efficient and less wasteful than the west's grand gestures but that it is no less self-interested.

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