Understanding Food Loss and Waste in Tanzania's Avocado Production Systems: A Case study of Domestic and Export Avocado Supply Chains.

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Abstract

On-farm food losses have been identified as a significant hotspot, and it is estimated that 1.2 billion tonnes of food production are lost globally on farms per year, representing 15.3% of global food production (WWF-UK, 2021). Empirical studies to date, on food loss and waste in the global South and indeed in the global North have primarily focused on 'how much loss/waste', often at post-harvest stages of supply chains, to the neglect of on-farm losses. In the global South, food losses and waste are viewed as inefficiencies in the production and supply chains, and there has been no attention to understanding how institutions, materiality and practices interact to produce food waste. This thesis aims to understand how institutions, practices, and materiality intersects to produce food loss and waste in Tanzania's domestic and export avocado production systems and how losses and waste production manifest power relations and inequalities within the two distinct avocado production systems. This study views food loss and waste as a 'social relations' to unpack the complexities of the socio-cultural, economic, material, and institutional arrangements and the context of the social relations within which losses and waste occur in agricultural production and early stages of food supply chains. It draws on the food waste regimes concept to propose a new conceptual framework whereby insights from institutions, materiality and practices are integrated to understand how their interactions generate food loss and waste. It puts social relations at the centre of food loss and waste analysis to argue that rethinking food loss and waste as 'social relations' helps us to understand better how power relations and inequalities operate in the food production system to generate food loss and waste in the global South context which has not been attended to in the food waste and loss debate.

The research adopted a qualitative case study methodology using 'following the thing' and 'go-along' ethnographic observation approaches as the principal tools to collect empirical evidence. Data was collected from various participants, including farmers, nursery owners, traders, exporters/packers, stakeholders, and key informants, in two major avocado production regions (Kilimanjaro and Mbeya). The findings underscore the importance of how different institutions (norms, value(s), beliefs, code of practice, guidelines, rules, regulations, and standards, among others), materiality and practices interact to produce loss and waste in the context of the domestic and export avocado production systems and supply chains. Economic and no-economic value(s), risk avoidance strategies used by farmers, traders, and exporters /processors, and the social relations within the institutional arrangements, which structure the production and distribution practices, were food to result in loss and waste production, on farms and within early stages of the supply chain. Different values influence how agronomic, harvesting, and handling practices were

enacted in the two avocado production systems resulting in a different context in which preharvest loss and waste occur, but also during harvest and early stages of the supply chains. The study argues that farm-level losses, including preharvest losses, are connected to broader market institutional structures, socio-cultural values, and norms. Therefore, preharvest losses should be viewed not only through the prism of economic value; but also, through other values derived from the crop. I contend that in order to understand loss and waste in food production systems, there is a need to attend to the role of values and norms held by the farmers, traders and exporters and other actors with a specific food system.

While risk avoidance strategies used by traders and exporters, such as delaying harvest due to lower prices, overloading sack bags, and in some cases, side selling by farmers, played significant roles in the ways losses and waste were produced; the materiality of the avocado – its 'perishability' and 'size' was found to be a vital object through which control and power were exercised. Often, the perishability of the avocado (particularly in the case of the domestic supply chain) was drawn upon by traders to blackmail, sanction, and extract value (profits) from other actors; in this case, the seller(s) who is always in a vulnerable position. The use of the 'perishability' to wield power and inequalities was found to shift along the supply chain as the avocado is sold/re-sold from one seller to another. In the case of the export avocado, the size of the avocado linked to the spatial-temporal location of the farmer (site of production) and cosmetic appearance was found to be the means through exporters and processors used to exercise power, to extract value and create price inequalities among growers, often advantaging small growers. Taking a social relations approach enabled analyse of food loss and waste through the lens of power relations, value extraction and inequalities, and vulnerabilities among growers. Thus, pushes against the technological, infrastructural, and managerial inadequacy and practical know-how bias, which dominated food loss and waste discourse in the global South.

Moreover, a 'credit system' and a 'reject sharing system' as an institutional arrangement in domestic and export supply chains provided an avenue for exploitation, inequalities, losses, and waste generation. Again, the responsibility for or sharing the 'burden of losses' was found to significantly influence opportunistic trading practices by traders and farmers, resulting in losses and waste generation in the domestic supply chain.

These findings, taken together, have implications for how food policy actors, development practitioners, farmers, and commercial stakeholders approach food loss and waste reduction on farms and the early stages of the supply chain. It calls for the need to sufficiently engage with the

systemic causes embedded in institutions that structure how production, management and distribution practices are enacted and what materials are drawn upon to accomplish those practices. Underlying the importance of that, any approach to reduce food loss and waste must give primacy to the interaction between institutions, materiality, and practices. This thesis also opens new avenues for researchers to examine and better understand which social relations lead to food loss production, and conceptualising losses and waste as issues of power dynamics will help better understand inequalities in food systems. Shifting attention from what is lost or wasted to understanding why the loss and waste occur. It opens new ways to conceptualise food loss and waste as power issues and inequalities in food systems.

KEYWORDS: Food loss and waste, institutions, materiality and practice, power, food waste regime, social relations.

DEDICATION

To my parents, *Emmanuel Yepah Cromwell* and *Grace Aryeh*, my wife*, Araba Yankson* and my sons, *Kwamena and Nana*.

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LIST OF ACRONYMS

AEZ	Agro-Ecological Zone
AMCOS	Agricultural Marketing Cooperative Societies
ANT	Actor Network Theory
ASDP	Agricultural Sector Development Programme
ASDS	Agricultural Sector Development Strategy
BRC	British Retail Consortium
COSTECH	Tanzania Commission for Science and Technology
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FSC	Food Supply Chain
GDP	Gross Domestic Product
GLOBALG.A.P.	Global Partnership for Good Agricultural Practices
GMP	Good Manufacturing Practice
HACCP	Hazard Analysis Critical Control Points
IPPC	International Plant Protection Convention
ISO	International Standard Organisation
ITC	International Trade Centre (Trade Map)
KEDA	Kilimanjaro Environmental Development Association
LGB	Larger Grain Borer
MBEAFA	Mbeya Avocado Farmers Association
MOA	Ministry of Agriculture
MRL	Maximum Residues Levels
MT	Metric Tonnes
NAFN	Njombe Avocado Farmers Network
NBS	National Bureau of Statistics
NH	Northern Highlands
NPHMS	National Post-Harvest Management Strategy
PHL	Post-Harvest Losses
PHM	Post-Harvest Management
QMS	Quality Management Scheme
RAC	Rungwe Avocado Company
REPOA	Research on Poverty Alleviation
SAAGA	South Africa Avocado Growers Association
SAGCOT	Southern Agriculture Growth Corridor of Tanzania
SDG	Sustainable Development Goals
SH	Southern Highlands
SMETA	Sedex Members Ethical Trade Audit
SPS	Sanitary and Phytosanitary
SSA	Sub-Saharan Africa
TAFSIP	Tanzania Agriculture and Food Security Investment Plan
TAHA	Tanzania Horticultural Association
TANTRADE	Tanzania Trade Development Authority

TBS	Tanzania Bureau of Standards
TDV	Tanzania Development Vision
TFDA	Tanzania Food and Drug Authority
TPMP	Tanzania Post-harvest Management Platform.
UK	United Kingdom
UN	United Nations
USAID	United States of America International Development
URT	United Republic of Tanzania
USD	US Dollars
UWAMARU	Umoja wa Wakulima wa Maparachichi Rungwe
VEO	Village Executive Officer
WAO	World Avocado Organisation
WEO	Ward Executive Officer
WHO	World Health Organisation
WTO	World Trade Organisation
WTS	Westfalia Technological Services
WWF(UK)	Worldwide Fund for Nature

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Chapter 1

Introduction

1 Introduction

This research focuses on food loss and waste in Tanzania's two distinct avocado production systems to elucidate how dynamic interrelationships and interactions between institutions, materiality, and practices shape the ways loss and waste production occurs in the production systems. This thesis provides a detailed case study and ethnographic analysis of Tanzania's avocado production system to inform policy and development projects that aim to reduce agricultural loss and waste and improve avocado production systems, especially among smallholders. This thesis takes a social relations approach to food loss and waste study and draws broadly on the food waste regimes concept put forward by Zsuzsa Gille (2013). It adopts 'following the thing' and 'go along' ethnographic approaches (Cook, 2006; Kusenbach, 2003) to highlight the social relations, power dynamics, and inequalities in the domestic and export avocado production systems and its implications for loss and waste generation. Following this introductory section, the research background section highlights the trends in loss and waste studies to situate this thesis. The chapter then provides an overview of Tanzania's agriculture and economy, food loss and waste, policies, and strategies to deal with Post-Harvest Loss (PHL) and the thesis structure.

1.2 Research background

Food – its production, distribution, and consumption- provides a powerful lens to examine broader societal changes and explore almost any geographical inquiry of interest (Goodman, 2016; Jackson, 2009; Freidberg, 2004). In recent decades, one aspect of food that has received much attention in public and academic discourses is food loss and waste because of its social, environmental, and economic impacts (Papargyropoulou *et al*., 2014; Evans *et al*., 2013; Campbell *et al*., 2017). Food loss and waste present a loss of resources used in producing, processing, distribution, and preparation. But also, loss of income to farmers (particularly to smallholders), processors, manufacturers and retailers, higher food prices, and significantly threatens the food and nutrition security of millions of people in both developed and developing countries.

Since the seminal work by Parfitt *et al*. (2010), which identified 11 stages of the food supply chain (FCS) where losses and waste occur, there has been a surge toward quantification of food loss and

waste in global food production and supply chains (FAO, 2011; Gustavsson *et al*., 2013). However, the burgeoning literature in social scientific studies on food loos and waste is overly concentrated on the off-farm stages of the food supply chains (storage, distribution, supermarkets/retails, and household consumption) to the neglect of farm-level loss and waste (Alexander *et al*., 2013; Buzby *et al*., 2014; Johnson *et al*., 2019). Evans *et al*. (2013) argued that these stages lend themselves more easily to social scientific research because the waste can easily be quantified, causes identified, and mitigations or interventions prescribed.

A recent report by WWF-UK (2021), which focuses on farm-level losses and waste, identified primary production as a major hotspot for global food losses. The report estimates that global food loss and waste on farms (include early stages of supply chains) amounts to 1.2 billion tonnes per year, representing 15.3 per cent of global agricultural production[1]. This is higher than an earlier study by FAO (2011), which estimated that annually, 1.3 billion tonnes of food is lost and wasted in global supply chains from production to consumption; and higher than FAO's (2019) revised estimate, which put farm-level losses at 14 per cent of global agricultural production. According to the WWF-UK report, fruit and vegetable losses and waste on farms, including pre-harvest losses, account for 26 per cent of all food wasted globally during production (ibid). Fruits and vegetable losses from farm to retail stage is the most significant contributor to total food loss in the global food supply chain (Parfitt *et al*., 2010; FAO, 2011; Buzby *et al*., 2014). In developed countries, losses from the farm to retail account for half of the total losses of fruits and vegetables in the supply chains (Gunders, 2012; Parson *et al*., 2018). While in developing countries, it is estimated that much of the losses and waste occur in early stages of food supply chain (FAO, 2019; 2011; WWW-UK, 2021).

Due to the significant amount of loss and waste in agricultural production and across sectors of the food supply chains, there have been growing calls to reduce loss and waste at all stages of the food supply chain. For example, the United Nations Sustainable Development Goal (SDG 12.3) set the target of halving per capita global food waste at the retail and consumer levels and significantly reducing food losses along production and supply chains, including post-harvest losses by 2030 (UN SDG, 2015). In Africa, the African Union Commission (AUC) set the target to halve current levels (estimated at 37% of production) of PHL by 2025 under the Malabo Declaration's commitment to ending hunger in Africa by 2025 (AUC, 2018; FAO, 2011). In Tanzania, about 40% of all harvest is lost through post-harvest, and the government's 10-year Post-Harvest

[1] Of the 15.3% of total farm losses and waste, 8.3% of food is preharvest waste and 7.0% is during farm-stage post-harvest activities.

Management Strategy (PHMS – 2019-2029) aims to reduce post-harvest losses along commodity value chains and sufficiently contribute to food and nutrition security and the economy (URT-PHMS, 2019).

Despite agricultural production being a hotspot for food loss and waste in both developed and developing countries, understanding farm-level food waste remains on the fringes compared to efforts targeted at retail and consumption food waste (Alexander *et al.,* 2013; WWF-UK, 2021). When attempts are made to investigate agricultural loss and waste, they focus mainly on quantification. Further, the results have been patchy due to complexities - differences in methodologies; definitions of food loss – what is to be counted; and data quality (particularly, lack of in-field measurement) associated with measuring farm-level loss and waste (Johnson *et al.,* 2018b). However, recently, there has been progress toward overcoming the methodological challenges of measuring farm-level losses with a more standardized approaches (see for example, FAO, 2019; Johnson *et al.,* 2018a; Johnson *et al.,* 2018b; Food Loss and Waste Protocol, 2016). Notwithstanding, significant challenges remain to harmonise approaches (Ellison *et al.,* 2019).

In SSA, like much of the global South, food waste research concentrates on estimating the magnitude of losses (post-harvest losses–PHL) and intervention measures (Sheahan and Barrett, 2017; Minten *et al.,* 2016; Affognon *et al.,* 2015; Rosegrant *et al.,* 2015; Abdoulaye *et al.,* 2016; Abdoulaye *et al.,* 2015 Kaminski and Christiaensen, 2014). In Tanzania, much of the scanty academic research and government effort toward food loss and waste is focused on post-harvest management strategies -PHMS (URT – Ministry of Agriculture, 2019; Gromko and Abdurasulova, 2019; Gromko, 2018). However, these studies and mitigation strategies propose by them fails to recognise actors' role and actions and the power relations among actors in the supply chains. Therefore, there is the need to rethink food loss and waste as 'social relations' (Gille, 2013) to understand how power dynamics involved in the production and distribution of food manifest in the generation of food loss and waste in the global South context.

1.3 Towards food loss and waste as a social relation

Within food waste literature, there is often distinction between food losses and food waste based on the stage of the food chain at which the loss or waste occurs (FAO, 2011; Parfitt *et al.,* 2010; Gustavsson *et al.,* 2013). However, there is a lack of consistency in the use of the terms and the exact scope of what is food loss and what is food waste (Schneider, 2013; HLPE, 2014). "Food loss" is argued to happen at the pre-consumer stage of the food chain (growers, distributors,

manufacturers, processors etc.). In contrast, "food waste" occurs at the retail or consumer stage of the food supply chain (Parfitt *et al*., 2010; FAO, 2011). Other scholars base the distinction between food loss and food waste on the nature or origin of the causes of loss or waste. If the reason is "behavioural" or "voluntary", it is considered waste; if it is "not behavioural" or "non-voluntary" is considered loss (HLPE, 2014). Such duality of approaches often confuses the definition and scope of investigation on food losses and waste, contributing to unreliability and lack of understanding of "why" loss and waste occur. Within agricultural production, food loss and waste can happen either due to decisions and direct or indirect actions/inactions by actors both at the distribution and retail stages of the supply chain or at the production stages (Gille, 2013; Alexander *et al*., 2013; Minor and Thornsbury, 2020; WWF-UK, 2021). The binary approach to food loss and waste 'reduces all food waste to the problem of inefficiency and technological inadequacy' (Gille, 2013, p.39).

Consequently, farm-level and PHL and waste in the global South are mainly characterised as due to lack of technology, infrastructure, and poor management practices (Parfitt *et al*., 2010; FAO, 2011). Therefore, policy interventions emphasise technological improvements (technological fix) in production, storage, and distribution (Sheahan and Barrett, 2017). Structural and institutional causes such as market conditions (inadequate information and bad anticipation of market conditions), trading practices by traders, exporters, retailers and local norms and values that shape agricultural systems are primarily ignored (HLPE, 2014). Moreover, such a binary approach fails to address power inequalities and social relations in the agricultural production system and their implications for losses and waste (WWF-UK, 2021; Gille, 2013). More so, there is a tendency to conflate the causes of food waste with the stages in which they occur. Therefore, drawing such an apparent dichotomy between loss and waste is not helpful for this thesis, which seeks to understand how interactions and the interrelationships between institutions, practices, and materiality lead to losses and waste. In this thesis, the term "losses and waste" is used to cover everything - it means losses and waste during pre-harvest, at harvest and in the early phase of the supply chain.

Within social scientific research on food waste, there have been calls to take a more social relations approach to researching food waste (Evans *et al*., 2013; Alexander *et al*., 2013; O'Brien, 2013; Gille, 2013; Evans, 2012; 2011). Taking a social relational approach to food loss and waste allows us to refocus food loss and waste research to give an audience to social relations between food production and waste generation. Thus, we take a step away from the dominant question of "how much waste is there" to ask "what", "how", and "why" losses and waste occur (Moreno *et al*., 2021; Meah and Watson, 2013). This calls for shifting our focus from the matter that has been wasted to

the activities from which waste emerges, without ignoring the material concreteness of what has become waste (Gille, 2007; 2013). Gille (2013, p.29) suggests that 'waste constitutes a social relationship and as such should be studied as something produced materially and conceptually as social relations.'

Approaching food loss and waste from this perspective allows us to consider the role of institutions, conventions, materiality, and practices in food waste production, enhancing our understanding of and rethinking agricultural losses and waste as a 'social relations. This helps to illuminate power relations and inequalities involved in the production systems and how they manifest in the generation of losses and waste, particularly in the global South. Researchers like (Gille, 2013; O'Brien, 2013 and Krzywoszynska, 2013) have engaged with the role of institutions and social structures to ask essential questions about value, governance, and power in waste production (Evans *et al.,* 2013). Their work reveals the subtle production of inequality at various levels. Therefore, attention to links between different economic, regulatory, and cultural processes that gives rise to food waste is essential. However, such analysis has yet to be extended to specific contexts in the global South. Besides, the role of informal institutions (norms and customs and values) has not received much attention in food waste research in the global South and food and waste literature in general (especially, on-farm losses).

This research stems, in part, from a desire to challenge the dominant view that food losses and waste in the global South are due to inefficiencies in agricultural, storage and infrastructural systems. It does so by recognising the inherent power in agricultural production systems and the role of institutions, focusing on broader structural, systemic, and social/cultural causes of losses in agri-food production (Alexander *et al.,* 2013; Gille, 2013). More generally, it is a response to the calls to take a social relations approach to food waste research (Gille, 2013; O'Brien, 2013; see also Evans, 2011; 2012) and to situate food waste research upstream of supply chains, focusing on losses and waste in agricultural production systems (Alexander *et al.,* 2013).

1.4 Moving towards food waste regimes

By approaching agricultural loss and waste "as arising from social relations, and from 'macro' structural and institutional forces that operate across multiple scales" (Gille, 2013, p.41), it is possible to theorise and conceptualise farm losses and waste as issues of power dynamics and inequalities. I draw on the concept of food waste regimes by Zsuzsa Gille (2013) to understand the social relations of loss and waste production within Tanzania's avocado supply chains.

The concept treats food waste as a social relationship. It assumes that there is waste circulation and value circulation in any economy and that the two are interdependent. She argues that waste generally exhibits social systemicity at the macro and micro levels. Therefore, the food waste regime is conceptualised as "the dynamic interrelatedness of value chains and waste chains with risk avoidance strategies as the most important transmission belt between the two" (ibid, p.28). The food waste regimes concept, according to Gille (2013, p.29), "consist of social institutions and conventions that do not only determine what wastes are considered valuable but also regulate their production and distribution". The concept identifies three regimes: production of waste, representation of waste and the politics of waste:

> *"The production of waste explores which social relations determine the waste production and their material composition. While the representation of waste investigates how waste is viewed within key dichotomies and on which side it lies (e.g., efficiency/inefficiency, gain/loss, usefulness/uselessness), alongside how the waste materiality has been understood and with what consequences, as well as the body of knowledge and expertise that are mobilised to deal with the waste. In researching the politics of waste, key questions include – to what extent is waste issue in public discourse; what the taboo is; what are [the] policy tools; who is mobilised to deal with the waste issues" (ibid, 29).*

Each regime is not static and must be approached and investigated dynamically. The food waste regimes incorporate cross-national and cross-scalar linkages that affect food waste production, representation of food waste, and politics of food waste. In the context of this research, I focused on the production of farm waste – to explore which social relations lead to losses and waste generation. Gille (2013) argues that in the production of farm waste, uncertainties and risk plays important roles, and risks themselves present power issues in the production system. To use the food waste regimes concept, I adopt an integrative approach that views losses and waste production in the domestic and export avocado production systems as the outcome of interactions and interrelationships between institutions, materiality, and practices (elaborated in chapter 2). The following section provides a contextual background of the study site.

1.3 Contextual background

1.3.1 Overview of agriculture and economic growth.

This brief overview of Tanzania's agriculture and the economy will provide context for the analysis presented in this thesis regarding the broader agricultural production system within which avocado

production is situated. The United Republic of Tanzania (URT) is in Eastern Africa, located between longitudes 29° and 41° East and latitudes 1° and 12° South. Politically, URT consists of mainland Tanzania and the semi-autonomous state of Zanzibar (Islands of Zanzibar and Pemba). Figure 1.1 shows the physical geography of Tanzania.

Figure 1.1: Physical geography of Tanzania. Source: Available at: https://www.nationsonline.org/oneworld/map/tanzania-political-map.htm. Accessed 31/03/22

In terms of landmass, Tanzania is bigger than Kenya and Uganda combined, covering 945.5 thousand sq. km. Of this, 884 thousand sq. km is land area, and 61.5 thousand sq. km is made up of inland lakes (Tanzania National Bureau of Statistics - NBS, 2021). Of the total land area, productive agricultural or arable land covers approximately 44 million hectares representing 45% of the country's total land area (FAO, 2016). According to FAO estimates, as of 2016, only 33%

of the agriculturally productive land was under cultivation, indicating a vast unexploited agricultural potential (FAO, 2016)

Tanzania's climate, land structure, and soil type vary significantly across the country and even within regions. Broadly, Tanzania is zoned into nine agro-ecological zones (AEZs) (Du Pauw, 1984). Figure 1.2 shows the main AEZs in Tanzania (Note - that Isolated Granitic Mountains in the legend are not classified as AEZ). Avocados are grown mainly in the Northern Highlands, Southern Highlands, Western Highlands, and Southwestern Highlands areas, also designated as coffee-banana livelihood zones (Figure 1.3). A recent study by Tanzanian government on agriculture climate resilience (URT, 2014) mapped out 14 different livelihood zones based on the AEZs, and significant crops are grown in those regions.

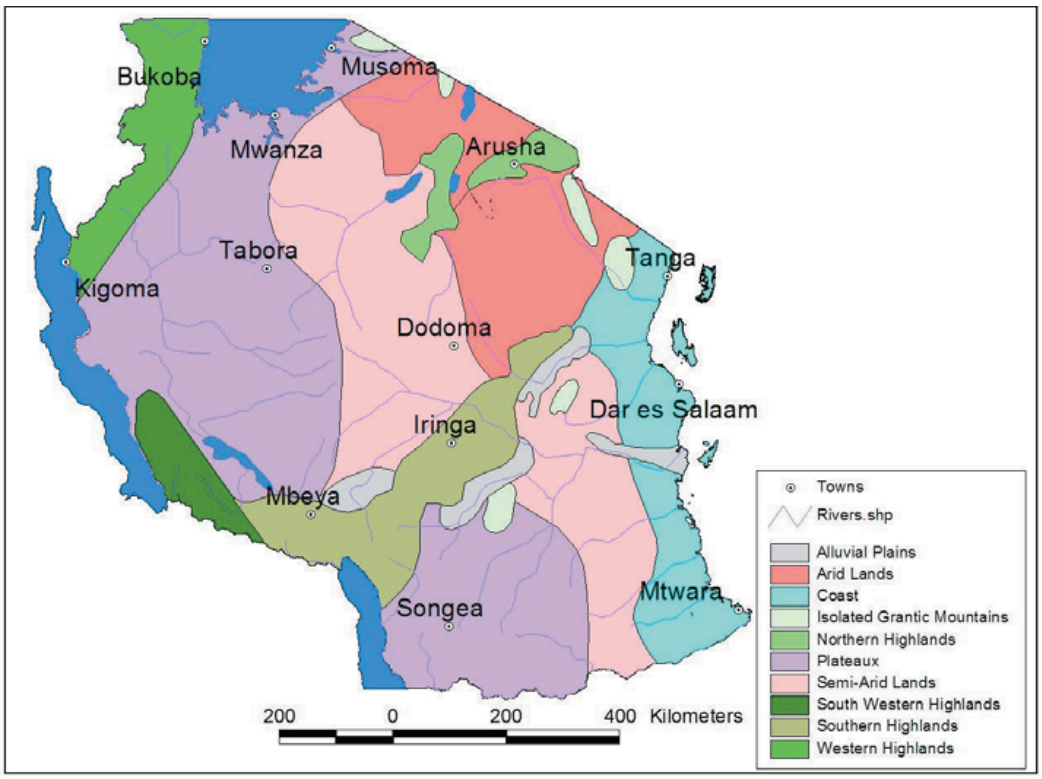


Figure 1.2:Tanzania's Agro-ecological zones. Source: URT (2014).

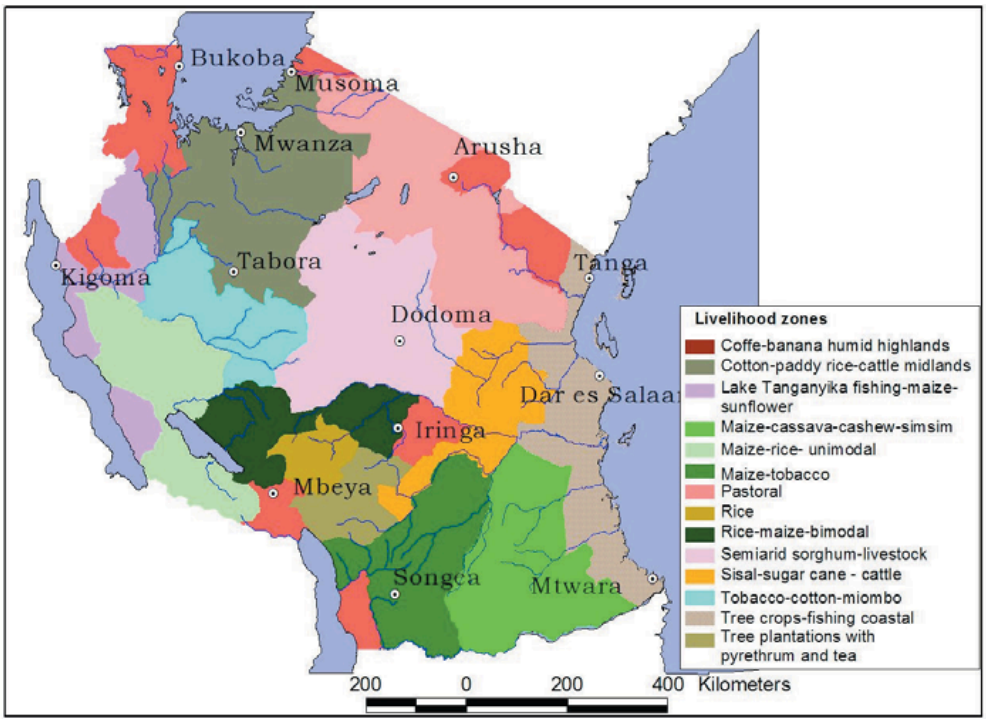


Figure 1.3: Tanzania's Livelihood zones. *Source: URT (2014)*

Notable avocado producing regions in the highlands AEZs include Kilimanjaro, Arusha, Mbeya, Njombe, Iringa and Songwe, but also in Tanga, Morogoro, Kigoma and Kagera regions (Mwakalinga, 2014; Juma *et al*., 2019).

The population of URT has quadrupled since 1967, from 12.3 million to 57.6 million in 2020, with an annual average growth rate of 3.1 based on the 2012 population census (NBS, 2021). Most of the population (77%) live in rural areas, with agriculture as the main occupation[2], while 23% of the population live in urban areas (NBS, 2021). In terms of economic growth, URT was recently (in 2020) classified as a lower-middle-income country and aims to achieve a middle-income economy by 2025 (World Bank, 2021). In the last two decades, Tanzania has experienced high economic growth, with GDP rising from 3.5% in the 1990s to an annualised average rate of 6.5% since 2000, which has positioned URT among the fastest growing economies in Sub-Saharan Africa (World Bank, 2021; NBS, 2021). Agriculture is the mainstay of Tanzania's economy, accounting for about 30% of gross domestic product. In 2018, the agricultural sector contributed 24.5% of annual export earnings (FAO, 2018). However, growth has been slowest in the agricultural sector, averaging about 4% a year compared to other sectors like manufacturing and construction (World Bank, 2021; 2016; FAO, 2019).

[2] About 14 million smallholder farmers and 1.5 million commercial farmers are directly engaged in agricultural sector (NBS, 2021).

Despite the agricultural sector witnessing slower growth during the last decade (2006 – 2016), there has been remarkable growth since 2016 - an increase of about 6.5% in 2018 due to the strong performance of the horticulture sub-sector (Modamba *et al.,* 2019; URT – ASDP II, 2017). The horticulture sub-sector is the fastest growing industry in the agriculture sector, with 11% annual growth rate and the highest forex exchange earnings over the past decade (Tanzanian Horticultural Association - TAHA, 2017). According to TAHA, between 2012 and 2016, horticulture exports grew by 43% (from USD 374 million in 2012 to USD 640 million in 2016), rising to USD 779 million in 2019. And is on track to achieve 3 billion USD annual export earnings by 2025 as set out in Tanzania Development Vision 2025 (TAHA, 2020; 2019). Avocado export contributions to horticulture earnings have grown steadily since the first export in 2009. Between 2014 and 2018, export earnings from avocados have averaged around 8.3 million USD per annum (ITC, 2020) and increased to 10 million UDS in 2019.

The horticultural sub-sector is a critical driver of Tanzania's agriculture sector and has attracted $30 million worth of foreign direct investments in the last four years (TAHA, 2020; 2016). Export avocado production has contributed significantly to investments and export earnings within the horticulture sub-sector. It has gained prominence from the government, development agencies and the private sector for its potential to reduce rural poverty (Christiansen *et al.,* 2014). Currently, over 10,000 smallholder farmers are involved in export avocado production (Field Journal, 2019). Nationally, there has been an upward increase in the volume of horticulture production in the last ten years, with an annual production growth rate of 75% for vegetables and 31% for fruits (from 2010 to 2019) (van der Maden *et al.,* 2021). Figure 1.4 shows the predominant fruit and vegetable growing areas in Tanzania.

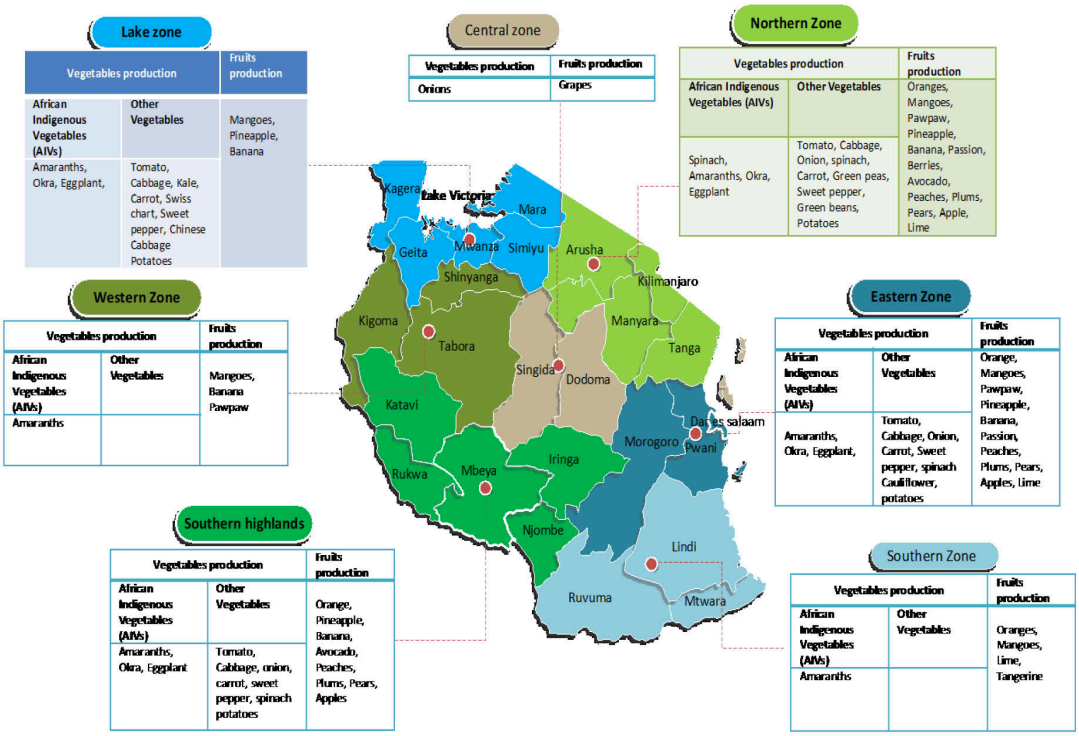


Figure 1.4: Fruits and Vegetable production areas. *Source: Adapted from van der Maden et al. (2021)*

1.3.2 Food loss and waste in Tanzania.

Like the rest of SSA, Tanzania faces significant food losses and waste throughout the entire supply chain for different commodities. The National Agricultural Policy (2013) recognise pre-harvest and post-harvest losses, which account for 30-40% of the total yearly crop production, as one of the significant challenges facing the agriculture sector. Losses are higher in the horticulture sub-sector (e.g., fruits, vegetables, root, and tuber crops), with losses estimated at around 40-50% of all production due to perishability of the commodities and lack of post-harvest infrastructure (URT - NPHMS, 2019; FAO, 2011). According to several studies by FAO, Tanzania farmers lose up to 40% of their harvest – although there are variations depending on the geographical location and the crop type (FAO, 2011). For example, a study on mango in the Morogoro region found that losses ranged between 48 and 60% along the supply chain (Msogoya and Kimaro, 2011). Other scholars have investigated post-harvest losses of different products within the horticulture sector at the retail level (see, for example, Mtui, 2017; Majubwa *et al*., 2015).

A recent case study by Ekka and Mjawa (2020) on the role of Tanzania's Horticulture Association in reducing post-harvest loss in the horticulture sector concluded that post-harvest losses for fruits

and vegetables in the domestic market is about 40% compared to post-harvest losses in the export-oriented supply chains, which is about 10% (ibid). This is because the domestic markets are faced with fragmented value chains, poor transportation infrastructure, long distances between markets and production areas, poor handling practices, improper harvesting practices, a lack of temperature management systems, oversupply during peak seasons, and unsuitable storage facilities, (Ekka and Mjawa, 2020; see also URT – NPHMS, 2019; Guo *et al*., 2020; Mtingele and O'Connor, 2019; Affognon *et al.,* 2015; Kitinoja and Kader, 2015). On the other hand, the export-oriented sector has improved production and post-harvest practices, infrastructure (packaging, temperature management, electricity, transportation) and a streamlined value chain (Ekka and Mjawa, 2020).

Although efforts have been made toward the quantification of losses and waste, the studies reviewed above do not reveal the full extent of the problem as there is no compressive and accurate data on losses and waste, and most studies are confined to small geographical areas (Affognon *et al.,* 2015; Mtingele and O'Connor, 2019). Moreover, the studies focus on post-harvest losses to the neglect of farm losses. As already argued, the focus on quantification and drivers or causes of losses and waste does not attend to the why question, even at the policy level (section 1.3.3). This study addresses this gap by giving attention to broader structural, systemic, and social/cultural causes of losses in relation to agri-food production.

1.3.3 Key National policies, strategies, and programmes to reduce losses

Since the 1980s, losses in food supply chains in Tanzania have received considerable attention following the advent of the Larger Grain Borer (LGB) pest, which led to significant losses in cereals and threatened food security in the country. As a result, there have been several policy reforms within the agricultural sector to reduce losses and waste especially PHL and achieve food security. The most significant being the National Agriculture Policy (2013) and the Agricultural marketing policy (2008), which view post-harvest losses as a challenge in achieving food security. For instance, the Agriculture Marketing Policy calls for developing and improving agricultural marketing infrastructure to reduce the PHL of agricultural products. To achieve implementation of these policies, several reform programmes such as *KILIMO KWANZA* (which means Agricultural First launched in 2009)[3], the Tanzania Agricultural and Food Security Investment Plan (TAFSIP),

[3] *Kilimo Kwanza* called for more commitment to a stronger public-private partnership to fast track the commercialisation and modernisation of the smallholder sector (World Bank, 2016)

and the Southern Agriculture Growth Corridor of Tanzania (SAGCOT, launched in 2010)[4] have been initiated to speed up implementation of the Agricultural Sector Development Program (ASDP-I, from 2006 to 2013, and ASDP-II, from 2018 to 2025)[5]. In 2014, the Tanzania Post-Harvest Management Platform (TPMP) was launched to bring together efforts from different stakeholders dealing with issues of post-harvest management – particularly within the policy framework arena. This effort led to the development of the new ten-year National Post-Harvest Management Strategy (2019-2029), which provides a clear road map for government and industry stakeholders with set of strategic objectives and management interventions to reduce PHL.

However, the policy interventions on PHL often fails to recognise how social relations among the actors and how institutional arrangements between actors and power dynamics result in losses and waste on farms and within the distribution chain. This thesis addresses this knowledge gap; it takes a qualitative approach to research losses and waste in Tanzania's avocado production and supply chain.

1.4 Aim and objectives of the study

While there has been good progress in applying social practice theory and sociological approaches in understanding consumer food waste, the same cannot be said of on-farm and early stages of production systems, particularly in the global South. This study fills this gap by taking a sociological approach that integrates the concepts of institutions, materiality, and practices. This study aims to understand how institutions, practices, and materiality intersects to produce food loss and waste in Tanzania's domestic and export avocado production systems and how losses and waste production manifest power relations and inequalities within the two distinct avocado production systems.

[4] The SAGCOT program is an investment vehicle to attract foreign direct investment (a total of US$2.1 billion) into new agribusiness for 20 years backed by US$1.3 billion public sector infrastructure investments. In 2016, the world back approved $70 million dollars in investment project in SAGCOT programme aimed at helping 100,000 smallholder farming households by expanding partnerships with agribusinesses in the Southern Corridor of Tanzania. SAGCOT program aims to create at least 420,000 new jobs and lift more than 2 million people out of poverty and to bring at least 350,000 additional hectares into commercial production by 2030. (World Bank, 2016; SAGCOT investment blueprint, 2010) Available at http://www.worldbank.org/en/country/tanzania/brief/southern-agricultural-growth-corridor-of-tanzania-sagcot-fact-sheet. Accessed on 21 July 2017. See also SAGCOT website http://www.sagcot.com/

[5] "The ASDP provides the government with a sector– wide framework for overseeing the institutional, expenditure and investment development of the agricultural sector" (URT-NPHMS, 2019)

1.4.1 Objectives

1. To examine the historical, socio-economic, and political context within which Tanzania's two distinct avocado production systems and supply chains have evolved and developed.
   a) How did different socio-economic, cultural, and political contexts contribute to the introduction and adoption of domestic and export avocado production systems?
   b) How has the rising importance of avocado as a global superfood engendered production levels in Tanzania?
   c) How are the two distinct avocado production systems and supply chains organised, and who is involved?
2. To critically examine how the interrelationship between institutions and materiality shapes the agronomic practices in the two different avocado production systems and its implications for pre-harvest loss and waste generation
   a) How do institutions and materiality structure planting and agronomic practices in domestic and export avocado production?
   b) In what ways do the dynamic interrelationships between institutions, materiality, and agronomic practices lead to losses and waste during production?
   c) How do institutional arrangements between export avocado producers and exporters/buyers lead to new forms of social relations? How do farmers experience power play?
3. To investigate the institutional arrangements and the social relations in which buying and selling practices occur and how risk and power dynamics generate losses and waste in the domestic avocado supply chain.
   a) What institutional arrangement exists between farmers and traders?
   b) How does the institutional and material context in which buying/selling practices occur lead to losses and waste generation? How do the power dynamics manifest in these practices?
   c) How do different actors adopt risk-avoiding strategies, and how do social relations between the actors result in losses and waste generation?
4. To investigate how institutional arrangements and social relations among farmers, farmer groups, and exporters/buyers shape selling/buying relations and the implications for exploitation, loss, and waste production in the export supply chain.
   a) What are the institutional arrangements between farmers and exporters? How does this arrangement shape buying/selling relations?

b) What are the differences in how the social relations of buying/selling operate in the Northern Highlands (NH) and Southern Highlands (SH)? How do these differences produce losses and waste?
c) How do interactions between the materiality of the avocado, institutions and practices, and power dynamics create losses, waste, and inequalities among growers?

1.5 Thesis structure

This thesis is structured into eight chapters. Following this introductory chapter, the remainder of the thesis is organised as follows:

Chapter 2: The Literature Review critically evaluates the theoretical and empirical gaps in food loss and waste related to the key concepts of institutions, materiality, and practices. It argues that adopting an integrative approach that combines these concepts provides a better conceptual framework for understanding why food loss and waste occur in agricultural production. It further posits that such an integrative approach provides better theorisation of inequalities and power relations in food production systems through the lens of loss and waste.

Chapter 3: The methodology chapter first provides a brief overview of the epistemological and ontological stance and the rationale for choosing the qualitative case-study approach embedded with 'following the thing' as a methodological lens. It then explains the context and selection of the case studies. The chapter then critically reflects on the research methods adopted, the challenges encountered, how these were addressed, and how the data was analysed. The chapter ends with reflections on research experience and how issues of positionality and ethical considerations were negotiated and managed during the fieldwork, analysis and write up.

Chapter 4: The chapter first explores the historical account of the introduction of avocado growing and the socio-economic and political context for the development of Tanzania's two distinct avocado production systems. It argues that missionaries, colonisation, and, to a greater extent, coffee production are linked to the development of Tanzania's two avocado production systems. It then discusses how the supply chains are organised, who is involved and reflects on the challenges, which provides context for the subsequent empirical chapters. Empirically, the chapter contributes to a better understanding of how value(s) derived from the avocados and how the cultural framing of avocados as 'food' influences the perception of what is considered waste. The chapter concludes

with a reflection on how domestic and export avocado production systems allow for in-depth exploration of materiality, institutions and practices that intersect to produce losses and waste.

Chapter 5: This chapter addresses the second objective of the study, it argues that consideration must be given to the dynamic relationship between institutions, materiality, and agronomic practices to understand why losses and waste occurs during production. It calls for the need to sufficiently engage with the root causes of pre-harvest losses and waste. Which are embedded in institutions that structure how agronomic practices are enacted and what materials are drawn upon to accomplish those practices, and the effects on pre-harvest losses. Further, it highlights how institutional arrangements between exporters and farmers create forms of social relations of production and the power inequalities experienced by farmers.

Chapter 6: This chapter addresses the third objective of this research, which focuses on the domestic avocado supply chain by examining the institutional and material context in which buying and selling practices lead to losses and waste. In the global South, agricultural losses are attributed to a lack of technology and infrastructure, which provides only a one-sided view and fails to consider how the social relations and the interrelations between institutions, materiality and practices create losses and waste. The chapter addresses this gap by examining how traders' risk avoidance strategies and power dynamics manifest in the trading practices to produce losses and waste. The chapter argues that market institution – "a credit system" which underpins the supply chain provides an avenue for exploitation. Empirically, the chapter contributes to the scanty literature on social relations of food waste in agricultural production in the global South.

Chapter 7: This chapter provides new empirical evidence of how institutional arrangements shape modes of buying and selling relations. It argues that risk avoidance strategies by farmers and exporters aid value extraction and exploitation, which impacts food losses and waste production. The chapter discusses how the institutionalised 'rejects sharing systems' among growers in the NH create an avenue for risk reduction strategies by farmers, which further produce losses. The egalitarian nature of the reject sharing system exacerbates inequalities among growers. It highlights farmers' vulnerabilities and how these vulnerabilities lead to further losses and waste generation. Furthermore, it illustrates farmer(s) resistance against monopolistic power and control and its implication for losses.

Finally**, chapter 8** provides a broader discussion on how the findings (chapters 4 -7) illuminate and further academic understanding of agricultural losses and waste in different production systems

and what they mean for the Tanzania farmers and beyond. It highlights how social relations in the production system and food loss and waste generation provide a critical lens to understanding power dynamics and inequalities in food supply chains. The chapter first revisits the conceptual framework developed in chapter 2 and discusses how it enabled the conceptualisation of food loss and waste as social relations. It then discusses how the findings from this thesis support and contribute to the current debates on food loss and waste and makes policy recommendations. The chapter, finally, concludes this thesis by discussing the implications of this research and future research directions.

Chapter 2

Understanding Food Loss and Waste: Theories of institutions, materiality, and practices

2.1 Introduction

This PhD research explores food losses and waste in Tanzania's two distinct avocado production systems to understand how attending to losses and waste in the production and supply chains can help us understand how inequalities and power operate in food systems. The thesis adopts a social relations approach, drawing broadly on Susuza Gille's (2013; 2010) food waste regimes concept. Sociological approaches to studying food waste have only gained traction in the last decade to understand the complex processes and interactions in agricultural production, distribution, and consumption of food and why food loss and waste occur within those processes and interactions (Evans, 2014; 2012; 2011; Evans *et al.,* 2013; Meah and Watson, 2013). This literature broadly asks, 'why does good foodstuff become 'waste'?'. Unpacking the complexities in the social relations of agri-food production and distribution that produces food losses and waste requires integrating approaches that bridge many knowledge domains. Goodman (2016, p.257) argues that: "in studying food, it is impossible to separate notions of culture, space, economy, politics and the materiality within which it is thoroughly imbued". By attending to the concepts of institutions, materiality, and practice, we can better understand how these concepts intersect to produce food loss and waste in agricultural production to highlight the nuances in how food loss and waste occur in domestic and globalised food systems.

This chapter reviews the theoretical and empirical work within these concepts mentioned above and how they have been applied to agri-food and food waste studies to highlight critical research gaps and to provide a theoretical context for the thesis. The chapter first examines the concept of institutions in general, the role of institutions in domestic and global agri-food systems; how trust, risks, food safety, and quality are institutionalised; and the implications for food loss and waste in both domestic and export-oriented production systems. Secondly, the chapter discusses the concept of materiality and how it has been conceptualised in agri-food production and food loss and waste studies. It highlights relational materiality as a way of linking production and consumption approaches. Lastly, the chapter discusses practice theory in relation to food production and food waste.

2.2 Institutions: Food production, and food loss and waste

2.2.1 On institutions and institutional arrangements

Institutions, as used in the context of this research, draw on a new institutionalism paradigm which regards institutions as rules (not organisations as defined by old institutionalism) (Miller, 2009). Institutions are seen as dynamic but stabilising patterns of behaviour, which are contextually embedded (North, 1990). That is, institutions do not exist as independent entities but instead connect with other arrays of institutions, which may either reinforce or undermine the effects of one another (Lowndes and Roberts, 2013, p.22). New institutionalism focuses on both informal conventions as well as formal rules. They argued that informal conventions and norms could equally shape actors' behaviour the same as formal procedures and sometimes reinforce formal rules (Lowndes *et al.,* 2018). There are several versions of new institutionalism, but the three most dominant versions are rational choice institutionalism, sociological institutionalism, and historical institutionalism. Here, I briefly elaborate on the rational choice institutionalism to set the context of how 'institutions' is applied in this thesis.

The rational choice institutionalism defines "institutions as the rules of the game in a society; more formally, they are the humanly devised constraints that shape human interaction" (North, 1992, p.477; see also 1990). The approach assumes that actors calculate the best course of action to maximise their interests within a specific institutional arrangement (Ostrom, 1986). The institutional arrangement refers to "a set of rules or agreements governing the activities of a specific group of people pursuing a certain objective" (Eaton *et al.,* 2008, p.10; see also Williamson, 1998). In the context of this research, such institutional arrangements may include, for example, contracts (such as exchange of goods), farmers or producer organisations with agreements to purchase inputs together or supply products together to a buyer (ibid). The institutional arrangement occurs within institutional environment which is described as the broader socio-economic framework within which different institutional arrangements take place (Eaton *et al.,* 2008; Williamson, 1998). The institutional environment consists of formal and informal institutions (Keefer and Shirley, 2000; Williamson, 2002).

According to North (1990), formal institutions are explicit rules and regulations – codified at different scales as in national laws such as constitutions, economic rules, local regulations and enforced via monitoring systems, penalties or sanctions, or incentives. On the other hand, informal

institutions are social norms, values, trust, conventions, sanctions, taboos, customs, traditions, and codes of conduct (see also Keefer and Shirley, 2000). Informal institutions are usually socially shared rules, unwritten and typically tacit. They are maintained and reproduced through ways of thinking and repeated social practice and enforced by customs and habits (Scott, 2008; Hodgson, 2006; North, 1990). Figure 2.1 depicts institutional arrangements within different formal and informal elements of the institutional environment.

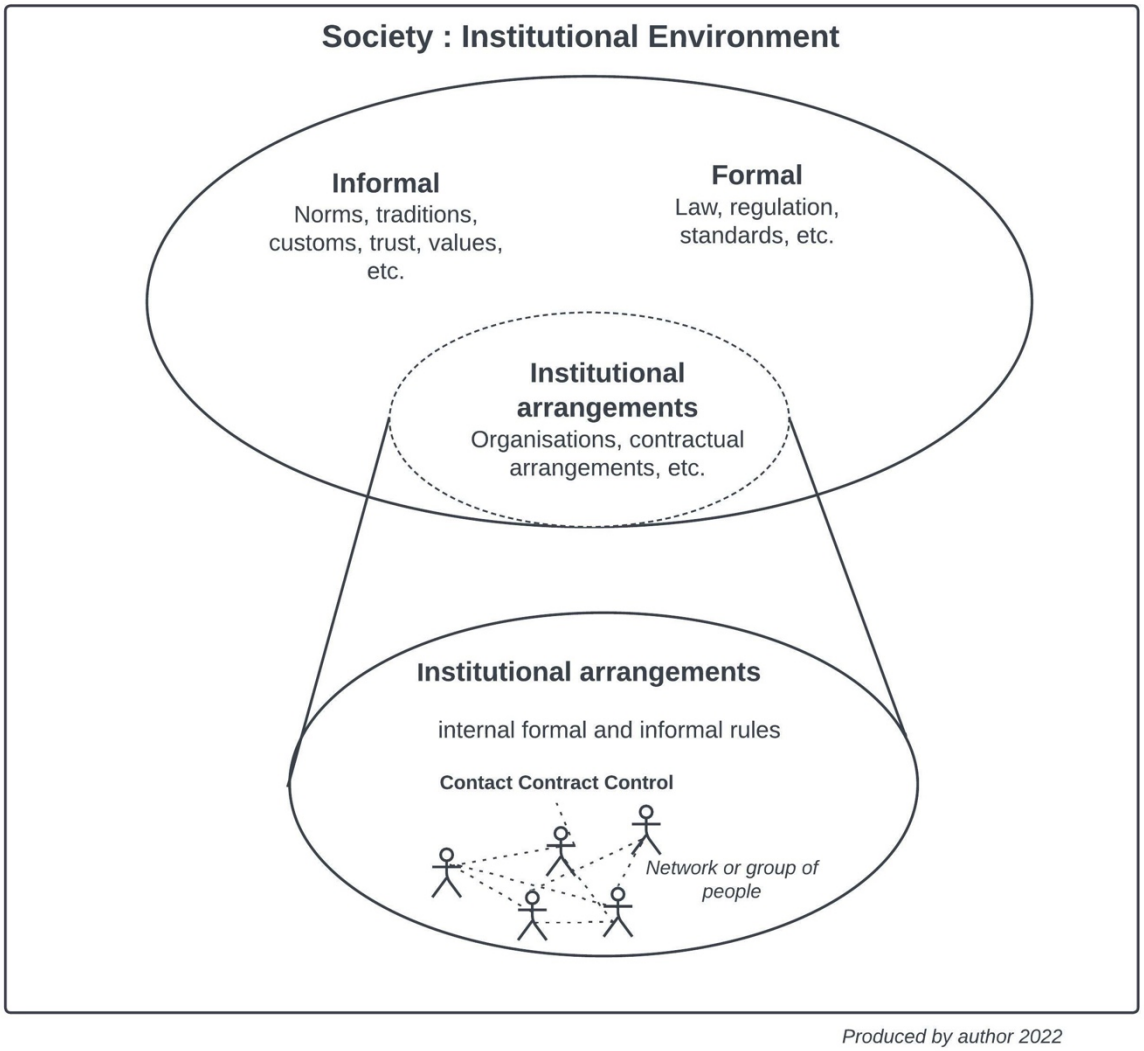


Figure 2.1: Different levels and components of institutions. *Source: Adapted from Eaton et al. (2008)*

From Figure 2.1, the institutional arrangements are set within the broader formal and informal institutional environment. The institutional arrangements themselves can be formal or informal rules governing the activities of the group of people or network of people. The institutional environment provides information and enforcement mechanism that reduce uncertainty for each actor about the corresponding behaviour of others. In the context of this thesis and agri-food

production systems in general, the growing of food and its distribution and consumption are governed by formal and informal institutions – formal rules and informal rules.

For example, in high value horticultural production (in this case, export-oriented avocado production and supply chain), formal institutions include food safety rules and regulations, grades and quality standards, trade rules, and certification schemes that determine how the avocados must be grown, harvested, transported, processed, and traded (Pritchard, 2016; Campbell, 2016; Henson and Reardon, 2005; Busch, 2000; North 1992; 1990). The institutional arrangement will include farmer groups, out-grower associations, and the contractual arrangements between farmers and exporters, the constitution that determines the rules for joining and leaving and sanctions when rules are broken (references). North (1992) argued that such formal institutions reduce transactional costs by enhancing contract enforcement, and increasing available information, reducing uncertainty and risks for actors (Coase, 1991). Institutions also provide legitimacy, and therefore, regulatory legitimacy requires farmers and exporters to operate according to the rules and standards. The standards and the certification bodies set the rules of the game to impose sanctions when expectations are not met (Scott, 2003).

In the case of the domestic avocado production, the production system can be categorised as subsistence (small scale). Therefore, the production and distribution systems are structured by informal institutions - social norms, values, sanctions, customs, and codes of conduct - socially shared rules, unwritten rules (Granoventter, 1985; Thornton *et al*., 2011). These could include, for example, cultural values and norms that shaped the agronomic practices of growing the avocados, gender roles in its production, and selling and distribution.

In Tanzania, the institutional arrangements for marketing fruits and vegetables can be viewed on a continuum ranging from spot markets at one end to a hierarchy at another, with many hybrid forms of institutional arrangements in between the two extremes, e.g., contract farming (see chapters 5 and 7). According to Eaton *et al*. (2008, p.19), the different forms of institutional arrangements are marked by different transactional characteristics. That is in terms of (a) relationship - which can vary from anonymous to personal; (b) different coordination ranging from atomistic to integrated; (c) duration of the transaction or relations ranging from short/once to long/repeated; (d) form of formalisation ranging from non-formalised to a full formalised. In pure spot market institutional arrangements, transactions are usually characterised by anonymous relationships, short term transactions and no formalisation. The institutional arrangement for the marketing of the domestic avocado is essentially spot transaction (spot market) and transaction costs are thought to be high in

Tanzania and SSA spot markets (Gereffi *et al*., 2005; Eaton *et al*., 2008). In reality, a pure form of spot markets hardly exists in Tanzania and SSA as markets transactions usually occur between persons who know each other, and transactions are repeated (Gereffi *et al*., 2005). Therefore, trading relations are based on a personal exchange where "kinship ties, friendship, personal loyalty, and repeat dealings all influence participants' behaviour and reduce the need for costly specification and enforcement" (North, 1992, p.478; Eaton *et al*., 2008). Such institutional arrangements can be characterised as 'relational value chain.' (Gereffi *et al*. 2005, p.84). Where the networks involve complex interactions between buyers and sellers, which often creates mutual dependence, and is managed through trust, reputation, or family and ethnic ties (ibid). But it can also be managed through imposition of costs or sanctions on parties that breaks the contract (Williamson, 1983). As argued by Gereffi *et al*. (2005), in such institutional arrangements, the exchange of complex tacit information is most often through face-to-face interaction and involve high levels of explicit coordination, which makes the costs of switching to new partners high.

In East Africa's fruits and vegetable export supply chains, formal institutional arrangements are mostly hybrid, which combines elements of coordination and governance mechanism, mainly in the form of price and hierarchy (Eaton *et al*., 2008; Gereffi *et al*., 2005; Humphrey and Schmitz, 2000; 2002). Three predominant forms of hybrid institutional arrangements have been identified; namely, contract farming (CF), producer organisations (PO - farmer associations and cooperatives), and a combination of contract farming and producer organisation (CF+PO) (van der Maden *et al*., 2021; Eaton *et al*., 2008; De Putter *et al*., 2007) (see chapter 4, 5 and 7). In all three forms of hybrid arrangements, transactions are motivated by prices (monetary incentives) and individual actors' decisions and actions are restrained by the transfer of rights to another party (van der Maden *et al*., 2021). For example, in producer organisations and contract farming, the grower waves their rights; they must comply with the rules jointly agreed by the members of the producer group or comply with the terms of the contract in case of contract farming. Both PO and CF involve some form of personal relations, formalisation, and coordination. The basis of a contract farming arrangement is a commitment on the part of the farmer to provide a specific commodity in quantities and at quality standards determined by the buyer and a commitment on the part of the buyer to support the farmer's production and to purchase the commodity.

Drawing on examples from East African fresh produce export, mainly fresh fruits and vegetable trade between Kenya and the UK, Gereffi *et al*. (2005, p.92) argued that there has been a shift from "market-based global value chain governance to more explicit coordination" highlighting the importance of competitive strategies adopted by UK based supermarkets to derive this change. In

the mid-1980s, supermarkets based in the UK and their European counterparts started to use quality standards and variety of their produces offering on shelves to differentiate their competitive advantage resulting in many forms of institutional arrangements at different stages in the supply chain (ibid). Thus, the fresh vegetable trade that occurred through "arm's length markets relationship" – where the exporters in Kenya purchased produce at the farmgate or the wholesale markets and exported to the UK wholesale markets (Barrett *et al.,* 1999) changed to explicit coordination, where supermarkets worked closely with UK importers and the Kenyan exporters (Barrett et al., 1999; Gereffi *et al.,* 2005). Barrett *et al.* (1999) asserted that whilst the supermarkets do not have direct investment in Kenya, they controlled the production process through intermediaries – the importers, who ensured that standards quality and presentation are met. Such explicit coordination resulted in yearly renewable contracts where UK-based supermarkets monitor and regulate the capabilities and systems used by the suppliers with regular audits and spot checks at all points of the supply chain, including field visits in Kenya. To ensure quality and traceability, the institutional arrangement – contractual agreements were made mainly with large-scale farms using productivist farming methods. Margaret FitzSimmons (1986) reported similar coordination and integration in the speciality crop produce (vegetables) that she studied in Salinas Valley in California. Also, Friedland *et al.* (1981; 2013) trace such vertical integration in the lettuce industry.

The institutional arrangements and the vertical integration result in shifts in economic power and overall control of the production process towards larger producers' who are themselves exporters or leading exporters/firms who become the only market access through which smallholders and independent farmers (FitzSimmons, 1986; Gereffi, 1996; Gereffi *et al.,* 2005). Thus, retail and wholesale market access are only through intermediaries – processors, shippers, and growers' cooperatives (FitzSimmons, 1986). In such cases, the industry becomes more concentrated as the investment costs of processing rise (Gereffi *et al.,* 2005). As this investment shifts from the consumption sites to the producing sites, the increasing quality and safety requirements lead to exporter-producers increasing their own-farm production at the expense of buying from smallholders and even large contract farmers. Traditionally, institutional arrangements are created to reduce transaction costs in exchange (Eaton *et al.,* 2008; North, 1990). However, Dorward and Kydd (2004) assert that the purpose of an institutional arrangement is to reduce transactional risks. They are argued that in any transactional exchange; parties face risks that the transactions will fail. Therefore, institutional arrangements are instituted to protect each other against transaction failure or to reduce uncertainty. The following section (2.2.2 and 2.2.3) provides an overview of the institutionalisation of risks and trust in formal and informal institutions to argue the implications for Tanzania's export-oriented and domestic production system.

2.2.2. Institutionalisation of risk, trust, and safety in an export production

Dorward and Kydd (2004) argue that formal institutions are created to reduce transactional risk. The very nature of food and the biophysical processes involved in agriculture and eating means uncertainties and risks are associated with both processes (Goodman and Redcliff, 1991). And the issue is even heightened where the production sites are located several thousands of miles away (global South) from the consumption sites. Trust forms a vital part of the social and economic relations of food production, distribution, purchasing, preparation, and consumption – all of which involve some assumption that the food is right – risk-free and safe (Whitworth *et al.,* 2017; Kjaernes, 2013). Trust is more than individual attitude or private and personal judgement; instead, it structures social life and has a collective orientation (Kjaernes, 2013, p. 414). Trust has been the underlying root cause for institutionalisation in contemporary Western agri-food systems

In the global North and contemporary Western food systems, 'food safety' has emerged as the object of regulation - *risk regulation* and governance in food production, processing, distribution, and preparation (Jackson, 2015; Kjaernes, 2013; Prichard, 2013; Campbell, 2013; Freidberg. 2004)[6], because of the food scares in the 1980s and 1990s in the UK, across Europe and USA (Whitworth *et al*., 2017; Richards *et al*., 2011; Murdoch *et al*., 2000). Therefore, regulatory bodies adopted various disciplinary regimes of surveillance and control associated with food safety standards and traceability mechanisms to reduce the risk associated with production and processing (Prichard, 2016; Campbell, 2016).

However, the food safety mechanism linking production sites to consumption sites is global. It cut across geographically separated regulatory regimes - national and regional borders in globally interconnected networks of safety and quality assurances (Campbell, 2016). From international regulatory institutions like the World Trade Organisation – WTO's non-tariffs barrier to trade agreements (Sanitary and Phytosanitary Agreement) and its institutional structures like the Codex *Alimentarius*, (Codex MRLs - maximum residues levels MRLs for pesticides); International Plant Protection Convention (IPPC) and the adoption of Hazard Analysis and Critical Control Point (HACCP) for food safety standards. For instance, HACCP now forms the basis of all food risk and

[6] There were reforms in major ministries and formation of new public regulatory bodies to restore public trust in food across Europe. At the European level there was the formation of European Food Safety Authority – EFSA; In the UK - the Food Standard Authority – FSA, among others across Europe.

safety regimes - marshalling the behaviour of both humans and nonhuman, chemical and biological entities involved in food production, including the foods themselves and the micro-organisms that inhibit them (Campbell, 2016; Busch and Cain, 2009, Henson and Reardon 2005).

Besides the government and international food safety and quality regulations and rules, there have been a surge in private food safety and quality standards, ethical certificate schemes, and accreditation networks by supermarkets and retailers– see appendix 5.1 (Busch and Lawrence, 2005; Henson and Reardon, 2005; Busch, 2000). In what has been described as supermarket manufacturing of consumer trust to meet the social expectation of agricultural production and food safety and quality (Buzby *et al.,* 2001; Jaffee and Henson, 2004; Richards, Lawrence, and Busch, 2011)) among a new generation of 'reflexive' consumers (Goodman and Redcliff, 1991; Barrett *et al.,* 1999). The institutionalisation of risk and trust through food safety and quality established grades and standards, creating standardisation and uniformity of product and shared norms and behaviour where the production process, harvesting and processing and packaging are expected to be the same across several sites (Busch, 2000; Freidberg, 2003; Henson and Reardon, 2005)

2.2.2.1 Creating shared norms and behaviour

The safety and quality management "metasystems" (Caswell *et al.,* 1998, p.547) have become the "codes of practice" or "codes of conduct" for agri-food systems that actors must follow (Henson and Reardon, 2005, p.224; Jaffee and Henson, 2004). For example, developing countries involved in export-oriented production systems must have Global Good Agriculture Practices (GlobalG.A.P.) certification in order to gain entry into the export market. Many exporting countries in the global South have developed national GAP standards – (e.g., KenyaGAP and MAURIGAP[7]) by benchmarking GlobalG.A.P., while in a place like Thailand, it is enshrined in national laws (Park and Gachukia, 2021; Neeliah *et al.,* 2013; Campbell *et al.,* 2006). Thus, a common 'code of conduct is shared among practitioners and adopters. GlobalG.A.P. alters smallholders' farming practices – as they internalise the values and practices prescribed by the codes of conduct and make

[7]In 2014, The Kenya Good Agricultural Practice scheme – KenyaG.A.P., was officially recognized as equivalent to the GLOBALG.A.P. - Integrated Farm Assurance Standard Version 4 for both Fruit & Vegetables and Flowers & Ornamentals. The programme which was started developed by the Fresh Produce Exporters Association of Kenya (FPEAK) was launched in 1996, is the first scheme in Africa to benchmarked against the GlobalGAP. Available at : https://www.globalgap.org/uk_en/media-events/news/articles/Kenya-GAP-Successfully-Re-benchmarked-for-GLOBALG.A.P.-Integrated-Farm-Assurance-Standard-Version-4/, accessed on 24/01/2022. MAURIGAP is Mauritius Good Agricultural Practices is horticultural quality standards (MS184:2015- level 1) developed at the Mauritius Standards Bureau with stakeholders (including the APEXHOM is association of horticulture exports association) is benchmarked to GlobalGAP standards. Avaliable at https://wedocs.unep.org/bitstream/handle/20.500.11822/33751/SUSAg.pdf?sequence=1&isAllowed=y

them their own and must adopt the group structure enforced by the GlobalG.A.P. (Lind *et al.,* 2011; also sees Freidberg, 2004; Madeley, 1999).

Standards facilitate the coordination of the agri-food value chain across space and between producers and transmit credible information on the nature of products and the conditions under which they are produced, processed, and transported (Henson and Jaffee, 2008). The modes of production and practices are expected to be the same across different production sites irrespective of the local context - where they are implemented (Busch, 2000, 2004; Henson and Reardon, 2005). Thus, these standards have the power to control the production systems spatially through the institutional organisations that set the standards, the network of third-party auditing/certification bodies, and the institutional arrangements at the site of production (such as out-grower associations, farmer groups and cooperatives) that organise, implement, and manage the scheme (Campbell *et al.,* 2013; Henson and Humphrey, 2010; Dolan *et al.,* 1999). Thereby they provide the institutional structures for monitoring and enforcement.

2.2.2.2 Effects of safety and quality standards on producers and exporters

The effects of the safety and quality standards and certifications on exporters, processors and particularly among smallholder growers are well documented in development studies, political economy and agri-food studies drawing on value chain analysis (e.g., Maertens and Swinnen 2009; Muttersbaugh, 2008; Gibbon and Ponte, 2005; Farina and Reardon, 2000; Reardon *et al.*, 2001; 2003; Reardon and Swinenn 2004). Other researchers have critiqued the exercise of control over production and influencing power and value distribution among the various actors (Ponte, 2002; Gibbon and Ponte, 2005; Freidberg, 2004, 2007). For instance, investments in smallholders GlobalG.A.P. certification by exporters/processors/buyers suppress their agency and place them in a subordinate position limiting their ability to freely decide on the buyer of their choice (Lind *et al.,* 2011). There is also loss of autonomy in the production decisions for small growers as the overall production is dominated by the decision of larger firms in their own internal production and in contract terms (Little and Watts, 1994; FitzSimmons, 1986). But also, exclusion of smallholders and medium-size producers going out of business due to high compliance costs (Asfaw *et al.,* 2010; Lind *et al.,* 2011 (Maskus *et al.,* 2005; Boselie *et al.,* 2003; Martinez and Poole, 2004; Friedberg, 2004; Dolan and Humphrey, 2000).

2.2.2.3 Institutionalisation and food loss and waste

In the past decade, a burgeoning set of studies have shown that grades, quality standards and stringent aesthetic requirements regarding shape, sizes and appearance that aims to create uniform

products result in massive losses and waste at the farm gate (e.g., Soma *et al.,* 2021; Johnson *et al.,* 2019; Feedback Global, 2015; Buzby *et al.,* 2014; Lipinski *et al.,* 2013; Gustaveson *et al.,* 2011; Stuart, 2009, FAO, 2011). Moreover, contractual relations issues such as the fear of losing a contractual relationship, lead to overproduction and higher quality standards when there is a bumper harvest (due to good weather), which has adverse effects on food loss (e.g., Sharon *et al.,* 2020; Feedback Global, 2015; Colbert, 2015; Bloom, 2010; Stuart, 2009; Clapp, 1994).

The cultural and socio-economic impact of contract farming on smallholders in Sub–Saharan Africa and other global South countries is well documented – see, for example (Little and Watts, 1994; Freidberg, 2004). Little and Watts (1994) argued that contract farming is a risk avoidance strategy used by prominent actors in agri-food systems to offload their risks to the exporters and farmers. For instance, Colbert (2015) notes that in the Kenyan horticulture industry, offloading risks were widespread for those producing for the European markets - imbalance of power and unfair trading practices – last-minute changes or contract cancellations- significantly impacted food loss and waste generation on farms (ibid). Gille (2013) argues that the current structure where all risks, either from demand fluctuations or aesthetic standards, are borne by the producer rather than shared with buyers, introduces a different mechanism for increasing food waste. In the global North, over-production has been cited as the primary driver for food loss and waste on farms as farmers use over-production as an economic risk avoidance strategy in contractual relations (Messner *et al.,* 2021; Soma *et al.,* 2021; Johnson, 2020; Johnson *et al.,* 2019; Bloom, 2011; Stuart, 2009). Moreover, "uneven distribution of risks […] and the types of social arrangements aimed at lessening or avoiding risks" play a vital role in waste production (Gille, 2013, p. 29-35).

However, there is little understanding in the ways that social relations within institutional arrangements operate in Tanzania context to create waste both in the domestic and export avocado production. There is little understanding and evidence, especially among smallholders, of how the new forms of institutional arrangements that organise the farmers and the resulting social relations between the exporters, buyers, and processors impact loss and waste during production and harvesting. And how do power relations lead to inequalities, for example, exporters shifting all costs to the growers and the implication for loss and waste generation? Chapters 5 and 7 of this thesis, which focuses on the export avocado production, examine how the institutional arrangement due to GlobalG.A.P. certification and buying/selling relations leads to loss and waste generation.

2.2.3. Institutionalisation of trust and risk in domestic production system.

Unlike the export-oriented avocado production, where food safety risks play a crucial role in meeting export standards, in the domestic avocado production systems, trust and risks play a vital role in the marketing and distribution of products in SSA. In the domestic production system, marketing of agricultural product is normal through the market or the spot market (Kydd and Dorward, 2004). Transactions are on the spot, a trader may contact the farmer, or the farmer may contact a trader; once products have been inspected and prices have been negotiated, the transaction will be sealed or executed within short hours (Fafchamps, 2004). In Tanzania, fruits and vegetables are produced in specific AEZs away from regional and national markets and consumers. As a result, transaction costs for traders from regional and national markets are higher in terms of obtaining supply information, which usually requires several trips to the production sites. Eaton *et al*. (2008) argued that forging personal relations in such circumstance help to reduce risk and cost for distance traders (see also Gereffi *et al*., 2005). Traders in the leading regional and national markets usually contract their established contacts in the production areas, who then reach farmers to gather price information, quantities, prices and then purchase and transport (ibid). This institutional arrangement can result in a long supply chain with many intermediaries and other actors such as collectors, packers, and transporters (Lynch, 1994; 1999). This is where risk and trust in those personalised relations become necessary in an informal institutional arrangement (Gereffi *et al*., 2005).

Further, where repeated transactions are executed between the traders and farmers in the spot markets, they may enter into informal agreements (Eaton *et al*., 2008). However, it is always not possible for the parties to comply. For example, the trader may buy from another farmer because of the product quality or for a lower price, or the farmer may sell to another trader because of a better price offer, such breaches increase risks and high cost. They can lead to losses if the farmer cannot sell to another trader and the product becomes unmarketable (Lyon and Porter, 2009). Establishing trust in the personalised relationship is vital to reducing risks and uncertainties, particularly where the institutional environment does not have a formal or informal mechanism for enforcement (ibid). As already indicated, because of the many social relations involved in the movement of food products from farms to primary markets, "transactions [can be] so complex that formal law cannot possibly cover all contingent circumstances" where there is a lack of formal contract to reduce risk and uncertainty (Moore, 1994, p.819)

Several development economists have observed and underscored that in SSA, trading of agricultural products depends on a 'credit system and long-term relations' that allow long-distant trade to happen (Porter *et al.,* 2003; Lyon and Porter, 2007). Transactions between farmers and traders and among traders are usually transacted on credit. The farmer may sell to the trader on credit, or the collector may sell to the wholesaler on credit. Trust in such informal market institutions plays a vital role in enabling the movement of food produce from the rural areas to urban centres (Amoako, 2019; Lyon, 2000; Lynch, 1999).

Personalised trust in the informal institutional arrangement is established based on an assessment of the trading partners' actions and characteristics, such as trustworthiness, information from third parties (friends, relatives, other traders), and direct interactions (Amoako *et al.,* 2021; Lyon and Porter, 2010; Lyon, 2006; Humphrey and Schmitz, 1996; Zucker, 1986). Lyon and Porter (2010), in their study of fruits and vegetable producers and traders in Ghana and Nigeria, found that individuals drew on both personalised social relations and institutional form of trust to offer trade credit facilities (see also Bennett and Robson, 2004; Mollering, 2002; Zucker, 1986). Both case studies found that trust was essential to overcome risk. While traders provided long term credit to farmers in both countries; in Ghana, credit systems flow in both direction – farmers provide products on credit to traders (ibid). Similarly, Van Ufford and Zaal (2004) found that within the livestock trade in Kenya and Benin, the personalised trust generated through a common ethnic identity between farmers, traders and butchers facilitated trade and extension of credit between parties. Establishing trust is also based on socially accepted sanctions for those who break the norms - enforcement is dependent on social consensus (Brennan and Pettit, 2004).

Informal institutional arrangement such as trade associations assume more prominence in enhancing trust by enforcing sanctions (Amoako and Lyon, 2014; Peng *et al.,* 2008). Amoako and Lyon (2014) reported that trade associations and religious institutions, for example, were essential in long distant regional trade of agricultural produce in Ghana and cross border trade in West Africa, particularly in areas where potential trade-credit partners were not existent. They found that traders rely on trust to offer trade credit to their trading partners and enforce trade credit agreements (Amoako *et al.,* 2021). Food market associations as informal institutions play a critical role in organising and controlling the market spaces in urban areas (Potter, 1997). They also provide several functions - including welfare support to traders in the event of unforeseen circumstances (Lyon and porter, 2009), settling disputes through sanctions of those who break the norms (Lyon and Porter, 2009; Lyon, 2003; Whetham, 1972), setting prices and ensuring that the rules in the

market are followed (Lyon and Porter, 2007; Porter *et al.*, 2007; Clark, 1994), sharing information and lending to one another (Smith and Luttrel, 1994).

While the market associations promote order and collective trading relationships within the market spaces, they have the power to coordinate and set possible prices and supplies from rural areas (Smith and Luttrel, 1994; Lyon, 2000, Porter *et al.*, 2007). However, there has not been any attempt to try and understand how trust and risk operates in the informal institutional arrangements (e.g., market associations) and the personalised trust relations to generate food losses and waste in the market spaces (immediate wholesale markets in the production areas and the distant markets). For instance, in what ways do the 'informal credit system' that underline the functioning of the domestic supply chain plays in losses and waste generation; and do traders use the credit system to exercise inequalities? Furthermore, there are sanctions when actors break the norms within the trading institutions or do not act as expected. But the role of sanctions in informal institutional arrangements in losses and waste production has not been investigated. For example, what implications do sanctions such as shaming, reputational damage, peer pressure or withdrawal of cooperation or exclusion from economic activity (Porter and Lyon, 2006; Lyon, 2000; Scott, 1976) have for food loss and waste production? How do power relations manifest through these trust relations as actors seek to reduce their risks and uncertainties and the implication for loss and waste generation at the different sites on farms and markets?

As has been suggested by Sayer (2004), in many circumstances, those in positions of low power are forced to accept some norms and institutions under duress of poverty, and trust-based relations can sometimes result in exploitation (Baier, 1994). Chapter 6 of this thesis addresses these gaps by examining the institutional arrangements – trading relations in the domestic avocado supply chain and exploring how risk and power relations manifest in the trading relations and the implications for food loss and waste production.

3. Materiality: Food production and food loss and waste

3.1 Materiality: Food and agri-food production

"Materiality" is an ambiguous term that invokes a range of notions and conceptualization, therefore, providing a critical lens on how the "matter of food matters" (Bakker and Bridge, 2006). While notions of materiality are broad among different academic disciplines, what is common is

the problematization of how materiality has been framed within the social scientific scholarship. Since the time of Emile Durkheim, social theorists have viewed the "social" as distinct from the material – the physical nature of the nonhuman world is considered only as a backdrop in social scientific inquiry (Breslau, 2000). Schatzki (2010) argued that for many theorists, materiality is understood to mean physicality (e.g., the materiality of the world is its physical constituents and properties). However, materiality can mean something more broadly than physicality (ibid, 2010).

At the broader level, Schatzki (2010, p.125) suggests two ways of thinking about materiality: (1) the materiality of the social life is its stuff; and (2) materiality should be considered as bio-physicality – which brings in the nature (the environment). Gille (2016, p.114; 2014, p.158) refers to materiality "as the physical world that surrounds us: nature, manmade objects, our bodies, and in broader sense the ways space is organised around us, and the concrete practices and the technologies we employ in our everyday lives". Gille's notion of materiality provides a broader view that encapsulates Schatzki's (2010, p.123) notion of social phenomena "as slices or nexuses of practices and material arrangements". By material arrangement, he meant sets of related entities - humans, artefacts, organisms, and things of nature (Schatzki 2010, p.129; Schatzki, 2002). For Schatzki, materiality does not only include the physicality and their properties, the material composition and nature; it encompasses organisms – thus, nonhuman organisms (and their sociality) are part of the society. Accounting for the role of materiality in geographies of food and agri-food studies in ways that connect production and consumption has been an intense debate (see for example, Goodman, 2016; Bakker and Bridge, 2006; Goodman and DuPuis, 2002).

Through the 're-materialisation' in cultural geography, scholars like (Crang 1996; Cook and Crang, 1996; Jackson and Holbrook, 1995; Jackson, 2000; 2002; Lockie and Kitto, 2000; Hughes, 2000; Kearnes, 2003; Crang *et al.,* 2003) attempted the 'reconnection' of the production-consumption relationship through 'commodity circuits or networks.' Cook and Crang (1996, p.131-132) argued that foods should not only be seen as placed cultural artefacts but also as displaced materials and practices that inhabit times and spaces – that they are mobilized within circuits of culinary culture, to outline their production through processes of commodity fetishism and arguing for forms of critical intervention that work with the fetish (ibid). Others sought the reconnection through the lens of 'quality' (Parrott et al., 2002) and 'conventions' (Thevenot *et al.,* 2000). The awakening to deploy the materiality concept and material culture has been described by Jackson (2000) as shifting the meaning of materiality from the dead world of artefacts to a living world of objects as a constituent of social relations.

This thesis is rightly placed within this theme so far as food loss and waste production within agricultural production are concerned. Although the focus is on food losses and waste, it is inextricably linked to consumption as retailers' and consumers' concerns mediate production and processing processes at a distance, which inevitably impact the ways losses and waste occur. (Alexander *et al*., 2013). The production and consumption of avocado is a vital part of the analysis, particularly in chapters 4 and 5. Materiality invokes the importance of the tangible world in the reconstruction of the social reality and draws attention to the meanings attached to the commodities biographies – 'biography of things' (Kopytoff, 1986).

One of the food geographies approaches that attend to materiality to connect the production-consumption nexus is the following the thing by Cook *et al*. (2004), which tells stories with the biographies of the food commodity being followed. I will now turn to look in more detail at how following the thing approach helps critically analyse materiality.

3.1.1 Following the thing

The 'Follow the thing' approach provides a distinct mode of analysis that draws heavily on relational materiality, which shows some degree of 'family of resemblance' with the Actor-Network Theory (ANT) approach. The following the thing approach draws on Appadurai's (1986, p.5) call to "follow the things"- global commodities - to understand their social, cultural, political, and economic relations behind food commodities. And Marcus' (1995) multi-sited ethnography approach which argues that it is no longer possible to study globalised and transnational processes in a single place. These types of studies focus on a particular commodity, 'following' it to uncover relevant areas of analysis and to avoid disciplinary 'boxing' of research and thereby their production and trade, and inequalities and power relations that exist within the production systems (Cook *et al*., 2006; Cook *et al*., 2004). Cook *et al*. (2004) work on fresh Papaya (Jamaica – UK) used the Papaya's materiality through vivid description of the fruit to lift the veil of the commodity fetishism was more than just tracing to reveal the physical flows and connections. But tells the story of the lives of the people "who were (un)knowingly connected to each other through the international trade in fresh papaya, and its entangled range of economic, political, social, cultural, agricultural, and other processes" (ibid, p.642). But also showed how "inherent instability of materiality emphasises the different ways in which the traces of the production can linger in the consumption experience (Bakker and Bridge, 2006).

Besides its initial application to the study of Papaya, the follow the thing approach has been applied to other foods such 'West Indian Hot Pepper Sauce' (Cook and Harrison, 2007); French beans and food scares (Freidberg, 2004)[8]; Broccoli and the desires of Mayan growers in the Highlands of Guatemala (Fisher and Benson, 2006); Deborah Barndt (2007) on tomato 'Tangled Routes: Women, Work and Globalization on the Tomato Trail'; Long and Villareal (1998) tamale study; Mansfield (2003) fish and factory trawlers; Choy *et al*. (2009) study of matsutake mushrooms; soybeans (de Sousa and Busch, 1998). The approach is reflected in other studies that trace foods across the sites implicated in their production, supply, consumption, and disposal (Bestor, 2001; Evans, 2017).

Since following the thing approach operates with analytical open-endedness and does not give privilege to a particular actor, it reflects the relational nature of ANT rooted studies (like Watmore and Thorne, 1997). The approach also draws on and somewhat extends Marxist ideas – Harvey's (1990) calls to 'defetishise' commodities by revealing their hidden relations of production. However, Cook *et al*. (2004) note complexities and contingencies in global commodity relations. For example, Cook and Harrison (2007), using the hot pepper sauce as a lens, they were able to piece together an association of 'people, plants, bugs, diseases, recipes, politics, trade agreements and histories' to explore the kinds of relations that exist between commodity producers, consumers, and those in between. By buying and using the sauce, Cook and Harrison showed that it connected them just as much as the trade agreements, regulations, capsicums and imperial histories, International Standard Organisation quality systems, and "modern" export-oriented agricultural and manufacturing practices. Such analysis proves valid for this present thesis – particularly concerning the export avocado production system and waste that might arise (chapter 5 and 6) and tracing the socio-cultural, economic, and political dimensions of the introduction of avocado, its production, and consumption in Tanzania (chapter 4).

Like ANT, the following the thing approach has been criticised for its elaborative nature of an array of diverse actors within the commodity production-consumption nexus (Barnett and Land, 2007; Saldanha, 2003). However, Cook *et al*. (2006) argue that the approach enables possible theoretical and methodological integration of ANT and Marxism. In this thesis, for example, using the

[8] Freidberg (2004) noted that the differences in English and French foodways translate into differences in production, regulatory and packaging requirements and new standards introduced into the green bean supply chain creates layers of complexity for pack house workers, field hands, farmers, and intermediaries in Burkina Faso and Zambia. She noted how global north consumer power to demand 'goodness' in food, defined by cultural meanings and norms of what is deemed to be safe food, natural, moral and appetizing, continuously introduces new forms of domination and vulnerability into postcolonial commodity networks.

following the thing approach enables drawing the ANT which have demonstrated the relational nature of power in the food system and how nonhuman agents shape global food networks. In the current thesis, ANT's relationality and agentic capacity of materiality help in the understanding of power relations within subsistence food systems as well as within an export avocado production system – the role of materiality and the ways it is used to control the production process and to extract value from growers. Combining ANT's agentic capacity of materiality - nonhuman actants (Gille, 2014; 2016) and Schatzki's (2002) notion of material arrangement and practices, where agency of the human actor is not decentred. Such linkage provides significant loci to attend to the role of both the relational power of nature and human actor in the food system and how the interactions between leads to loss and waste generation.

As argued by Freidberg (2003, p.6) following the thing approach enables "analyses of the nature, culture, and political economy of food […] on the same page", overcoming the culture-political economy duality of past agri-food studies – due to its attentiveness to the materiality of the commodity in question. Recently, Goodman (2016, p.264) renewed the call - on 're-materialisation' studies of food as a relational object - 'more than food' (what he considers stories of relationalities) of food, space, and place – a kind of 'more-than-following' (Cook *et al*., 2006) to analyse the social, spatial, and economic relations that get foods – in the first instance – into the vital material states.

While the literature that takes a relational materiality approach to researching the food commodity in question helps us, for example, consider the question of production and consumption simultaneously – such as who decides what is produced? How is it produced? They tend to focus on commodities in global trade between the global North and South to the neglect of domestic food production systems. Again, they do not consider food loss and waste in such an evocative analysis. In this thesis, I move beyond this so-far limited application of a follow the thing approach and apply it to asking critical questions such, how does the materiality – of the natural environment, variety of the avocado grown, cultural norms, values, and framings about avocado tree/fruit shape the condition for its production and consumption? But also, how does materiality of the avocado (fruit) provide an avenue for exploitation and understanding of power relations within subsistence and export avocado production system?

Besides, there is less attention to the role of nature – both the environment and other nonhuman things as an active agent, participating in the "collective action" of the production process in ways that are not predictable or controllable (Murdoch, 1997). These are critical gaps in knowledge that

this thesis set out to bring a new understanding of the role of the material relation approach to food production in the context of Tanzania's domestic avocado production systems and in the context of the global South and North commodity trade of export avocados.

3.2 Materiality: food loss and waste

In consumption and material culture scholarship, relational materiality approaches to the study of waste, in general, have been well explored (Thompson, 1979; Gandy, 1994; Strasser, 2000; Hawkins and Muecke, 2003; Scanlan, 2005; O'Brien, 2007; Gregson et al., 2007; 2010; Hawkins, 2009; among others). Some have been focused on the cultural location of waste and wasting from this body of works and put waste at the centre of the analysis (Evans, 2014). For instance, Susan Strasser's (2000) *Waste and Want* utilizes the changing notions of 'trash' to highlight and trace the social history of production, consumption, and use (see also Hawkins and Muecke, 2003; Scanlan, 2005; O'Brien, 2007). Other scholars within this genre moved the debates around material culture and everyday practices (Hawkins, 2006; Gregson *et al.,* 2007; Bulkeley and Gregson, 2009; Gregson and Crang, 2010; Moore, 2012; Gille, 2007; O'Brien, 2007). Martin O'Brien's *A Crisis of Waste* (2007) suggests that rubbish has been part of and is central to the processes of social organization. He called for sociologists to gaze on practices, institutions, innovations, and relations in the governance of waste and its transformation into value. Also, Gille's (2007) concept of "waste regimes" argued that institutions and conventions determine what wastes are considered valuable and how their production distribution is managed, represented, and politicised - highlighting that waste is neither a fixed category. Scholars like Hawkins (2009; 2011; 2015; 2017) and Gregson *et al.* (2007; 2010a, 2010b) also focused on relational materialist perspectives, where the 'matter' that is wasted is an active actant in the circumstances in which it becomes waste.

Food demonstrates agency, relationality, and potential for disrupting social practices and systems (Bemmel and Parizeau, 2020; Goodman, 2016; Bennett, 2007). The relational materiality of food and how it becomes waste have been picked up in food wastes studies – albeit consumption focused (David Evans, 2014; 2011; 2012a; 2012b; Watson and Meah, 2013; Meah and Watson, 2011; Cappellini, 2009; Evans *et al.,* 2013; Alexander *et al.,* 2013; Cappellini and Parson, 2013; Milne, 2013; among others). Within these registers, David Evans (2014), for instance, explores the processes by which stuff - that is, "food" becomes stuff that is "waste" and, in effect, becomes 'un-corporeal' and 'separated' from eaters (Gregson and Crang, 2010). This body of work examines the shifting socio-material life of food as it moves across different registers of value, knowledge, action, space/place, and 'smell' to those moments of disposal. Evans (2018) draws on 'follow the

thing' to highlight how ongoing categorization and valuation of things (food) in households shape their trajectories and move them in directions that give rise to disposal and (adverse) environmental impacts. In a similar relational materiality approach, Coles and Hallett (2013) illuminate the shifting geographies of edible/inedible salmon heads – where salmon heads are valued as a foodstuff in some places but categorized as waste in others[9]. They contended that food waste questions are not just questions of materiality but how the materials intersect with relations of the site (ibid, p.156).

While these studies recognize the "concrete and socially consequential of materiality" (Gille, 2010, p.1056) of food waste to focus on the cultural, social, economic, technological, and political relationships in which it is embedded and the different ways in which it is categorized, placed, represented, and managed (Evans, 2014). They are too centred-on consumption and household food waste (Alexander *et al.,* 2013). As argued by several scholars, there is the need to conceptualize food waste not as something that happens at the end of the point of the linear processes of production and consumption but also as something that arises at multiple sites within the food supply chain (Evans, 2014; Evans *et al*. 2013; Alexander *et al*., 2013; Gille, 2013).

However, there has been little attention to using the material relational approach to understanding processes of agricultural waste in general, and specifically food loss and waste in agricultural production systems. With except is Anna Krzywoszynska (2013) work on the relational materiality of bio-wastes (not directly related to food/waste) from Italian winemaking industry. She used the socio-material pathways of bio-wastes to show the significance of social and material relations to the valuation of agricultural waste materials. She called for consideration to be given to 'materiality, temporality, and spatiality' if excess bio-waste materials are integrated into sustainable rural landscapes (ibid, p.47-49). In the global South and the context of Tanzania, there is little attention to farm-level losses and waste.

More so, studies that focus on postharvest loss and waste, for example, are framed from perspectives that give primacy to the lack of technology and infrastructure as the necessary drivers for losses and waste (Alexander *et al*., 2013; Gille, 2013). While not discounting such perspectives, a relational materiality approach that refocuses food loss and waste at the centre of analysis in the agricultural production to explore its dynamic and shifting role in the social organisation of

[9]They described how salmon heads and 'trash fish' are usually designated as waste early in the value chain but were used as decorations for a particular fish stall in a London market. They were destined for the bin at the end of the day until the authors negotiated to buy them for a low price in order to turn them into stock

production and distribution will help to illuminate inequalities and power relations in the production system (Evans *et al.,* 2013; Coles and Hallett, 2013; Gille, 2013; Evans, 2014).

I Draw inspiration from the 'relational materiality, temporality, and spatiality' of foodstuff - avocados, without disregarding the concreteness of avocado waste (Evans, 2014; Gille, 2013; Gille, 2010); to ask how does abstraction of the 'notion of perishability' help us to: understand the process of valuation, and trajectories of how losses and waste occur in subsistence avocado production system, for example? How does the notion of perishability shape the social relations involved in the selling and buying process, and in what ways is it used to exercise power and extract value? And how does that create food loss and waste? Equally important is the understanding of how culturally specific perception about the materiality of the avocado – 'firmness' influences practices of handling and valuation and its effects on possible waste generation. Such nuance analysis often lacks literature on farm level food loss and waste in agri-food production, either subsistence or commercial, domestic or export supply chains. This thesis fills the gaps in knowledge by given attention to the relationality of 'vital materiality of the matter of foodstuff' (Goodman, 2016, p.262) in understanding social relations and power dynamics that create losses and waste. The next section looks at the practice theories as an integrative analytical tool.

2.4. Theories of practice: Agri-food production and food waste

2.4.1 Theories of practice and its essential components

Having discussed the role of institutions, institutionalisation, and materiality in agri-food production and its implications for food losses, I now turn to the concept of practice to examine practices that interact with institutions and materiality. Practices cannot exist without institutions (explicit and implicit rules) and materiality (Schatzki, 2002). The concept of practices sits at the heart of social practice theories, and it is central to social life (Everts *et al.,* 2011, p.323). Practice theory allows to 're-assemble the social' in terms of the social material activities and then use this basic building block (practices) to understand prominent and complex phenomena, including organisations, institutions, and society (Latour, 2005).

Several versions of the concept of practice exist in the broader social practice theory traditions (see Nicolini, 2012). The contemporary conceptualisation of versions of practice theories put forward by Schatzki (2002) and further developed by Reckwitz (2002) provide valuable loci to keep

production and consumption in the same framework. Thus, help attend to the role of nature (inanimate and animate things), the materiality of the food, the markets demand of consumers, cultures and meanings attached to the food. But also, the ecological and the political/institutional logics that socially construct the ways production, selling, and distribution of food practices are enacted and influence each other (Murcott and Campbell, 2004).

According to Schatzki (2002, p.87), "a practice is a temporally evolving, open-ended set of doings and sayings linked by practical understandings, rules, teleoaffective structure and general understandings". The doing and saying involves specific ways of understanding, knowledge of how things work and how to use things, but also the state of emotion (Reckwitz, 2002, p.249), and they are not isolated activities but interconnected bundled and therefore influenced by other practices and contextual developments (Shove, Pantzar, & Watson, 2012). Schatzki's (2002) notion of practice as 'site ontology' brings the place and space dimension into practices which sees practices as constitutive of the social (Everts et al., 2011). Everts *et al*. (2011) argued that development of 'geographical inquiry' that draws on theories of practice ontology by Schatzki 2001; 2002) and Reckwitz (2002) no longer views 'practice' as a 'metaphor of practice' on its own but is tied to 'site ontology' – occurring in a specific place that considers not only the practice but also the material and in-material arrangements which form crucial parts of the social reality (ibid). Schatzki's (2001, p.1) notion of practice theory - 'site ontologies' transcend somewhat the rigid dualism of action-structure oppositions (see, for example, Giddens 1984; Bourdieu, 1977 and 1990). It combines practice theory focus on concrete/specific activity (e.g., Giddens, Bourdieu, Taylor, Dreyfus) and 'arrangement theories', highlighting how thoughts and things are connected within complex networks of entities (e.g., Latour, Laclau and Mouffe). According to Schatzki, arrangements are constitutive of practice (Schatzki, 2002, p.xii), and this arrangement comprises entities such as material things, artefacts, or organisms and meanings (Schatzki, 2010, p.117). Thus, 'the site of the social is a mesh of practices and orders/arrangements', but 'practices and order/arrangements' enable and constrain each other.

This ontological position allows for an integrative conceptual framework that considers different phenomena concerning each other over space and time (Schatzki, 2003; Everts *et al.,* 2011). For example, farming avocados requires specific practices; harvesting and selling avocados also need specific practices as much as their consumption. Yet, these practices are connected through time and space by the different material arrangements (such as pests, viruses, irrigation systems, roads, trucks, tractors, laboratories for test analysis, cold-chains, and market infrastructures) involved in the practices. For instance, the practice-arrangement nexuses of growing avocados overlap with those of raising the avocado seedlings/planting materials, avocado sales, farm maintenance and

agronomic management and consumption activity. In turn, this links in with broader networks of nexuses composed of governments, financial institutions, traders' supermarkets, third-party certification bodies, and farming.

Thus, drawing on Schatzki's notion of practices – material-arrangements nexuses, we can link micro-level concrete practices to macro-level social phenomena (Schatzki, 2010; 1996; Reckwitz 2002a). In social practice-based analysis, everyday practice as the unit of analysis considers individuals as carriers of the practices (Reckwitz, 2002). An essential analytical difference is that practices can be viewed as performances or entities (Schatzki 1996; Reckwitz, 2002, Warde 2005; Shove *et al.,* 2012). When practice is approached as an entity that have a history or path of development, it is recognisable and generally understood as the ideal type of practice. For instance, irrigation is understood as the process of watering plants with the required amount of water at the right time so that they can grow well (Reckwitz 2002; Shove *et al*., 2012). Irrigation as a practice entity can be talked about and understood by people without enacting it, but at the same time, it only exists through their performance. On the other hand, practice as performance involves enacting the practice (irrigating) in a specific place setting and time. Its performance will vary slightly from place to place (Reckwitz, 2002). Therefore, practices as performance and entity are recursively related, unlike agency and structure in Giddens's theory of structuration (Welch and Wardie, 2015).

According to Schatzki (2002), actions that comprise a practice, say farming, are connected to each other through four main elements, namely: practical understanding, rules, teleoaffective structure, and general understanding. However, Shove *et al. (*2012) recognise that practices (as performance) involve three elements: meaning, materials, and competencies. Practical understanding refers to 'knowing that derives from being a competent member of a practice' - the ability to do something - competencies –skills and know-how needed for performing the practice. For example, knowing when and how to irrigate (Nicolini 2012, p.165) but also understanding what other actors do (Reckwitz, 2002). In other words, actions within practices are linked by practical understanding when most participants agree on what makes sense, or at least participants tacitly understand that there is one way to go about it (Schatzki, 2002, p.75; 1996, p.118).

However, practices are kept together through explicit rules, precepts, and instructions. Rules are programmes of action that 'specify what to do' (Schatzki, 2002). In this vein, rules provide guidelines for chains of activities – the type of water to use for irrigation, the amount to irrigate, and when to enact the task – thus, it connects tasks and projects in complex arrangements. Schatzki argues that people take rules into account when they are carrying out activities or actions, and therefore rules connect the actions together. Rules have the explicit purpose of orientating and

determining the likely cause of activity, and for this reason, they are introduced into social life by those who have power or authority (Schatzki, 2002; Nicolini, 2012; 2017).

All practices unfold according to a specific direction and 'oughtness', or 'how they should be carried out' (Schatzki 2002, p.80). Schatzki argues that activities are linked to recognisable practice through what he calls 'teleoaffective structure' – which is the internal structure of oughtness of practice (Schatzki,1996[10]). Through repetition, sanctions, and peer pressure, it is then re-enforced. Reckwitz (2002) argued that social practice consists of certain bodily and mental activities. Those carrying out the practice must put on the mental and bodily patterns that constitute the practice – which is part of the social and not the possession of an individual but of the social practice (Reckwitz, 2002, p.252). Specific social practice contains particular forms of knowledge, and this form of knowledge encompasses ways of understanding - general understanding, knowing how, ways of wanting and of feeling that are linked to each other within the practice - a sense of community (Reckwitz, 2002; Shove *et al.,* 2012).

To accomplish a practice, materials or things enter the process. Objects or things are necessary in the same way as bodily and mental activities are needed to achieve a practice (Reckwitz, 2002; Everts *et al*., 2011). According to Reckwitz (2002a; p.253), in studying the social, objects must be granted the necessary place and recognition 'insofar as they are necessary components of the social practices.' Schatzki, through his notion of materiality, equally recognise the role of material and argues that understanding specific practices involves understanding the material arrangements that are used to accomplish the practices (Schatzki, 2010; Schatzki, 2001, p.3). Thus, practices are unavoidably entangled with the material arrangements that they contribute to create, in which they are carried out and through which they transpire (Nicolini, 2017). Practices are tied to arrangements that help to constitute the social phenomena (Schatzki, 2010, p. 134-135).

However, Reckwitz's (2002) and Schatzki's (2010) notion and the role given to materials in the construction of social order contrasts those of ANT's, which decentre human agency as ontologically unique (Schatzki 2002; Simonsen, 2007). This thesis approach to materiality and practices recognizes the role of human agency (Schatzki, 2010; 2002; Shove *et al.,* 2012) and does not rest on the fact that artefacts alone have the capacity to 'construct social order' (Latour, 2002; p.113) which reduces the role of human agency (Schatzki, 2010).

[10] 'teleoaffective' indicates the directedness of feelings, expressing how human activity is goal-oriented and organised in tasks, projects, and ends. Since activities are governed by practical intelligibility, teleo-affective structure contributes to the shaping of what makes sense to do. Therefore, teleo-affective structure is not the property of the actors, but rather the property of practice - the sayings and the doings that make up the practice (Nicolini, 2012)

In agricultural production and distribution, materiality or material arrangement that makes the growing, harvesting and selling possible does include not only the physical environment and its landscape, organisms (pest and diseases), organization of space on farms and in markets, infrastructure – roads, cold-chains, irrigation system, pack-houses, markets, technologies, people, agreements/contracts, But also, macro-level arrangements in the form of farmers associations or cooperatives, standards and certification schemes, and regulations requirements by governments agencies, and international institutions and supranational organizations like the European Union, and so on. These material arrangements invariably influence' the way practices of growing, harvesting and distributions are carried out among them and with them. Nevertheless, through human activities, material arrangements can be altered, which in turn impact on practices (Schatzki, 2010). This thesis draws broadly on Schatzki's (2010) notion of practice and material arrangements to attend to macro processes or structures that are challenging to account for when focusing on practices as performances (Watson, 2014; Shove *et al.,* 2012). By approaching social practice this way, one can attend to the issue of power relations. As argued by Barnes (2001, p.28), social practice is all about power – "to engage in practice is to exercise power." For detail theoretical analysis and foundation of how to attend to the issue of power in practice theory see Watson (2016)

2.4.2 Practices, agricultural production and food loss and waste

Recently, a few studies within agri-food systems have engaged with theories of practice to 'increase understanding of the transformation and changes in farming practices' (Huttunen and Oosterveer, 2016, p.191). Such engagement has primarily emerged in the arena of sustainable transition or transformation in agricultural practices – e.g., sustainable fertilization usage, organic farming, agroecology, permaculture (Morgan, 2011; Freyer and Bingen, 2012; Huttunen and Oosterveer, 2016; Genus *et al*., 2019; Sahakian *et al*., 2017); urban agriculture (Jansma and Wertheim-Heck, 2021; Costa and Pinto, 2020); understanding farmers' routinized crop protection practices (Kaiser and Burger, 2022); transitioning towards sustainable food or alternative food choices (O'Neill *et al*., 2019; Tuscano *et al*., 2021); and agricultural advisory and extension system (Paschen *et al*., 2021). While such analysis improves our understanding of farming practices in relation to transformation, mainly from conventional agriculture to sustainable agriculture and crop protection practices, it falls short of illuminating how practices lead to food losses and waste in agricultural production.

There is no attention to how specific agricultural practices lead to food loss and waste in agricultural production – particularly pre-harvest food loss. Also, how specific cultural values influence farmers acquired practices that might lead to food losses and waste. Besides, current approaches to understanding pre-harvest losses in SSA tend to be a single perspective focus – either biological/climatic and environmental factors that reduce marketable yield or poor crop performance due to pest and plant diseases or orchard management practices – without social practice theoretical lens (Lufu *et al.,* 2020; Ramírez-Gil et al., 2019; Hussein *et al.,* 2018; Kirigia *et al.,* 2017; Oino *et al.,* 2017; Arah *et al.,* 2015; Kader 2002; Sams, 1999; Kays, 1998, among others). A social practice theoretical lens helps to overcome the single focus perspective to understanding pre-harvest losses and waste by considering the social, cultural, and material context within which the farming practices occur. Cultural values and customs, for example, determine what practices farmers enact.

A better understanding of the underlying causes of pre-harvest losses requires integrating the concepts of materiality, institutions and the practices and the interrelationship and interaction between them. For example, how do institutions (formal and informal rules) and materiality (including the crop being grown - say avocado) shape the enacted agronomic practices? And in what ways does that impact pre-harvest losses and waste? These are among some of the gaps in the literature that this thesis tries to address. Such understanding will move the farm-level loss debate beyond just placing it at the doorstep of technological inadequacy (Gille, 2013; Alexander *et al.,* 2013), as has been the case in the global South (Parfitt *et al.,* 2010; FAO, 2019b; 2011; Gustavsson *et al.*, 2011). For instance, there is a gap in understanding how new forms of social relations of production and power dynamics lead to pre-harvest losses in export avocado production.

Further, current debates on pre-harvest loss and waste fail to account for the role of the variety of crops in question in shaping agronomic practices. For example, introducing new (export) avocado varieties requires specific practices that pose challenges to farmers' already acquired knowledge and practical know-how of growing the old (domestic) varieties. Also, how does the materiality of the avocado shape social relations – harvesting and trading practices?

Soma *et al*. (2021, p.170) provide the first study which draws on a practice theory lens to 'understand the issue of food losses at the farm-level, [looking at] why edible food intended for human consumption remains unharvested' among producer growers in British Columbia, Canada. They argued that many of the structural factors (e.g., alternative markets, stringent aesthetic values, power imbalance, processing infrastructure, policies) were beyond farmers' control, limiting their

ability for reducing food loss and called for a shift in solutions that focuses entirely on the changing farmers' practices (ibid). Although their study illustrates that farmers make a farming decision based on several factors (material structures and systems, meaning and values, and competencies), it is too focused on solutions for reducing food loss and practices of tilling surplus/unharvested food (see also, Johnson *et al.,* 2019; Johnson *et al.,* 2018). Focusing on practice as performance (Shove *et al.,* 2012) limits the gaze on the social relationship between the actors (e.g., buyers and farmers) and how buying and selling relations impact practices that generate food loss or waste on farms.

This study will focus on the relational materiality of the avocado and how the material agency of the avocado is used by actors to understand how losses and waste occur, inequalities and power dynamics. Also, how the avocado itself is constitutive of the enacted practices – in its growing, harvesting and handling. As Schatzki (1996; 2010) argues, materiality represents a constitutive element or resource of social practices. Another critical question is how norms and value(s) manifest in the selling/buying practices to produce food losses at the farmgate and the immediate market spaces. The following session presents the conceptual framework that integrates institutions, materiality, and practices.

2.6 Conceptual framework

This study adopts a social relations approach that broadly draws on the food waste regimes concept (Gille, 2013) to integrate insights from institutions, materiality, and practices for analysing the generation of food loss and waste in Tanzania's two different avocado production systems. The above theoretical and empirical literature review led to the development of the conceptual framework (Figure 2.2) – an integrated framework to analyse the different aspects of the process of production and distribution of avocados and how the relationships and interactions between institutions, materiality, and practices help to understand how food loss and waste generation arises from the social relations. By drawing on the concepts of institutions, materiality, and practices together in a single analytical lens, it is possible to see how power dynamics manifest in institutional arrangement and the social relations of production and distribution of avocados.

Food loss and waste generation are viewed as constantly created and reproduced within this conceptual framework through the interactions and interrelationship between institutions, materiality, practices, and the competing interest of the actors.

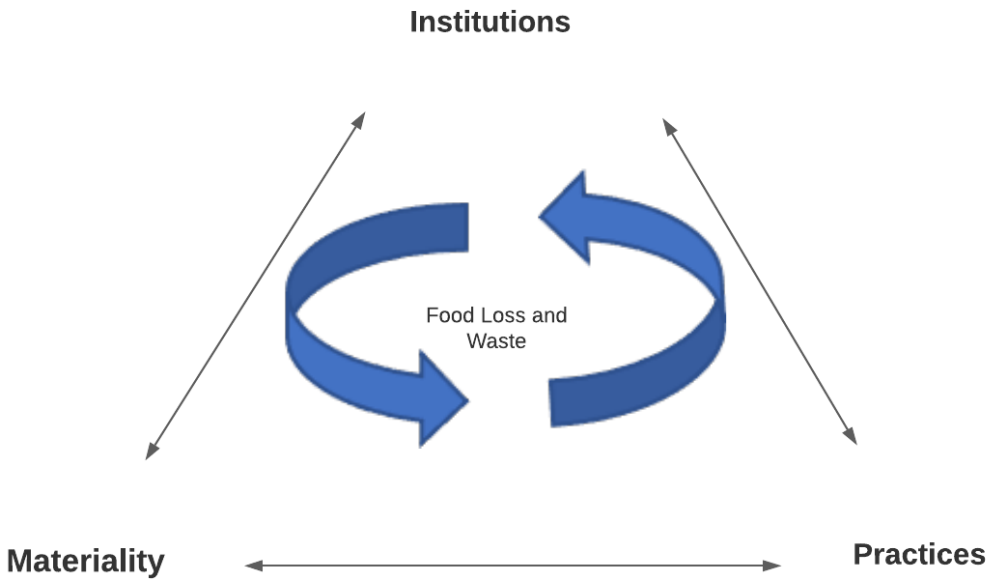


Figure 2. 2: Conceptual framework

In its most abstract form is a picture of the configuration of tensions. The structure does not determine any particular direction of action but may impose pressures and constraints. The three concepts- institutions, practices, and materiality- interact in a structure; no one-way determinism needs to be assumed among them. Institutions (be they rules, norms, values, customs etc.) define how practices are enacted, which behaviours are acceptable, and the prescribed sanctions for those who break them. But practices are enacted by drawing materiality – which helps create the practice and shape each other. Materiality – nature, environment, pest/diseases, and the crop itself also interact and play a role in establishing institutions (e.g., rules, regulations, standards, norms, etc.).

This study combines the strengths of institutions and practice to investigate the underlying drivers of historical, socio-economic, and political context and cultural framing of avocado as 'food' within which Tanzania's two different avocado production systems and supply chains have evolved developed (objective 1). But also, to identify how the supply chain has been structured and the actors involved in the two production systems. Significantly, how the cultural framing of the avocado as 'food' and motivations for the adoption influences different practices for the domestic and the export avocado production. The study uses the lens of institutions and materiality to examine how their interrelationship shapes the agronomic or growing practices in the two different avocado production systems and their implications for pre-harvest food loss and waste generation (objective 2). The study examines how institutional arrangements between export avocado producers (particularly smallholders) and exporters lead to new forms of social relations of production and how power play is experienced by farmers, and its implications for losses and waste generation. It also interrogates the concept of 'loss', particularly in the domestic avocado

production system in the context of agroforestry practices (objective 2). There are different institutional arrangements between traders and farmers that determines how the selling and buying relations and practices are carried out (objective 3 & 4):

Firstly, for the domestic avocado production systems, the study uses the lens of practices and institutional arrangements to explore how risk-avoiding strategies adopted by different actors in selling /buying relations result in loss and waste generation and the ways power relations manifest in these practices to produce loss and waste (objective 3). The study also examines the role of market institutions – 'a credit system arrangement' which underpins the functioning of the domestic avocado supply chain provides an avenue for exploitation and losses and waste production (objective 3). A material lens is applied to understand how the material state of the avocado - "its perishability" provides an avenue for exploitative power relations and perpetuates inequalities and waste generation in the domestic avocado supply chain (objective 3). Secondly, the study explores the different institutional arrangements and social relations between farmers, farmer groups, and exporters/buyers that shape the selling/buying relations and the implication for loss and waste production in the export avocado production system in the two sites studied (objective 4). However, the interactions between the materiality of the avocados, price determination and late payment of farmers create loss and waste and inequalities among growers. While standards and grades create loss and waste, the institutionalisation of a 'rejects sharing system' among growers as part of the requirement for the GlobalG.A.P. group structure creates an avenue for risk reduction strategies by farmers, leading to inequalities and losses and waste generation in the production system (objective 4).

2.7 Chapter summary

The production of food loss and waste with agricultural production and distribution are determined by complex interactions within and between multiple institutions, materiality and practice operating at different spatial and temporal scales. This chapter reviewed the theoretical development and the empirical studies related to these concepts and integrated them to form a conceptual framework for this PhD research. Notwithstanding, bringing these concepts is not straightforward; there are variants in conceptualisations, definitions and critical questions guiding each of the concepts and how they relate to each other. This chapter attempted to acknowledge these tensions and link each other to develop a narrative for this thesis. Each of the four study objectives focused on a different aspect of the interactions and interrelationships of the framework (chapters 4-7). The findings of the empirical chapters are combined to present a thorough picture

of food loss and waste in agricultural production as social relations giving primacy to the institutions, materiality and the practices that determine how loss and waste are produced (chapter 8). The following chapter presents the research methodologies used to operationalise the conceptual framework and the study aim and objectives.

Chapter 3

Research design and methodology

3.1 Introduction

This chapter provides an overview of the methodological approach adopted for this thesis. It justifies the selection of methods and research strategies, examining the different levels of decision making during the research process (Crotty, 1998). The chapter also reflects on the challenges faced during the research development. This research employs 'following the thing' and 'go-along' ethnographic approaches (Cook, 2006; Kusenbach, 2003) to explore the social relations of food loss and waste generation in domestic and export avocado production systems. The ontological and epistemic stance adopted for this study, sampling strategy and recruitment is presented in section 3.2. A discussion of the research design, methods and tools for data collection is presented in section 3.3. After that, the data analysis, and the methodological considerations (research in translation, use of interpreter, positionality, and ethics) are discussed in sections 3.4 and 3.5 respectively.

3.2 Methodological approach

3.2.1 Ontological and epistemic stance

This research explores how institutions, materiality, and practices help produce food loss and waste within avocado production in Tanzania. The social context within which food loss and waste arises is dynamic, multi-dimensional, and multi-situated, not only at the consumer level (Evans 2011; 2012) but also at the production stages. When farmers, traders, and other actors within the avocado production system recount experiences of food loss and waste as narratives, the narrative is a construction of the social world influenced by different actors, institutions, and cultural contexts. These narratives are also produced with the immediate and broader context, structures, and practices. As a result, the research focused on understanding the complexity and diversity of meanings that farmers, traders, and other actors construct of the social reality of avocado loss and waste generation through the production and distribution system.

Therefore, the social reality that the study aims to explore is approached from the constructivist-interpretive paradigm (Denzin and Lincoln, 2011; Guba and Lincoln, 2005; Guba, 1990). An interpretive approach to researching the social world aims to capture the multiplicities of realities embedded in the avocado loss and waste production.

Interpretive paradigm holds that multiple realities and meanings exist in our social world; it depends on the researched and is co-created with the researcher (Yin, 2014, Denzin and Lincoln, 2011). The epistemic stance of this research supports the notion of gaining knowledge as put forward by Crotty (1998, p.42) "that all knowledge, and therefore all meaningful reality as such is contingent upon human practices, being constructed in and out of an interaction between human beings and their world and developed and transmitted within essentially social context". According to Creswell (2013), these subjective meanings developed by individuals are "varied and multiple". Therefore, the researcher aims not just to narrow meanings into only a few categories but to look for the complexity of views, relying as much as possible on the participants' views of the social reality. Creating such complexity of views is like a photo montage; the aim is to piece together several slices of reality from perspectives of different participants around the central focus of avocado loss and waste generation.

The interpretive paradigm has been explored in greater depth by learning scholars (for example, Denzin and Lincoln, 2005; 2011; Jackson and Penrose, 1994; Berger and Luckmann, 1966). Therefore, the interest of this thesis is not to further explore this well-established paradigm within social sciences but instead to state my epistemic stance, to draw on Cook's (2006) approach of 'following the thing' and Stake's (2005) notion of case study research. Stake views case study research "as a choice of what is to be studied - a case within a bounded system rather than a methodology." This notion supports Cook's (2006, p. 657) approach of 'following the thing' - where the 'thing' to be followed becomes the "organising principle for the research" (see section 3.2.2). I argue that a constructivist-interpretive stance provides the appropriate platform from which various methods can be used to capture the multiple spaces and voices from which avocado loss and waste occur (Creswell, 2013).

3.2.2. Qualitative case study design with 'Following the thing' approach.

In social science, the case study method is preferred when the research asks 'why' or 'how' questions to explore, understand or explain a social phenomenon and is focused on a contemporary phenomenon within a real-life context (Yin, 2009, 2018; Stake, 1995, 2005). Creswell (2013, p.73)

describes a qualitative-driven case study approach as – "where the researcher explores a bounded system (a case) or multiple cases over time, through in-depth data collection involving multiple sources of information, and the outcome presented as a case description with case-based themes" (see also Creswell *et al.,* 2007). Exploring avocado loss and waste production in Tanzania is bounded within the avocado supply chain - which encompasses cultivating, harvesting, processing, distribution, and marketing systems. Nevertheless, it is also set within a context - social, economic, cultural, historical, temporal, and spatial (Yin, 2009; 2018; Stake, 2005)[11] in which these practices are enacted. The object is to 'get inside [their] networks, go with the flows, and look to connect.' (Crang, 2005, p.49; Crang *et al.,* 2003). In following the avocado, I aimed to understand how and why loss and waste occur in production and use the avocado to tell stories - 'everything in and around it' (Cook, 2006; Harvey, 1990). As Harvey (1990, p.442) argues, commodities "obscure the intricate geography of production and the myriad of social relationships embedded in the production system". Therefore, using qualitative case study design embedded with following the thing approach complements the object of case study research, which is to build an in-depth contextual understanding of the case (Yin, 2018; Creswell, 2013).

The question of which direction to do the 'following' has been raised (Gregson *et al.,* 2010). Earlier studies using 'following the thing' work backwards from the commodity through "assembling of pre-figured point of sale [of the] commodity" (Gregson *et al.,* 2010, p.5) and tracing it to the point of its origin (Hulme, 2017). However, there have been calls to attend to flows 'down' the value chain (Gregson *et al.,* 2010). In this study, the direction of 'following' started from the farm to the wholesale markets (domestic supply chain) and the packhouse (export supply chain), which is a departure from the "backtracking" associated with 'following the thing' tradition (Gregson *et al.,* 2010). The design approach provides a unique advantage for this thesis in two ways:

First, following the avocados from the farm and working forward along the supply chain offered the best opportunity to understand how the interrelations between institutions, materiality and practices manifest in the production system to produce losses and waste. It allowed the different actors and stakeholders who engage with the avocado through its journeys to be part of the research participants, thereby giving a richer contextual understanding of how waste production occurs and the social relations within the avocado production system.

[11] As Yin (2018) asserts, "You use case study because you deliberately want to understand contextual conditions - assuming that such understanding is pertinent to the phenomenon of study" (p.15).

Second, the comparative nature of this research – domestic and export avocado production with different contexts (variety, production systems, distribution, consumers, stakeholders) required a research design that would accommodate such distinctions yet bring them together to provide different perspectives on the issue of food loss and waste (Creswell, 2013; Stake, 2006; Yin, 2009, 2018). The aim was not to generalise but to give insights into each case's unique contexts and provide a broader contextual understanding. Thus, provides more in-depth knowledge than the current discourse about farm-level loss and waste, which largely borders on quantification and technological inadequacy in the global South (Gille, 2013; Alexander *et al.,* 2013).

Overall, the design strategy afforded multiple forms of data collection (interviews, go-along ethnographic observation, informal conservations, and secondary data) (Creswell 2009; 2013), which aided triangulation of findings and a comprehensive understanding of the differences and inconsistencies in participants' accounts (DeWalt and DeWalt, 2011). Besides, the analytic strategy provided a 'thick description' of each case and themes within the case (Geertz, 1973) by illustrating everyday experiences of avocado waste generation with textured accounts drawn from multiple voices, locations, and scales.

3.2.3 The case study selection

The case study requires selection of multi-sites along the supply chains for each of the cases. Purposive sampling was used to select the study sites at three levels: 1) National, to decide the country for the study; 2) Sub-national, to select the regions/districts; and 3) Ward level, to select villages/communities. Purposive sampling allows the selection of cases that illustrate some of the features or processes which the researcher is interested in (Silverman, 2020). The aim was to "select a setting – organisation, groups, or individuals where… the process being studied is likely to occur" (Denzin and Lincoln, 2006, p. 202) to enable a detailed exploration of the central themes and objectives of the study.

Table 3.1 shows the criteria used for selecting the cases at three different levels, and description of the national, regional, and ward (local contexts). At the ward level, a diverse case approach was used to select similar sites concerning certain essential features of AEZs, where avocados are grown, sold, processed, and packaged. As with the selection of cases, a purposive sampling strategy was adopted in recruiting participants (Holstein and Gubrium, 1995). The aim was to select a representative sample to gain a deeper understanding of how practices, institutions and materiality

led to waste generation, and to "discern meaningful patterns within a thick description" (Warren, 2011, p.6) rather than generalisation and representative sample (Charmaz, 2011; Valentine, 2005). I used two main strategies within purposive sampling - snowballing and gatekeepers (Bryman, 2012; Weiss, 1994) to contact and recruit participants (see section 3.2.4). The selected study sites, fieldwork, recruitment, and gaining access are discussed below.

Table 3.1: Case study sites selection criteria at three levels

Level	*Purposive sampling criteria*	*Case context*
National	1. East African country that produces avocados. 2. Distinct production systems for domestic market and export market 3. High involvement of smallholder farmers in both production systems. A mixture of different farm sizes in the export avocado production 4. The University of Sheffield has some external links with local organisations.	Situated south of the Equator, the United Republic of Tanzania possesses several agroecological zones suitable to produce avocados. For over a century, the country has grown avocados for domestic consumption (subsistence). In 2007, the country started producing commercial varieties of avocado for export. Tanzania's economy is mainly agricultural, with smallholders forming a more significant percentage of farmers and is mainly which is rural based. The University of Sheffield has established a field centre in Kilimanjaro and has links with a local NGO - KEDA, in the region.
Sub-national (Region/ District/ levels)	1. Located within a coffee/ banana agroecological zone that is suitable for avocado production 2. A significant production area domestic or export avocado production 3. At least has a processing factory – packhouse for the export of avocado 4. Availability of markets – wholesale and retail markets for the domestic avocado 5. Availability of logistical support, such as local key contact persons.	FAO (2010) report provides a detailed map of different livelihoods zones based on agroecological zones that indicate the predominant crop grown. Notable avocado production regions are the Northern Highlands (NH) and Southern Highlands (NH). Kilimanjaro and Arusha regions in the NH were selected because they are the country's highest avocado production areas (domestic avocado) and have some of the largest commercial avocado estates and packhouses (export avocado). Five districts (Moshi rural, Rombo and Siha – Kilimanjaro; Meru and Karatu districts (Arusha) were selected based on a pre-fieldwork scoping trip and consultation with KEDA. In the SH, the Mbeya region (Rungwe District) was chosen as a significant avocado production district based on consultation with government officials.
Ward level (Town/ Village	1. Villages/towns should have significant domestic or export avocado production 2. There should be differences in institutional arrangements between smallholders' farmers export avocado farmers and exporters/buyers 3. Villages/towns must have a significant wholesale market for the domestic avocados. 4. Major destinations for domestic avocados.	Villages/towns were chosen based on discussion with local contacts in the chosen districts at the ward level. For example (Marangu, Kilema, Lvamombi, Mamsera, Mwika, Sanya Juu) wards in Kilimanjaro region were selected because they are major avocado production areas and have markets that met the selection criteria. Similarly, consultation with the Rungwe district government officials and Wards officers helps select villages in the SH (e.g., Ilollo, Ibula, Syukula) with significant avocado production and has avocado processing facility. While consultation with traders helped select major avocado wholesale/ retail markets in Dar es Salaam.

A pre-fieldwork scoping trip to the Kilimanjaro region in January 2018 enabled establishing initial contacts with key stakeholders, which helped refine the selection criteria described in Table 3.1.

3.2.4 The study sites and Fieldwork

The study site is categorised into three areas – the NH, SH, and Dar es Salaam on the coast. The NH and SH were selected because there are differences in production scale and institutional arrangement between farmers and exporters/buyers.

Figure 3.1: Map of Tanzania showing study regions

Figure 3.1 shows the map of Tanzania with selected study regions, while Figures 3.2, 3.3 and 3.4 indicate the study sites at the districts and ward/village levels where data collection was conducted. The list of villages/towns is shown in Table 3.2.

Table 3.2 List of Villages and towns (field sites)

Region	District	Ward	Name of villages/Town	Markets/ packhouses/oil processing factories
Kilimanjaro	Siha	Kashashi	Dukani, Lukani, Naweru, Kashashi	
		Sanya Juu	Kifufu, Sanya Juu, Mwaokaa	Sanya Juu market Africado Ltd (packhouse)
		Makiwaru	Naibilie	
		Livishi	Samaki Maini	
		Kirua	Lawate, Kibong'oto	Lawate market
	Moshi Rural	Mwika Kaskazini,	Mwika	Mwika Market
		Kilema Kaskazini,	Kilema, Mureni, Keluo	Lyamombi market
		Marangu Magharibi, Marangu Mashariki	Marangu-Mamba	
		Kirua Vunjo	Mrumeni, Kileuo,	
	Rombo	Mamsera	Mamsera Juu, Mamsera Kati	Mamsera Market
		Shimbi	Shimbi Mashariki, Shimbi Kati, Shimbi Mashami, Shimbi Masho	
		Maro Kreyo	Kreyo, Maro, Maringa Juu	
		Olele	Kilema	
		Marangu Kitowo	Marangu	
Arusha	Meru	USA River	USA-River Limited Estate	
		Bangata	Bangata Village	
	Karatu	Ganako	Tloma	
Mbeya	Rungwe	Kiwira	Ilolo, Ibula, Kiwira, Sogea	Kiwira market
		Kyimo	Syukula, Ilenge/K. K, Syukula-Kati Syukula-Segera Syukula -Juu, Syukula-butundu	Rungwe Avocado company (packhouse) Kuza Africa Ltd (packhouse Lima Kwanza Ltd (packhouse) Parabe Ltd (oil processing company)
		Suma	Suma, Busona	
Njombe	Njombe urban	Njombe town	Njombe town	Four Seasons Orchard Ltd.
Dar es Salaam	Ilala	Ilala	Ilala Boma Market	Ilala Boma Market
	Temeke	Temeke	Temeke Stereo	Temeke Stereo
	Ubungo	Ubungo	Mabibo market	Mabibo market

3.2.4.1 The Fieldwork

Data collection took place in the NH (Kilimanjaro and Arusha regions) and SH (Mbeya region) over one extended visit (May to September 2018) and two short visits (March-April 2019 and July-August 2019). The fieldwork was planned to coincide with the main harvesting seasons for domestic and export avocados and is organised into phase 1 and 2 data collection.

Phase 1

Phase 1 of the data collection lasted almost six months over two periods (May-September 2018 and April 2019 in NH). This fieldwork followed a previous scoping visit to Kilimanjaro in January 2018. I spent the first month learning the Kiswahili language, immersing myself in the Tanzania culture, establishing new contacts, and building on the previous connections from the scoping trip. The fieldwork in the NH involved data collection in six districts - Rombo, Hai, Siha, and Moshi rural (Kilimanjaro region), and Karatu and Meru (Arusha region) (Figure 3.2). The first stage of the fieldwork lasted six weeks and involved go-along participant observations and interviews with farmers and traders (i.e., harvesting and selling go-alongs' in Kilimanjaro and Dar es Salaam). This stage focused mainly on the domestic avocado supply chain (see Table 3.3 and 3.6; and Figure 3.3), while the second stage of fieldwork focused on the export of avocados and lasted five weeks in Kilimanjaro and Arusha regions. The second stage involved interviews with smallholder out-growers, commercial out-growers, key stakeholders, and 'go-along' participant observation of harvesting and packaging/processing (see Table 3.4 & 3.6). It is essential to highlight that the first and second stages in phase 1 happened concurrently. For instance, I negotiated access to export avocado farmers, recruited participants during the first stage, and gained access to the packhouse facility. The third stage in phase 1 of fieldwork lasted three weeks (in April 2019), almost seven months after the first trip in May 2018. During this lap of fieldwork, ten follow-up interviews with smallholder out-growers and key informants were conducted.

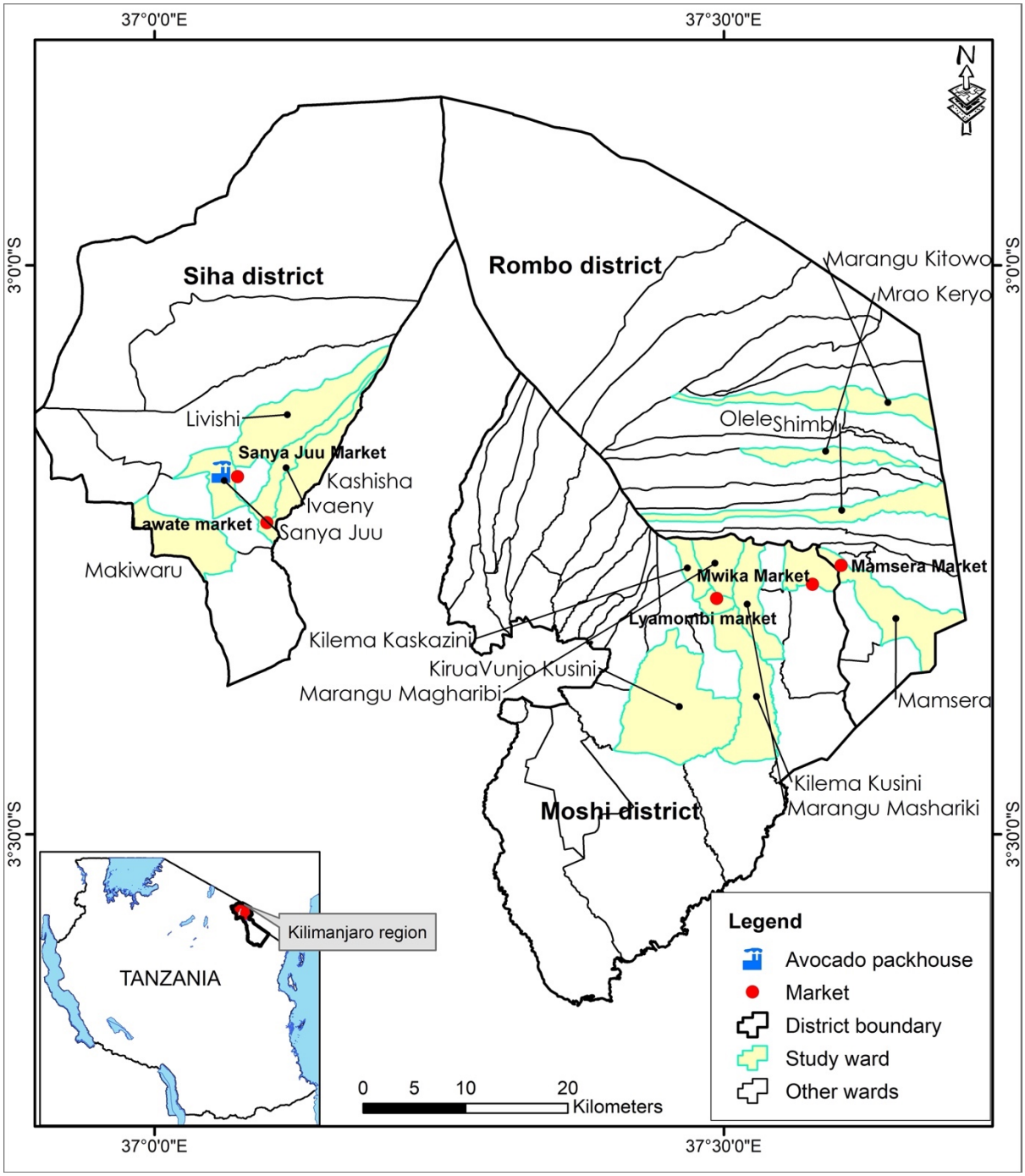


Figure 3.2: Study sites in Rombo, Siha and Moshi rural districts (Kilimanjaro region)

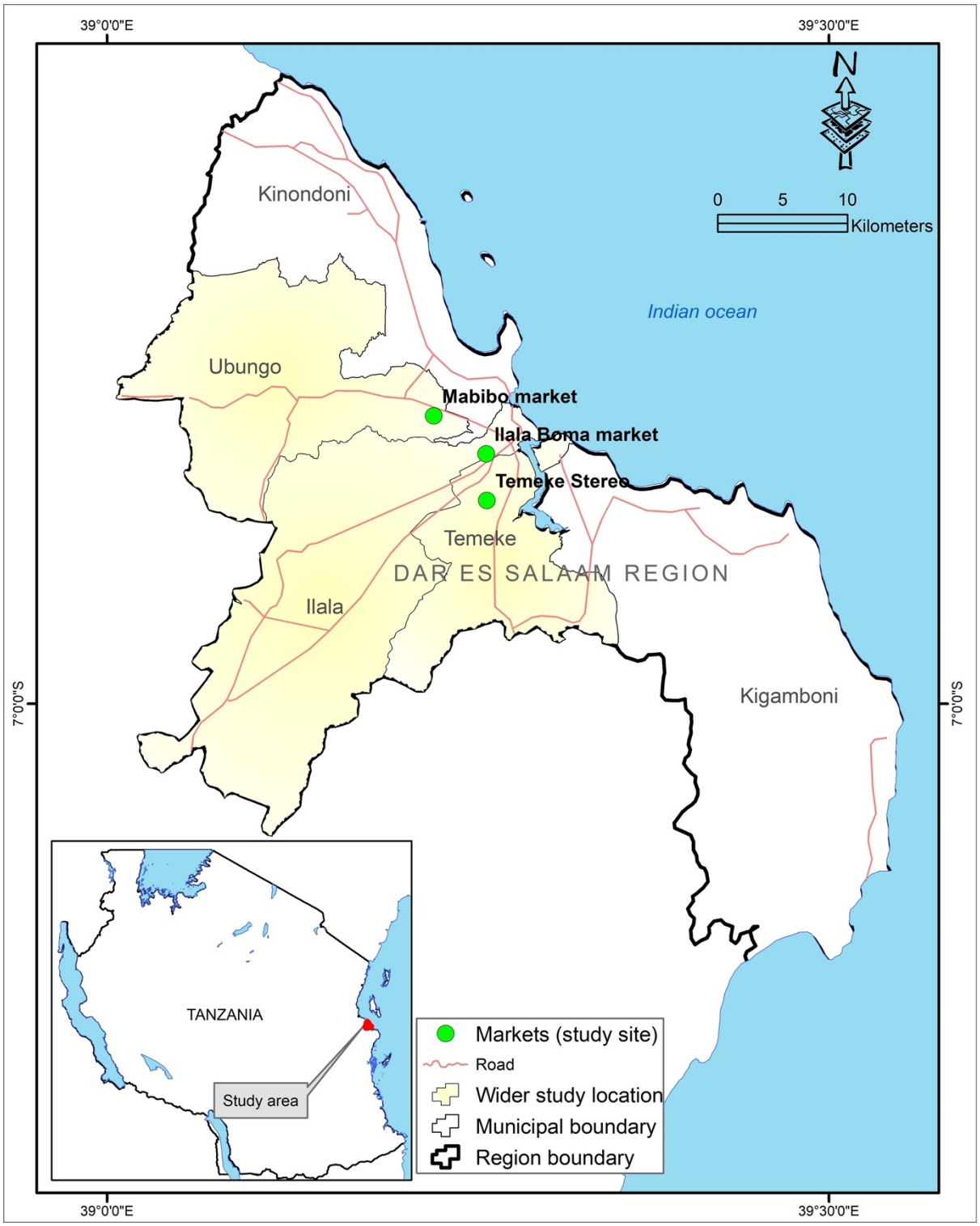


Figure 3.3: Study sites (wholesale markets) in Dar es Salaam

Phase 2

Phase 2 of the fieldwork lasted six weeks (July – August 2019), mainly in the Rungwe district (Mbeya region) and a few key informants in the Njombe town district (Njombe region). The short

period spent in the SH was because data collection activities focused mainly on the export avocado supply chain. This enabled comparison between the export supply chains operating in the Northern and Southern Highlands. During phase 2, interviews were conducted with farmers (n 34), field officers (n 4), key informants (n 16), and packaging/processing go-along (see Table 3.3 & 3.6).

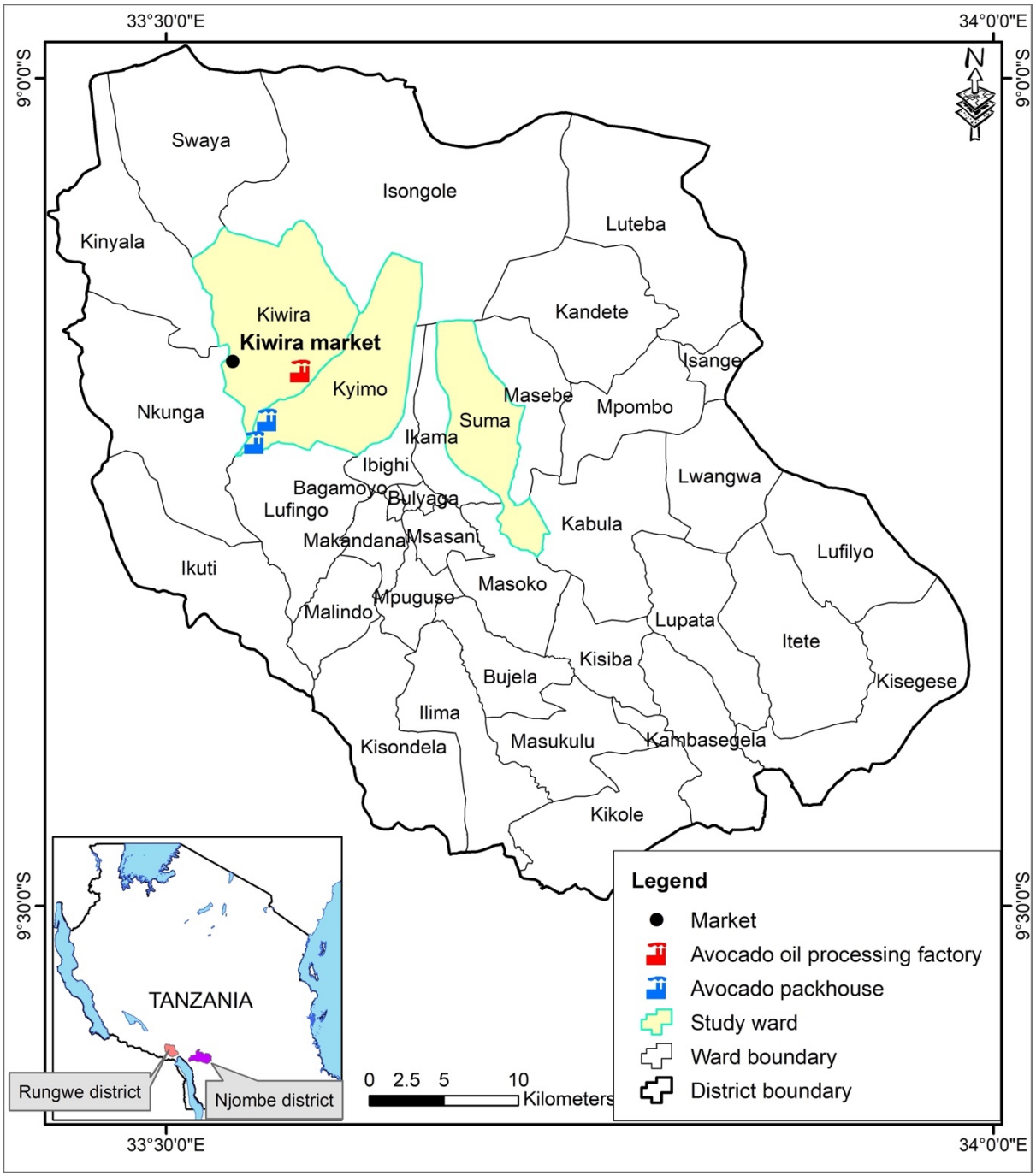


Figure 3.4: Study sites in Rungwe district (Mbeya region)

3.2.4.2 Gaining access - research permits and recruitments

Gaining research access in Tanzania involves a multi-layered process that is state-controlled. All researchers must apply for research permit clearance from the Tanzania Commission of Science and Technology (COSTECH) (see Appendix 3.1). After applying for and obtaining this permit, further permission and introductory letters from the regional and districts administration had to be obtained. The district-level letter indicates which specific Wards (community and village) the research will be conducted in. The letters and permits must be presented to the Ward Executive Officer (WEO) and Village Executive Officer (VEO) to access research participants. Although the process improves transparency, addresses ethical issues in the research process, and aid access to participants. The bureaucratic nature adds additional layers of power between the researcher, institutions, and participants, as noted in my field journal:

> *When dealing with participants in a formal setting (institutions, parastatal organisations, private organisations, NGOs and other civil society groups) and among the educated population, the research permit becomes a means to deny access if one does not have it (Field Journal, 1 June 2018).*

In the case of the domestic avocado supply chain, initial recruitments of participants were made through observation and interactions at various markets. Through these initial contacts, additional traders, helpers, fruit pickers and farmers were recruited through harvesting and selling go-alongs'. Therefore, the recruitment and sampling were ongoing throughout the fieldwork, primarily through snowballing, but sometimes spontaneous during go-along participant observations (Holstein and Gubrium, 1995). Many of the farmers were recruited while on harvesting go-alongs. Negotiating access with domestic avocado farmers, traders, and other local stakeholders was somewhat straightforward compared with exporting avocado actors.

Recruitment of participants in the export avocado was predominately through gatekeepers and, in some instances, snowballing. This was due to the nature of the organisation of the supply chain. For example, it was easier to access farmers through field officers of the export companies and the leadership of out-grower associations at the village level. This required collaboration from the export companies and the leadership of the farmer groups. As with many private commercial entities, access was challenging and fascinating, requiring negotiation skills, and through personal network and contacts and constant juggling of "familiar" and "unfamiliar" ways of thinking and doing in building trust with export/producer company (Truninger, 2015, p. 40). For example, initial contact with a gatekeeper of a large exporter/producer through "unofficial or backstage" (Truninger, 2015, p.40) visit during a scoping trip provided helpful insight into the Managing

Director's reservations about people researching his organisation how to circumvent some of the potential complexities.

The risks associated with using gatekeepers are well recognised in literature, such as gatekeepers imposing their agenda by directing the researcher to select specific participants (Valentine, 2005) or organisations (Kawulich, 2005). In this study, the use of the gatekeepers allowed for the recruitment of different groups of farmers who were not only articulate but critical in their views, which supports Holstein and Gubrium (1995, p.24) suggestion that, where possible, researchers should select "respondents because they are assumed to be capable of narrative production". The following section discusses the data collection methods employed for this study.

3.3 Data collection methods

The main data collection methods used were qualitative interviews (including informal interviews), documents review, and go-along ethnographic observation. Combining different qualitative data collection methods enabled triangulation (Bryman, 2012; Silverman, 2020). Figure 3.5 outlines the methodological framework, showing how the data collection methods relate to the research objectives. The following sub-sections discuss the research tools used to collect primary data from the study sites.

3.3.1 Qualitative interview

3.3.1.1. Theoretical background

Qualitative interviewing is "a conversation with a purpose' (Burgess, 1984, p.102). In this study, qualitative interviewing was viewed in the broader sense as "talking with people" (DeVault and McCoy, 2006) as a range of approaches to "talking" or conversation with participants (planned interview and informal interviews and conversations during observations) were employed. The purpose of these conversations was to "derive interpretations, not facts or laws from the participant talk" (Warren, 2011, p.2), where participants were viewed as meaning makers, not just passive conduits for retrieving information from existing vessels of answers (Holstein and Gubrium, 1995). However, the approach used to derive the interview data and how the interview data is viewed is essential (Baker, 2002). This study takes a constructionism approach where the researcher and the

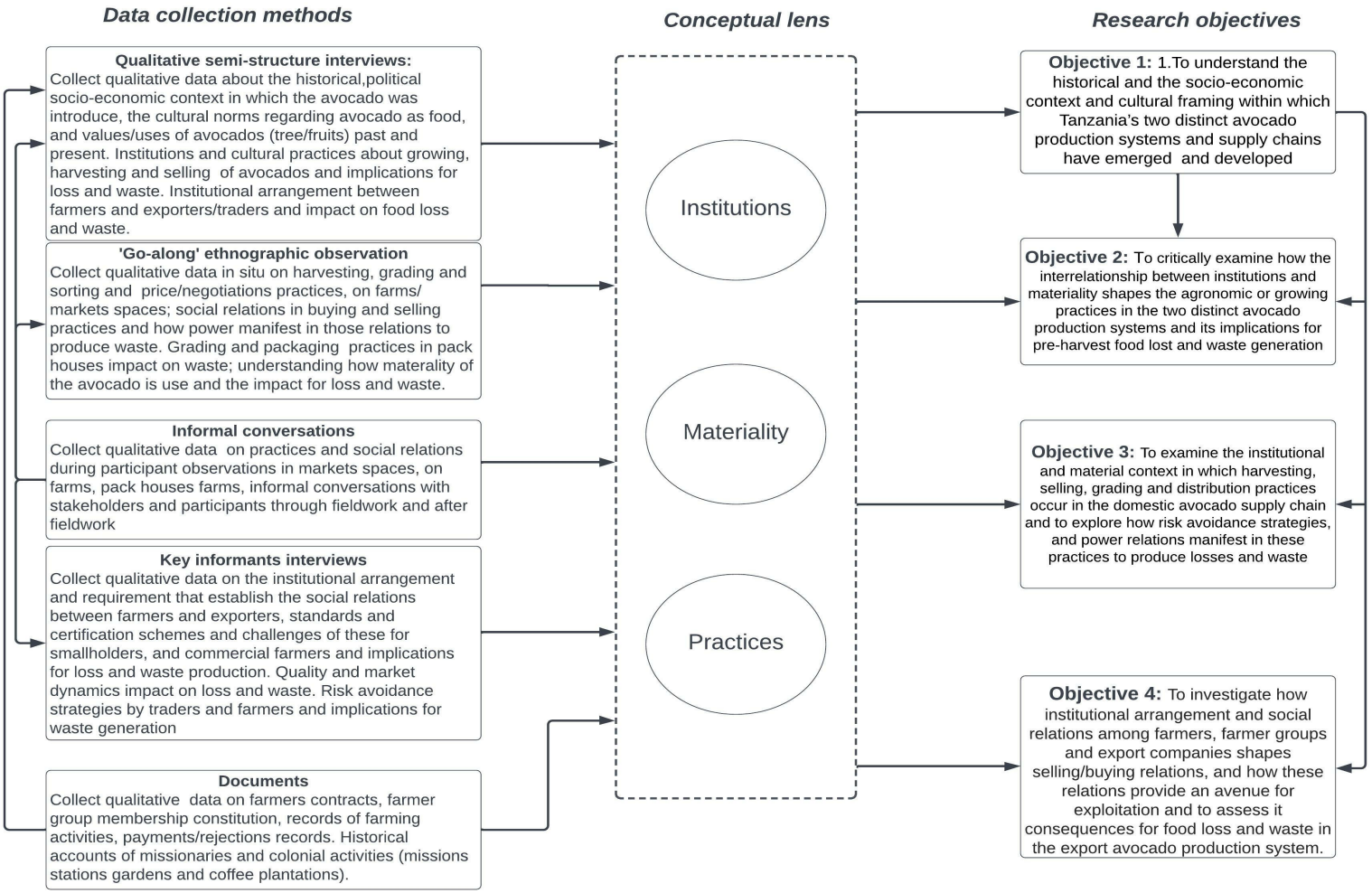


Figure 3.5: Methodological framework showing links between the data collection methods, the conceptual lens and research objective

participants constantly and actively engage in constructing meaning – where the research topic and aims becomes how meaning is mutually constructed as social interaction in a conversational manner (Silverman, 2020; Denzin, 1989). The interest is documenting how the accounts are part of the world the participants describe. The goal is to show that the interview responses are produced as an outcome of interaction between the researcher and the researched without losing sight of the meanings produced or the circumstance that conditioned the meaning-making process.

"The analytic objective is not merely describing the situated production of the talk but to show how what is being said relates to the experiences and lives being studied" (Gubrium and Holstein, 1997, p.127). However, the constructionist approach to generating interview data has been criticised as being narrow – too focused on the conversational skills of the participants instead on the content of what is being said and its relation to the world outside the interview (see Silverman, 2020). However, as Schegloff (1997) argued, the interview data can only be found through how it is made available by the participants. As such, it is by focusing closely on the co-production of interview talk that we can say a great deal about the content without importing our own sense of what content is essential.

3.3.1.2 Design and conducting of interviews

In designing the interview, cognisance was given to Kvale (1996, p.4), who advised that "the interviewer goes along with the participants; ask questions that lead the participants to tell their own stories of the lived world". Therefore, open-ended questions using a semi-structured style were adopted to ensure participants travel along and for topics or themes to emerge in the context, but also to allow for thematising participants' experience (Bryman, 2016).

Following Rubin and Rubin (1995, p.145-146), three types of qualitative questioning were used: main questions that guided the conversation, probes to clarify answers or request for examples, and follow-up questions that pursue the implications of the answers to the main questions. Equally important, the interview was designed to accommodate and allow for flexibility and attentiveness to various meanings that emerged as the interview progressed, thereby facilitating meaningful data production (Mason, 2002). The design followed the standard ethical practice of doing no harm, obtaining informed consent, protecting participants, and dealing transparently with participants (Bryman, 2016; Denzin, 2001). All interview schedules were translated into Kiswahili, and the conversations were audio-

recorded with participants' consent. 180 different participants, including key informants, were interviewed across multiple sites. Tables 3.3 and 3.4 show the categories and number of participants who participated in the domestic and export avocado, respectively.

Table 3.3: Interview participants' domestic supply chain

Domestic avocado supply chain			
Category of participants	*No Male*	*No Female*	*Total*
Farmers (smallholders)	7	13	20
Fruit pickers	6	2	8
Local brokers	4	14	18
Packers	5		5
Wholesalers	3	5	8
Agent traders (Dar es Salaam)	6	2	8
Key informants*	4		4
Total			***71***

Note* Key informants (District agricultural officer, Ward extension officer, Director of local NGOs)

Table 3.4: Interview participants export supply chain

Export avocado supply chain					
	N/Highlands		**S/Highlands**		
Category participants	**Male**	**Female**	**Male**	**Female**	**Total**
smallholders (micro-scale; 1-100 avocado trees)	19	2	17	5	43
Smallholders (small-scale; 100-1200 avocado trees)	4	2	7	1	14
Large-scale farmers (above 1200 avocado tress)	2		2		4
Commercial export-producer companies	2		2		4
Nursery owners	2		3		5
Key informants:					
Field officers (extension officers employed by export companies/processors)	2	1	4		7
Out-grower manager & HR manager	2				2
Farmer groups (association/cooperatives leaders)	1		3		4
Packhouse supervisors	1	1	1	1	4
Export managers /packhouse managers	1		2		3
Technical managers /farm managers	2		3		5
MD of export companies	1		1		2
Global G.A.P external auditor	1				1
GAP Manager - Tanzania Horticultural Association.			1		1
Manager of TAHAFresh (Shipping/logistic company)	1	1			2
SAGCOT cluster coordinator			1		1
Manager of an avocado processing company	1		1		2
Agricultural official (district officer and ward officer)			2		2
Ward/Village officials			2		2
Total					***109***

3.3.1.2.2 Interviewing farmers, traders, and key informants

The interviews with domestic avocado farmers were in-depth, covering different themes: the socio-economic and political context in which the avocado was introduced to their village, how it was consumed in the past and present, how it is grown, harvested, and sold, experiences of losses and waste, the importance of the avocado to farmer's livelihood. A total of 20 farmers were interviewed, most of them women (Table 3.3). This is expected as traditionally, women are responsible for selling foodstuff, and the domestic avocado is not regarded as a major cash crop. The interviews lasted between 40 and 90 minutes, with an average interview lasting 60 minutes. The majority of farmers were recruited during harvesting go-along with traders. Initially, I planned to conduct interviews with farmers during the harvesting go-alongs due to logistical challenges, but I realised farmers were hesitant in discussing pricing issues or other trading relations when the local brokers (traders) were present. Therefore, the decision was made to conduct interviews with farmers after establishing initial contact, which enabled participants to construct their lived experiences in the context of avocado production.

The interviews with export avocado farmers covered their motivations for growing the export avocados; the rules, guidelines and instructions about the growing process, agronomic practices, and challenges that farmers face in enacting agronomic practices. The conversations also explored the out-grower association (how it is organised, its structure and function, and challenges), GlobalG.A.P. certification and institutional arrangement between farmers and exporters (contract type, terms, and consequences for cancellations). Harvesting and grading practices were explored as well as the pricing mechanism and access to market and price information. Sixty-five (65) interviews were conducted with different groups of farmers in the NH and SH (Table 3.4). The interviews typically lasted 90 minutes. Several informal follow-up interviews and informal conversations were conducted with some farmers and stakeholders throughout the fieldwork, during data analysis and thesis write-up.

Interviews with local brokers, wholesalers, and agents/retailers (domestic supply chain) started by exploring their experiences in the trade. From that point, they diverged into specific and emergent themes related to the processes of buying and selling, institutional arrangement, and quality criteria used for buying and selling. The interviews also covered the challenges traders face, the social relations, and practices that cause losses and waste. A total of 34 traders were interviewed, consisting of 18 local brokers, 8 wholesalers and 8 agent traders. The interviews lasted between 40 and 90 minutes, with an average interview

lasting 60 minutes. Besides the traders, I also conducted shorter interviews with fruit pickers, packers, and helpers – 13 in total. These conversations did not only focus on their roles but also helped triangulate data gathered with traders and farmers, especially with the packers; it helped to understand the grading criteria used in the market and how their packaging practices impact losses and waste.

Key informant interview

A total of 35 key informants were interviewed, including GlobalG.A.P. consultant, government officials, packhouse managers and commercial farm managers, and opinion leaders and community leaders (Table 3.4). The diversity of the key informants drawn upon helped to triangulate the data collected.

3.3.1.3 Interview setting and knowledge generation

The location for the interview conversations, particularly on farms, markets and packhouses, offered a unique interview experience for both the researcher and the researched, bringing life into the meaning-making process (Holstein and Gubrium, 2011; 1995). Interviews with farmers usually started with a traditional sit down for the first half, and the rest of the interview was conducted while touring the farm. Sometimes the entire interview was conducted while touring the farm. In this way, farmers could talk about the history behind the avocado trees[12] - the age, yields, taking care of the tree, how many times they have replaced a particular tree (e.g., export variety), harvesting and grading practices by pointing to and touching fruits, objects (buckets, sack bags) and temporary structures without being prompted. Similarly, interviews with most traders were carried out in the market setting while they were actively engaged in their trading activities. For instance, when talking about quality and aesthetic requirements, participants touched specific fruits and held them in their hands to describe which fruits passed the size and appearance criteria (Figure 3.6)

[12] I heard stories behind avocado trees example, 83-year-old retired teacher told me story of how he planted his 45 years old avocado tree (the oldest of the domestic variety I have seen), while a stories behind the oldest export variety (25 years and 20 years old trees) in two district was told

Research participant holding avocado on the tree while discussing harvesting processes and quality standards – size and appearance during interview (export avocado)

A local broker showing different types of domestic avocados during interview at home.

Researcher and research assistant, interviewing domestic avocado farmer at the farm during harvesting go-along.

Figure 3.6: Use of objects during interviews

3.3.2 Participant observation – 'go-along' method

Participant observation is a well-established qualitative research method of data collection in ethnography (O'Reilly, 2012; Atkinson and Hamersley, 1994; Spradley, 1980; Agar, 1996). Whereby the researcher immerses themselves in the research setting to "experience

and observe at first hand a range of dimensions in and of the setting" (Mason, 2002, p.84). The traditional approach to participant observation as used by an anthropologist or in ethnographic research requires the researcher to spend an extended period of at least a year or more (Atkinson *et al*., 2001; DeWalt and DeWalt, 2011). However, the technique is very flexible and has been adopted in many studies (DeWalt and DeWalt, 2011).

In this research, the ethnographic technique that was used "is not lengthy in duration as in traditional ethnography, and less comprehensive in scope" (Guest *et al*., 2013, p.78). It was "as a strategic method that places the researcher where the action is and let them collect data" (Bernard, 2006, p.343) akin to Kusenbach (2003) 'go along' method. Kusenbach (2003, p.463) explains that the go-along method is "more limited and more focused" relative to "the generic ethnographic practice of 'hanging out'. Kusenbach further elaborates that:

> *"When conducting go-alongs, fieldworkers accompany individual informants on their 'natural' outings and – through asking questions, listening, and observing – actively explore their subjects' stream of experiences and practices as they move through, and interact with, their physical and social environment. A hybrid between participant observation and interviewing, go-alongs carry certain advantages when exploring the role of place in everyday lived experience. Go-alongs are a more modest but also a more systematic and outcome-oriented version of 'hanging out with key informants – an ethnographic practice that is highly recommended in virtually all fieldwork manuals and textbooks" (Kusenbach, 2003, p.463)*

Several practice theory-oriented consumer food waste studies (e.g., Evans, 2012; 2014; Watson and Meah, 2013) have drawn on Kusenbach's go-along method – especially accompanied shopping, cooking, storing, and eating. In this study, the 'go-along' method provided the sort of targeted but relatively 'open' form of data collection that Kusenbach advocates. The go-along focuses on observing participants' "spatial practices *in situ* while simultaneously accessing their experiences and interpretations" (ibid, p.463, original emphasis). This method is well-suited to a theoretical orientation toward social practice, in which both practical activity and meaning making are essential and inextricable (Schatzki, 1996).

In the context of this research, the go-along approach was appropriate as the aim was to 'follow the avocado' (Cook *et al*., 2006) on its journey from farms to the wholesale markets in the Kilimanjaro region, where it is sold and moved on to wholesale markets in Dar es Salaam (domestic avocado); or from the farms to the collection centres and to packhouses where the avocados are processed and packaged, and stored for onward shipment (export avocado). Thus, go-along was suitable when conducting a "short

duration" participant observation (Blake, 2019b) and when dealing with 'compound' practice (e.g., harvesting, selling) in a geographically dispersed (multi-sited) integrative practice (Warde, 2016; Marcus, 1995). As argued by Guest *et al*. (2013, p.78), participant observation, when used even on a limited basis, "produce[s] penetrating insights and highly contextual understanding". Inspired by recent consumer food waste and surplus food flows that have used short duration ethnographic observation (Blake, 2019; Evans, 2011; 2012; Ganglbauer *et al*., 2013; Waston and Meah, 2013), this research sought to understand how institutions and structures drive waste production in avocado supply chains. Therefore, gaining first-hand experience and insight into the context, interactions, relationships, rules, and norms that govern the avocado trade and how this drives waste production practice was essential. The methodological rationale was to provide a 'thick' description of the account to ensure the 'trustworthiness' of the research; therefore, observation data was important (Denzin and Lincoln, 2017; Lincoln and Guba, 1985). Tables 3.5 and 3.6 below summarise the accompanied actors and the number of go-alongs (days). The rest of the section discusses how the 'go-along' approach was operationalised, the challenges encountered, and the strategies adopted to overcome them.

Table 3.5: Go-along participant observation (domestic avocado supply chain)

Nature of go-along	*No. of 'go-along.' (in days')*	*Type of participant*	*No. of traders (followed)*	*Wholesale market*	*District*	*Region*
Harvesting & selling	4	Local broker	4	Sanya Juu	Siha	Kilimanjaro
Harvesting	2	local broker	1	Sanya Juu	Siha	Kilimanjaro
Harvesting & selling	2	local broker	1	Mwika and La	Moshi rural	Kilimanjaro
Harvesting	3	local broker	2	Mamsera	Rombo	Kilimanjaro
Selling	3	Wholesaler	2	Sanya Juu	Siha	Kilimanjaro
Selling	4	Wholesaler	1	Mamsera & Mwika	Rombo/ Moshi rural	Kilimanjaro
Selling	2	Wholesaler	1	Ilala Boma	Ilala	Dar es Salaam
Selling	1	Agent	2	Ilala Boma	Ilala	Dar es Salaam
Selling	1	Agent	2	Temeke Stereo	Temeke	Dar es Salaam
Selling	1	Agent	1	Mabibo	Ubungo	Dar es Salaam
Total	**23**		**17**			

Table 3.6: Go-along participants' observation (export supply chain)

Nature of go-along	*No. of go-along (in days)*	*Type of participants*	*Town/Village*	*District*	*Region*
Harvesting	2	Commercial farmer	USA River	Meru	Arusha
Harvesting	1	smallholder (small-scale)	Kibanoni	Hai	Kilimanjaro
Harvesting /collection	2	Smallholders (micro-scale)	Shimbi	Rombo	Kilimanjaro
Harvesting/collection	2	Field officer	Shimbi/ Kreyo	Rombo	Kilimanjaro
Harvesting	1	smallholder (small-scale)	Lukani	Siha	Kilimanjaro
Harvesting/collection	2	Field officer	Lawate	Siha	Kilimanjaro
Harvesting/collection	2	Field officer	USA River	Meru	Arusha
Grading/processing /packaging	2	packhouse manager/supervisors	Sanya Juu	Siha	Kilimanjaro
Grading/processing /packaging	1	packhouse manager/supervisors	Ilolo	Rungwe	Mbeya
Total go-alongs	17				

3.3.2.1 Go-alongs: domestic avocado supply chain

The go along focused on the practices of harvesting and selling (in wholesale markets in Kilimanjaro and wholesale markets in Dar es Salaam). In Kilimanjaro, traders (local brokers and wholesalers) were recruited through interviews and informal observation and conversations with the traders at the various markets. I found that the "prestige of the subject matter" – avocado loss and waste was of interest and valued by most participants, which aided access (Jorgensen, 2011a, p.17), as did the offer to shadow and help with their tasks (Figure 3.7 and 3.8 shows harvesting and selling go-alongs in Kilimanjaro region).

In conducting the go-alongs, I suggested to participants that the observation event follow specific order – harvesting and selling to enable 'following' a particular avocado. How it was harvested and sold by the farmer and how it was transported from the farm and sold at the wholesale market (Kilimanjaro). This, I judged, enabled the research to be conducted in a short, focused period of 2-3 days – one day spent harvesting and the second day spent selling it at the market. For the harvesting go-alongs (n=12), I arranged with local brokers when they were going on harvesting, and this was followed up with selling – the two practices are connected. A similar approach was adopted for the buying/selling specific go-alongs with wholesalers (n=13) at different wholesale markets in Kilimanjaro and agent traders (n=5) in Dar es Salaam. Three local brokers took part in the harvesting go-along but did not participate in the selling go-along (Table 3.5)

Researcher and research participants sorting and packaging at the farm

Researcher and participant loading avocado onto motorbike at the farm

Researcher collecting avocado together

Researcher ferrying avocado to a roadside.

Figure 3.7: Samples of photos of Harvesting go-alongs in the Kilimanjaro region

Figure 3.8: Sample photos of selling go-alongs in avocado markets in Kilimanjaro

The participants were not given any remuneration as I offered to help them during the harvesting and selling of avocados. Thus, I actively participated in the practices while observing and asking questions (Kusenbach, 2003). During the harvesting go-along, I engaged in collecting the fruits together, initial sorting at the farm and ferrying the avocados to the roadside for further sorting and packaging. By actively participating in the actions as they happened, it facilitated data collection in a way that was not intrusive to participants. The local brokers I accompanied were women with different years of experience in the trade (ranging from 3 months to 15 years) and different age groups (30 – 55 years old). This provided an opportunity to understand harvesting practices, grading, sorting, rules and norms, institutional arrangements, and material arrangements, and how these interactions and feedback produce waste in the avocado production system. I also explored different social relations between traders and farmers, the price negotiation process, power relations and sometimes the disagreement between brokers and farmers and the strategies used to reduce risks.

The selling go-alongs in the markets allowed me to 'follow' the avocados harvested at the farm to the markets. Working with the brokers and wholesalers in the market opened-up the trading practices and the power relations between local brokers and the wholesalers and their workers, and how wholesalers coordinate to exert power and control over price. The selling go-alongs widened understandings of the commercial structures of the domestic avocado supply chain. The go-alongs allowed for several direct observation and informal conversations with helpers/packers and other traders and to witness broader trading practices and norms in the markets beyond the brokers and the wholesalers I was observing.

The last stage of following the domestic avocados was at Dar es Salaam, some 568km from Kilimanjaro. In Dar es Salaam, go-alongs were conducted with agents in three markets - Temeke Stereo, Mabibo and Ilala Boma (Figures 3.9 and 3.10). The go-along helped to observe how the avocado is sold on, what criteria consumers use to evaluate the avocados, and how the informal market institution 'credit system' operates. Although the markets setting was visible and open to the observer, it can be considered a close setting – it contained less visible events like inequalities and power relations between the traders that require access and participation to be visible to the observer (Jorgensen, 2011a, p. 9).

Researcher working with an agent trader in IIala Boma market during go-along

Avocados in sack bags from Kilimanjaro region delivered at Temeke Stereo market to an Agent trader I shadowed

Display of avocados at stall in IIala Boma market which are ripped, any delays in selling these avocados would lead waste

Agent traders sitting by their avocado stalls in Temeke Stereo market

Figure 3.9: Selling go-alongs in Dar es Salaam markets (wholesale/retail)

Rejects avocados due to over-ripened or immature fruits. A trader buys at a very cheap price/no price from agents. She rescues the relatively good ones and re-sell them to juice makers and consumers

Researcher working with trader re-selling rejected avocados at Malbibo market

Inside view of Malbibo market in Dar es Salaam

Over-ripened avocados most of which would be sent to the waste site if the trader is not able to sell to juice makers.

Figure 3.10: Selling go-alongs in Dar es Salaam markets (wholesale/retail)

3.3.2.2 'Go-along' – Export avocado supply chain

The go-along approach in the context of the export avocado supply chain involved harvesting (n=12) and, grading and processing (n=4). These go-alongs allowed me to participate in and observe harvesting practices with various avocado growers (smallholders, large-scale, and commercial farmers). First, I accompanied two field officers[13] on harvesting trips for one week. This allowed for understanding the organisation of harvesting practices – planning of schedules, delivery of harvesting materials, initial sorting and grading and weighing at collection centres, rules, and norms about harvesting processes and reject sharing system. Besides shadowing the field officers, I spent two days with a commercial farmer, three days with the medium-scale farmer and three days with the smallholder out-growers on harvesting go-alongs (Figure 3.11). The processing and packaging go-along involved trips to two packhouses – one in the NH and one in the SH (Figure 3.12)

As with the other research methods, the discussion during the go-alongs was intended to be open while attending to key elements of harvesting, collecting, grading, and processing practice – understanding what has transpired (Spradley, 1979). I was interested in understanding how institutions, practices, and materiality intersects, and operates in the export supply chain.

3.3.2.3 Data gathering during go-alongs (farms, market spaces, packhouses)

The go-alongs were audio-recorded with participants' permission. The audio recordings were intended to provide a relatively unobtrusive record of events so that participants could proceed as naturally as possible. My decision to undertake the 'go-alongs' as a 'helper' - actively participating in activities (e.g., sorting, packaging, loading etc.) meant that participants continue their practices, as usual, to avoid making encounters less 'interview-like'.

Interview recordings were complemented by recording observations in field notes in situ and retrospectively - close to the events depending on the situation (Guest *et al*., 2013; Emerson *et al*., 2001). Due to the settings where the observations were done, I adopted Payne and Payne's (2011) suggestion of using a "temporary field note". In this temporary field note, I recorded short notes with clues and pointers to remember events, who was involved, what was observed, and what was said (Jorgensen, 2011b); this was later written/typeset in a full field journal.

[13] The field officers are like extension officers – employed by the export aggregator. They work with a network of avocado out-grower to provide them with advice and training in growing the export to using GlobalG.A.P good agricultural practices, carrying out internal audit for GlobalG.A.P certification scheme.

Researcher harvesting with smallholder farmer

Emptying avocados from harvesting pole into a crate

Farmer show researcher how to cut the stalk on avocado.

Field officer weighing avocados at collection centre as farmers look on

Researcher getting ready for harvesting (with harvesting bag) on a commercial farm

Researcher sorting and trimming the stalks on avocados on a commercial farm

Smallholder export avocado growers keenly inspect the recordings of their avocado's weights at collection centre. **Export avocado is considered as a cash crop therefore men a responsible for selling it.**

Figure 3.11: Harvesting go-alongs with smallholders and commercial export avocados growers

I also recorded my "experiences, feelings, and mood" in the field journal, as suggested by Coffey (2006, p.216). I also took photographs to help record events accurately (Jorgensen, 2011a;

Jorgensen, 2011b). The analytic orientation was towards a general understanding of aspects of harvesting, selling, and packaging practices rather than a detailed analysis of the temporally unfolding nature of these practices. For such a purpose, photographs were deemed sufficient. The go-alongs provided valuable data but were, in certain senses, a less successful research method than other interviews. I discuss these issues in the following section.

Processing line

Grading and packing line

Inside cold room

Computer monitor show processing output from the computerised packaging line

Researcher inside the pack house

processed avocados from smallholders out-growers (different packaging used for smallholders because they do not use any pesticides/chemicals in their production

Figure 3.12: Processing and packaging go-alongs in NH

The go-alongs provided several significant functions in the data collection. Firstly, it provided a deeper understanding of the domestic and export avocado production practices that lead to loss and waste generation. These, specifically, were the practices of risks avoidance strategies, reject sharing, and credit system and the broader webs of practice in which the avocado is harvested and sold. Secondly, the go-alongs operated (like an active interviewing strategy) as a 'jump off' point for further discussion about participants' growing, harvesting, selling, and trading practices. Thirdly, they provided valuable insights into the material environment and physical organisation of growing, harvesting, selling/buying, and trading practices. Lastly, they illuminated the existence of different 'modes' of institutional arrangements that underpins the selling/buying and trading relations in the two-production system. The go-longs notably contributed to the analysis presented in chapters 6 and 7.

While the go-alongs were intended to provide deeper insight into the lived experience of participants' practices, the participatory encounters require active listening as the main feature of collecting data and interactions that ensue in the setting (Kusenbach, 2003; DeWalt and DeWalt, 2011). Therefore, the researcher's command of the local language or dialect is vital for effective engagement in interpersonal communication. My limited fluency in the Kiswahili language (and no knowledge of the Chagga dialects) meant I could not fully engage in conversations which could have hampered gaining a deeper insight into the lived realities and unenacted practices. However, using an interpreter and adopting an 'informal interview style' helped to overcome some of the shortcomings. The use of interpreters in participatory observation is recommended (see Tonkin, 1984; DeWalt and DeWalt, 2011; Borchgrevink, 2003). Tonkin (1984) advised that depending on the nature of the topic, ethnographers (in this case, short duration ethnography) can use an interpreter and support this with a systematic recording of relevant material. I reflect on the challenges of using an interpreter in section 3.5.2.

Moreover, the repeated nature and the length of the go-alongs (a typical day of harvesting or selling trip lasted from morning until evening) allowed me to engage participants in conversations after an event or situation of interest. For instance, during harvesting, I used the time in-between – walking from one farm to another (sometimes 1-2km) to discuss issues that need further clarification. Notwithstanding, sometimes undertone conversations and switching from Swahili to the local Chagga dialect (the interpreter cannot fluently speak the Chagga dialect) between local brokers and farmers, notably during price negotiations, prevented me from fully assessing what transpired in the setting.

3.4 Data Analysis

This section discusses how data analysis was conducted. First, how the interview data was analysed is presented, followed by an explanation of the go-along participant observations.

3.4.1 Interviews

All interviews, including informal interviews/conversations during go-alongs and follow-ups, were audio-recorded and transcribed verbatim. The interview data were coded thematically using an inductive approach – in which themes were allowed to emerge through careful reading of data (Glasser, 1978; Charmaz, 2014) and a deductive (theory-driven) approach. NVivo 12 software was used in organising and coding of data. The coding was prefaced and accompanied by "careful reading and re-reading of data subconsciously, not just the coding system, but to develop connections that lead to flashes of insights" (Saldana, 2016, p.70; cf. DeWalt and DeWalt, 2011). Since the analytic interest was to understand the phenomenon of food loss and waste in agricultural production, the aim was to explore participants' actions/processes, perceptions and meanings found within the data. Therefore, descriptive, process and versus coding methods and categorising based on themes were adopted (Saldana, 2016).

The descriptive and process coding methods allowed an analytic lens that draws on multiple data (in this case, interview transcripts, field notes, documents, and photos) as a means of attuning to participants' perspectives and actions (Corbin and Strauss, 2015; Charmaz, 2002). Descriptive coding – sometimes called "topic coding" – helped to extract a word or short phrase from qualitative data as the topic to be talked about or written about (Wolcott, 1994; Saldana, 2003; Strauss, 1987, p.33). The descriptive approach also helped to document and analyse material products and physical environments (Hammersley and Atkinson, 2007, p.121-139), such as the interaction between the materiality of the avocado and the physical environment and practices. On the other hand, process coding helped identify observable/conceptual actions (e.g., price negotiation or harvesting) and psychological concepts such as "trust" in the trading relations and the implication for loss and waste production. (Willig, 2008, p.164; Saldana, 2016). As described by (Saldana, 2016), the versus coding method was used to capture actual and conceptual conflict within, among, and between participants to bring to bear the tensions and power issues (e.g., packers versus local brokers versus farmers; exporters versus farmers).

As with data-driven coding, emergent codes were identified through close, comparative reading of transcribed data. Through an iterative process, new codes were created as interview transcripts were read. The organisation of the codes assisted in creating order out of the messiness of qualitative data, clarifying ideas, and identifying patterns associated between groups of nodes (Bazeley and Jackson, 2019). The codes were then structured into broader themes and sub-themes; similar codes were subsumed/sub-codes or recoded to create themes and subthemes – into a hierarchy for nuanced analysis and conceptualisation (Saldana, 2016; Gibbs, 2007; Coffey and Atkinson, 1996). Data-driven codes that were generated include: 'butter for dogs', values (economic and non-economic value), marketability, pricing, 'it grows by itself', 'different plants', 'hard as stone', perishability, firmness, and buying/selling social relations that emerged, and which were of analytic relevance (for chapters 6, 7 and some sections of chapters 4 and 5).

In the deductive-driven coding, codes were developed regarding the relevant aspects of avocado growing (e.g., seed selection, planting, and agronomic practices), the influence of proximate practices (such as agroforestry), and the constitution of farming routines, harvesting, and grading practices. However, the inductive and deductive coding modes were not exclusively distinct; instead, they represent two different coding orientations that occurred side-by-side (Lincoln and Guba, 1985; Strauss, 2003). All transcribed material was coded, a point of saturation was reached when new codes ceased to emerge by continued analysis. Nonetheless, the analysis did not end at this point, but it was an iterative process that continued until all data was accounted for and throughout the writing stage.

3.4.2 Go-alongs (harvesting/collecting, selling, processing/packaging)

Go-alongs were audio-recorded, and the data was transcribed in its entirety and complemented with a detailed field journal that was typeset and imported into NVivo 12 for coding. Like the interview data, the coding of the go-along data was both inductive and deductive (Thomas, 2006). The data were analysed in relation to codes developed earlier, but new codes were generated where necessary. The go-along data was particularly helpful in developing codes (e.g., hard as stone, perishability, firmness). As part of the analysis, photographs supported emerging themes and brought further clarity. This agrees with the analytic approach that sought to trace a general understanding of harvesting, selling, and packaging practices and their relation constitution. The following section discusses the methodological considerations during fieldwork, including ethics and positionality.

3.5 Methodological considerations

3.5.1 Cross-language research

This research was conducted in two languages - English and Kiswahili, which required translation and the use of a research assistant (as interpreter). Most participants in this study did so exclusively using Kiswahili, while most key informants used English or a combination of the two languages. The use of interpreters and translation in cross-cultural or language research has methodological and epistemological implications for the research process and the participants (Temple and Young, 2004; Borchgrevink, 2003; Temple, 2002). The strategies employed to mitigate translation-related difficulties and the use of research assistant both practically and epistemologically are discussed below.

Some of the interviews were conducted in English; apart from two participants who were native English speakers, the rest of the participants provided accounts in their second language (English). This was not problematic, as in most cases, the participants could speak English fluently, with high command over language structure (Squires, 2009). Despite the participants' high level of English language skills, a few of the interviews lack nuance and detail in participants' accounts compared to other reports from this group of participants (Cortazzi *et al*., 2011).

To reduce these epistemological challenges, I adopted several strategies. During interviews, participants who struggled with an expression in English were encouraged to express them in Kiswahili, which I took note of, and checked certain words or phrases with my interpreter if needed. Cortazzi *et al*. (2011) argued that when participants are encouraged to use their first language, it reduces some of the challenges of expressive quality in second language interviews. Again, the face-to-face encounter between the participants and the researcher ensured a degree of understanding that could not have been captured by words alone. Thus meaning, as it were, was actively co-produced (Merriam and Tisdell, 2015; Welch and Piekkari, 2006). While this presented an analytic challenge, in that sometimes points were implied but not clearly and fully vocalised, the overall impact on the data quality was minimal.

3.5.2 The use of a research assistant/interpreter

Another translation-related issue was concerned with participants who provided accounts in Kiswahili, which required an interpreter. The use of an interpreter has positive and negative effects on the researcher and the fieldwork process, access to information, the communication process, and the translation itself. The present study's practical concern was selecting a locally based interpreter. Epistemological issues include the process of translation – interpreting, and explanation, which adds a further layer of interpretation to the data (Cortzza *et al.,* 2011). The interpreter's experience affects the quality of translation, which has consequences for coding and data analysis (Temple and Young, 2004). The interpreter was selected with the help of a gatekeeper. I trained the interpreter on research ethics, confidentiality, participant's consent, research information, critical concepts and phrases and the project aims. The training provided an opportunity for the interpreter to ask questions about the research (Borchgrevink, 2003).

Notwithstanding, the 'interpreter effect' can enable access and gaining information or close-up access and deny information and, in some cases, power relations (Borchgrevink, 2003). In this study, the interpreter was positioned (as a research assistant) as visible, engaged, and active in the research process (Wong and Poon, 2010; Higginbottom and Serrant-Green, 2005; Temple and Edwards, 2002; Temple, 2002). She was responsible for making appointments and following up on issues. By building friendships and working closely with the interpreter over a period in a non-hierarchical way, the interpreter was a valuable source of information and discussion partner which greatly enhanced data collection (Kosny *et al.,* 2014). Besides, working with an interpreter provided companionship to me as a researcher in a place I considered 'distant home' (Borchgrevink, 2003).

3.5.3 Positionality: the spaces in-between

In qualitative research, reflexivity of the researcher's influence on the whole research process is encouraged (Mason, 2002; Clifford and Marcus, 1986; Geertz, 1983). As a Ghanaian-British researcher researching in Tanzania (East Africa), I am an outsider - in cross-cultural research, with no "lived" or "embodied" cultural knowledge (Labree, 2002). At the same time, my ethnicity – as African descent, positioned me as being in a 'distant home' – kind of an insider (Giwa, 2015). As Adamson and Dovonan (2002, p.816) observe, ethnicity is "practically impossible to define" – its meaning encompasses the aspect of skin colour, place of birth, culture, language, food preferences, behaviour, among others. I was neither insider nor outsider. Being either of them to the research

community has inherent methodological benefits and liabilities related to the researcher's self, their situated knowledge, and their location in the social order (Banks, 1998).

Instead of considering myself as an 'outsider', which usually overlooks the fluidity that context, rapport, and trust provide in the blurring inside/outside dichotomy (Mulling, 1999; Dwyer and Buckle, 2009), I embraced the diversity of positionality as put forward by Smith (2006). Smith argues for the dynamism of positionalities in time and space on the insider/outsider duality (ibid). Therefore, in my interaction and encounters with research participants, I looked for "positional spaces" (Mulling, 1999, p.340) or "the space between" (Dwyer and Buckle, 2009, p.60). As argued by Mulling, the "positional spaces" – are areas where the situated knowledge of both the researcher and researched in the interview encounter engender a level of trust and cooperation, which ensures data collection that faithfully represents the real world (ibid). My multiple selves and sub-identities (Male, African, Ghanaian, British, a son of a smallholder farmer, experience of living in a rural African context)[14] were relevant in negotiating access, building rapport, trust, and encounters with the research participants. Therefore, I duly acknowledge the politics of identity and multiple sub-identities that arise from the influence of my position as a researcher. I approached the field with different sub-identities and projected different sub-identities based on the situation and the location (Valentine, 2007) to take advantage of the positional spaces (Mullings, 1999) between the insider/outsider dichotomy (Dwyer and Buckle, 2009).

For instance, when I accompanied smallholder farmers and traders on harvesting and selling go-alongs sharing my lived experience in the rural farming community in Ghana facilitated easy acceptance and access to information (Alder and Alder, 1987). Despite the commonality with smallholders/traders through our lived experience, my privileged status as highly educated and studying in a Western institution, and the presence of an interpreter in the setting constantly reinforced our differences. This left us in an in-between space or positional space that challenged the binary of insider versus outsider status (Dwyer and Buckle, 2009; Mulling, 2009). Besides, the occasional demand for the right to be 'here' (when interviewing key stakeholders/informants), which must be evidenced by a research permit (from different levels of government), disempowered me as a researcher, which challenges the Western notion and expectation of power relations in researching in the global South (Giwa, 2015). This reiterates the fluidity of my positionality as constantly shifting between outsider and insider, which in effect was positive for the research process.

[14] I am conscious of my potential capacity as a 'research subject' and the potential prejudices and subjectivities that might bring to the research.

5.3.4 Ethical considerations

The research was given ethical approval by the University of Sheffield ethics committee (Appendix 3.2) and research clearance from the Tanzania government through COSTECH. All interviews and go-along observations were conducted with participants' informed consent. Due to the low level of literacy among research participants (smallholders and traders) in the context of rural Tanzania, verbal consent was deemed the most appropriate. Also, a written consent was viewed as an intrusive exercise of power and counterproductive in establishing relationships of trust with research participants in this context. In the case of verbal consent, the interpreter read out the information sheet, consent form, and all the processes required in Kiswahili to the participants and the verbal consent was then captured in audio recordings.

However, even among highly educated informants, including farmers, some declined to sign a consent form and preferred verbal consent. On the other hand, signing the consent form provided the needed assurance for participation for some key informants. In all circumstances, participants were offered the option of both written and verbal consent. Thus, gaining consent in this research was not a blanket process; each participant's situation was different and assessed for the appropriate process.

By way of the process, the participant information sheet and consent forms (see Appendix 3.3 and 3.4) were translated into Kiswahili; this helped overcome some of the barriers to consent. All data provided by participants were treated confidentially. Participants' names in all interview transcripts and field journals have been replaced with pseudonyms[15]to protect participants' identities and confidentiality. All identifying information was also changed when there was a risk that data could reveal facts about the participant in analysis, dissemination, publication, or future data reuse. However, given the nature of the export supply chain, it was difficult to guarantee complete anonymity in the case of exporters and buyers, particularly in the northern highlands, where there was only one exporter in the study area.

[15] To facilitate easy reading of text, all quoted extracts have been given a code next to the person's fictional name in case of the supply chain, their role

3.6 Chapter summary

This chapter discussed the methodological approach and research methods applied to address the research objectives and introduced the multi-sites selected for this study. Based on a constructivist-interpretive ontological stance, this study used a qualitative case study research design embedded with 'following the thing', whereby two diverse avocado production systems were selected to generate insights on food loss and waste in an agricultural production system. The study employed a qualitative approach for data collection (semi-structured interviews, key formants interviews, informal interviews, go-along ethnographic participant observation, documents, and field journal). The qualitative data analysis involved translation, transcription, and coding/analysing the data based on existing and emerging themes and sub-themes. The following empirical chapters (4-7) use the data collected and theoretical insights from the literature review to address the research objectives set in chapter 1.

Chapter 4

"Two avocados," one country: Development of Tanzania's Avocado Industry.

4.1 Introduction

This chapter situates the research in the broader global production and consumption of avocado. It reviews the rising global importance of avocados as a "superfood" to provide context for this research, which focuses on avocado production and waste in Tanzania. While few studies have researched avocado production in Tanzania, there is a narrow focus on how the industry has developed and its implications for food loss and waste. This chapter draws on in-depth interviews and secondary data to provide a historical account of the introduction of avocado growing in Tanzania. It examines the historical, economic, and political context to highlight how Tanzania's two different avocado production systems and supply chains (domestic and export chains with different varieties) have evolved and developed. The findings illuminate the cultural acceptance and framing of avocado as 'food - butter for dogs,' especially among the Chagga tribe in the Kilimanjaro, and how increased awareness has changed perceptions about avocado as food - particularly among men. The findings also bring to the fore the critical role of missionaries, colonisation, and to a greater extent, how coffee production is linked to the development of avocado production systems in Tanzania. The history, cultural, political, and socio-economic context and globalisation of avocado provide a critical understanding of the drivers underlying the increased growth in avocado production and the implications for food losses and waste production.

This chapter first discusses the rising importance of avocado as food – its early discovery and dissemination. It then examines the development of Tanzania's avocado industry by highlighting the timelines, the historical and socio-economic, and political context of how different varieties of avocados were introduced and the motivations for its adoption by farmers (4.2.1). Within this context, the chapter explores the cultural framing and acceptance of avocado as "food," particularly among the Chagga tribe of Kilimanjaro (4.2.2.1). The globalisation of avocado as a superfood and its impacts on current global production and trade trends are discussed, focusing on the export of fresh avocados (4.2.3). The chapter then situates avocado production levels in Tanzania – (export avocado) in the context of the broader globalisation of avocado trade and consumption (4.2.4).

Sections 4.3 and 4.4 broadly focuses on domestic and export supply chains structures to highlight the key actors involved and critical challenges facing the production systems. Finally, the chapter concludes with a summary of how comparing domestic and export supply chains allow for an in-depth exploration of how materiality, institutions, and practices intersect to produce waste and inequalities in the avocado production systems in Tanzania. It then set out the key issues to be examined in the remaining empirical chapters of the thesis.

4.2 The globalisation of avocado as a food

4.2.1 Early discovery and dissemination.

In the Kiswahili language, the avocado is called *Parachichi* (single fruit), *Maparachichi* (plural), and the avocado tree *Mti wa parachichi*. The avocado (*Persea americana* Mill.) is often referred to as the most nutritious of all fruits (Purseglove, 1968). It is currently marketed and promoted as '*The fruit for life'* by World Avocado Organisation (WAO, 2021)[16]. The origin of the avocado stretches over a large region covering geographical areas of Mexico, Guatemala and the Pacific coast of Central America, and the West Indies – see Figure 4.1 (Knight, 2002; see also Storey *et al*., 1986; Popenoe, 1920). Botanically, the avocado is classified into three ecologically distinct varieties (the Mexican (M), Guatemalan (G), and the West Indian (WI)) based on their ecological adaptation, origin, tree characteristics, flavour, and nutrients, water, and oil contents (Yahia and Woolf, 2011; Knight, 2002; Biale and Young, 1971).

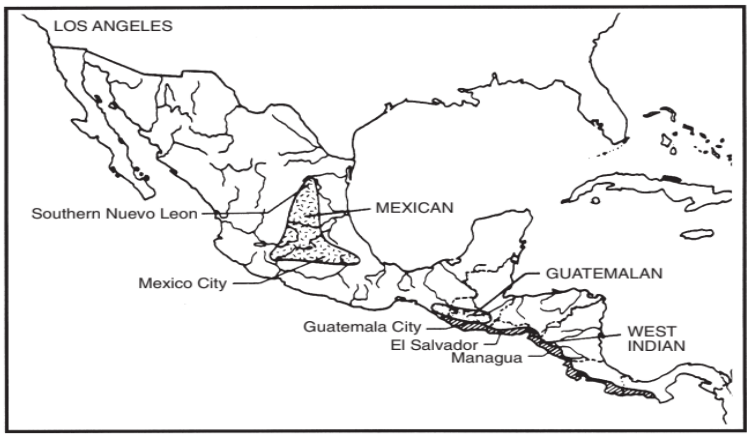


Figure 4.1: Geographical origin of avocado varieties. *Source: Adapted from Storey et al. (1986)*

[16] WAO was formed in 2016 as multinational nonforprofit organization to represent the interest of major world avocado producers, exporters and importers. Zimbabwe and Tanzania joined WAO in 2017, strengthening the organization's footprint in Africa as South Africa is already a founding member. Available. https://avocadofruitoflife.com/wp-content/uploads/2020/06/wao-bm.pdf

The early discovery and human consumption of avocados dates 10,000 years ago in Mexico through the Mayan and Aztec civilisations.

In Africa, avocado cultivation was first reported in 1780, in Mauritius (Juma *et al*., 2019), and in the Islands of Zanzibar (Tanzania) in 1892 (Royal Botanic Gardens - Kew, 1892) and in the 1890s in mainland Tanzania. In South Africa, the avocado was introduced around 1904, and by the 1930s, the first commercial orchard was established (Toerien *et al*., 1992). In Kenya, different varieties of avocado were introduced in the 1930s by a Portuguese farmer (Griesbach, 2005;1985; 1984). However, a 'phenomenal rise in avocado production in many parts of the world where it was not a traditional crop occurred between 1933 and 1998, when 179 avocado germplasm were distributed to over 163 recipients across the continents of the world (Knight, 2002, p.5)[17].

Although FAO (2004) have documented that over 500 different avocado varieties exist, most have discarded - no longer cultivated to create varieties that are adaptable to commercial production. The most economically significant commercial varieties include the Hass (hybrid of G/G x M), Fuerte (hybrid of M x G), Ettinger (M), and Pinkerton (hybrid of G x M), with the Hass being the most preferred for export because of its resilience to withstand transport conditions (Yahia and Woolf, 2011). Todays' most technologically advanced avocado industries consist of hybridisation between the Mexican and the Guatemalan varieties (Knight, 2002; Wolstenholme, 2003).

4.2.2 Early dissemination and development of Tanzania's avocado industry.

4.2.2.1 Adoption of local avocados: Socio-economic and political context.

Lynch (1999, p.177) underscored the importance of analysing the local ecological and locational issues and broader economic and political factors to understand the activities of fruits and vegetable producers. He argues that certain aspects of production such the choice of variety and management practices are influenced by external economic issues and by local historical or environmental considerations. In the context of this research, understanding the broader socio-cultural, economic, ecological, and political dimensions that influenced the adoption of avocado production in Tanzania is critical to illuminate crop management practices and the choice of varieties.

[17] Knight 2002 noted that not all location for the 179 gemplasm (a single distribution consisted of one or more units of germplasm i.e., cultivars or seeds) distributions destination is known. However, there are records of the 163 recipients: Florida, 35; California, 15; the rest of the USA, 21; Central America and the Caribbean, 23; Asia, 23; Africa, 22; South America, 14; Seychelles, 4; Europe, 3; Australia, 1; Fiji, 1.

The significant variations in Tanzania's climates, topography, and soils offer a diversity of agro-ecological zones that support the growth of different cultivars of avocados (Juma *et al.,* 2021; Juma *et al.,* 2019; Field Journal, 2018; Mwakalinga, 2014). The introduction of avocado in Mainland Tanzania is linked to the works of German missionaries in the late 19th century (the 1890s in Kilimanjaro and Mbeya regions, Field Journal, 2018)[18] as many missionaries and settlers established themselves in various parts of Tanzania "incentivised by cheap land" (Coulson, 2013; Glenk, 2011, p.28). Elsewhere (in Spain, Philippians among others), records shows that Catholic priests played important role in the introduction of avocados outside their indigenous origin (Sauer, 2017; Knight, 2002; Sotto, 2000). In Figure 4.3, I delineate a plausible timeline of Tanzania's avocado industry development – from its early adoption to the development of domestic and export avocado supply chains. I draw on the extensive work by Munson (2013) on 'The Nature of Christianity in Northern Tanzania', Glenk (2011), Paul Fleisch (1998), and oral account by research participants to delineate the early introduction and adoption of avocados.

4.2.2.1.1 Mission stations/gardens, coffee plantations and spread of avocados

In the NH (Kilimanjaro, Arusha regions), the Catholic missionaries established a mission station (*Windthorst*) in Kilema (East Kilimanjaro) in 1890 (Figure 4.3). According to Munson (2013), the mission in Kilema planted a garden with many European vegetables. It introduced Arabica coffee - which they had earlier introduced in Bagamoyo from the Reunion and [possibly] avocados [from their earlier settlement in Zanzibar][19] – see Figure 4.3. As the Catholic mission expanded from East Kilimanjaro to the southern slopes of Mt Kilimanjaro in Rombo Mkuu, more stations were built, and new crops, including avocado, were introduced to the indigenes. For example, Munson (2013, p.39) reported that a German military station in Marangu (established in 1891) had four hectares garden planted with seeds (exotic fruits and vegetables) from the Catholic mission in Kilema (6km south of Marangu). Not only did the Catholic missions help with the spread of avocados through their mission stations, but also the Leipzig missions (the *Evangelische –Lutherische Mission*) who first established Ashira station (in 1894) on 20 hectares of land and later founded other stations which had gardens planted with exotic fruits (including avocados) and vegetables (Munson, 2013;

[18] The congregation of Holy Ghost Fathers and the Spotless Heart of Mary (*Kongrgation der Vater vom heiligen Geist und unbefleckten)* who called themselves Spiritans are Roman Catholics Religious Congregation founded in 1703 who are dedicated the work of evangelism in remote places across the world.

[19] The earliest form of the presence of avocados outside the mainland Tanzania was recorded in 1892 by Sir John Kirk on the Islands of Zanzibar and Pemba (a British protectorate in 1890) (Royal Botanic Gardens – Kew, 1892). Sir John Kirk, in his compilation, noted that "the Avocado pear (*Persea gratissima*) grew well and was introduced on the Islands later compared to Mango [*Manifera indica, L.]* which had been introduced earlier by the Arabs and much older trees exist" (Royal Botanic Gardens – Kew, 1892, p.89). Munson (2013) indicated that the "Spiritan" (Society of Roman Catholic Fathers – Catholic Missions) landed in Zanzibar in 1859 and by 1867 had opened up a mission station in Bagamoyo - on the mainland. Bagamoyo later became the capital of German East Africa from 8185 -1895.

Glenk, 2011; Fleisch, 1998). Figure 4.2 shows significant towns where the missionary stations were founded in the Kilimanjaro region, areas that have become critical avocado production zones (different varieties of avocado thrives in areas 1000 – 2500 metres above sea level).

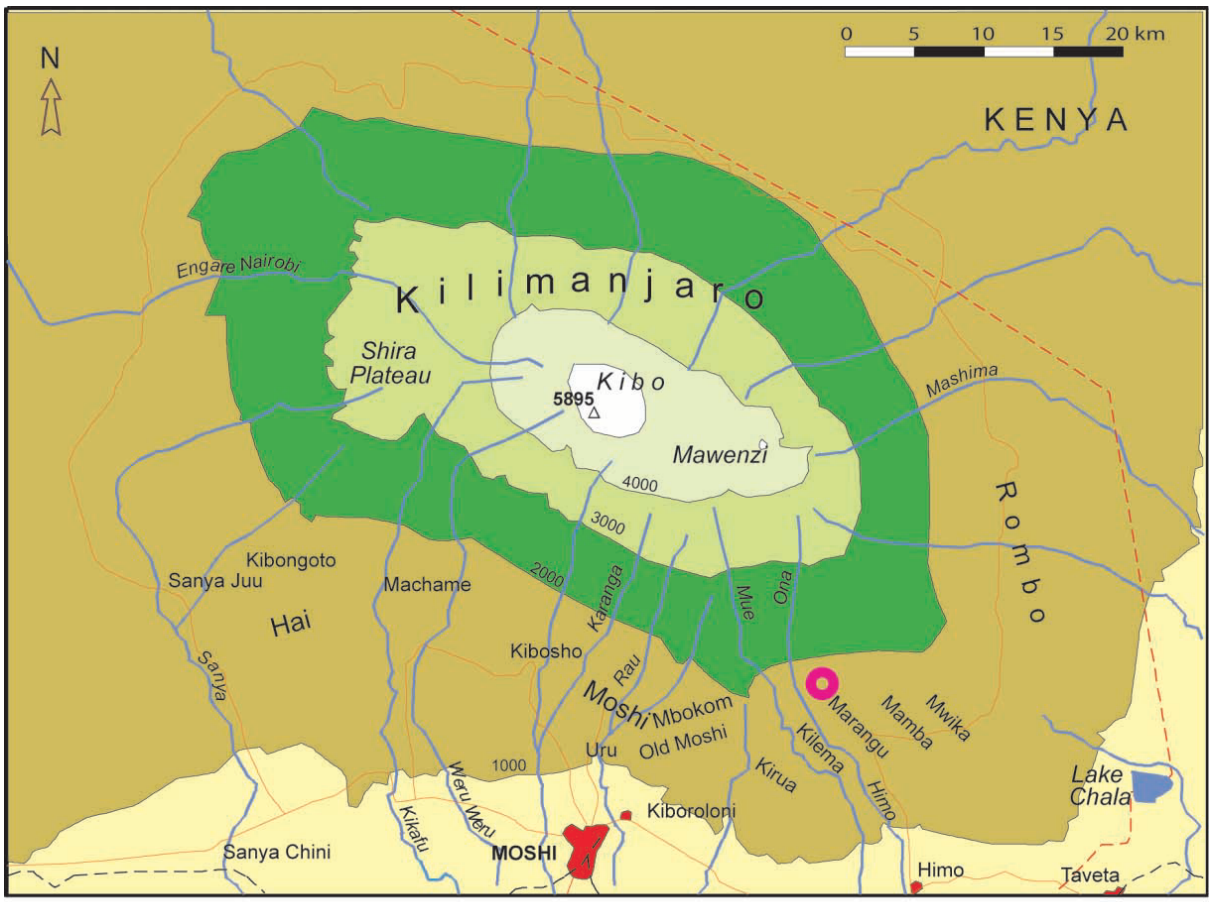


Figure 4.2 :Map of Mountain Kilimanjaro showing avocado growing areas and mission stations

Source: adapted from Tagseth (2008a)

In East Kilimanjaro, the missionary stations in Kileman, Ashira, Marangu quickly developed into a cluster of European settlements with farms and shops. Munson (ibid) reported that by 1906 there were six European settlers (five Italians and a Greek) engaged in farming and commerce. Interviews with farmers in Kileuo village, in Kirua Vunjo Ward near Kilema, confirmed that the avocado was first planted by a European farmer (Greek settler) who introduced coffee to the village:

> *"Unfortunately, I did not grow up to meet my grandfather, but my father told me that a certain European, a Greek, introduced coffee in this area. His farm is not very far from here, about 1.5 km. He started growing coffee on his farm and had some Mediterranean fruits…. including peaches, pears and papaya, and avocado, but the avocado was the primary fruit in his orchard. That place is called 'Kwa Muzungu'.... up to this moment. That is where the avocados originated in this area of Kilimanjaro. And,*

for sure, they were moved from this place to other parts of Kilimanjaro" (Male, late 60s, farmer and a director of local NGO-KEDA; PTK_LF_0140).

In West Kilimanjaro, the Leipzig Mission[20] was the first to establish mission station in Machame, in 1893 and expanded to Sango (between Siha and Samake) and Masama (Fleisch, 1998; Munson, 2013). Farmers interviewed in the Siha district recall that the Leipzig Mission introduced avocados. The quote below from a 90-year-old farmer from Samake Maini village confirm the role of the missionaries in the spread of avocados:

> *"Here at Kilimanjaro, the way I know avocados and mangoes, the Germans brought them. When they came here to our village, they brought the seeds because they were missionaries. In this village, there was a bishop (Askofu) from Germany. He was buried here [..], just over there are German graves" [Male, Farmer, Aged 90; PTK_LF_0025]*

The competition between the Catholic Missions and the Leipzig Missions to claim more areas along the slopes of Mt Kilimanjaro and Mt Meru resulted in the gradual spread of avocados in villages along the slopes of Mountains where Mission stations and gardens were established (Munson, 2013; Fleisch, 1998).

From Figure 4.3, the Moravian missions who settled on the slopes of Mount Rungwe (in Rungwe district) above the present-day Ilolo village in 1891 introduced the avocado in the SH[21]. This was indicated during interviews with farmers in Ilolo village and other villages in Rungwe district:

> *Avocado farming started many years ago before I was born when my mother was in middle school. The European missionaries introduced it at the Lutengano mission[22] . Slowly, people started taking the seeds and planting them on their farms, mainly for food…, so there were avocado trees in every household, but few - 2 or 3 trees. As years went on, they started selling avocados in Kiwira, then Mbeya, Iringa, Dar es salaam and other places, but still it was not a big business [Male, smallholder farmer, 75 years old, PTSH_EF_0210]*

[20] The Leipzig missions in December 1892 acquired the right to the CMS's former station at Kitimbirihu. However, on their arrival, the Kitimbirihu station had been burnt down by the chief of Moshi and they moved to West of Kilimanjaro and established a station in Machame. See also British Library : Endangered Archive programme 'Collecting and preserving the records of the Evangelical Lutheran Church of Tanzania in Moshi, Tanzania (EAP099) https://eap.bl.uk/project/EAP099, accessed 06 Mar 2020

[21] The Rungwe Archie and Musem Center. History of the Moravian Mission and the Moravian Church in Tanzania. Available https://www.rungwe.org/?page_id=100. Accessed, Mar 9, 2020.

[22] Lutengano mission is among the two missions (Lutengano and Ipyana) which was established in 1894 by Morvian missionaries in Rungwe District, after the first mission station was established 1891. Source: Godfred Mwakikagile (2018). Africa in Transition: Witness to Change, New African press, Dar es Salam.

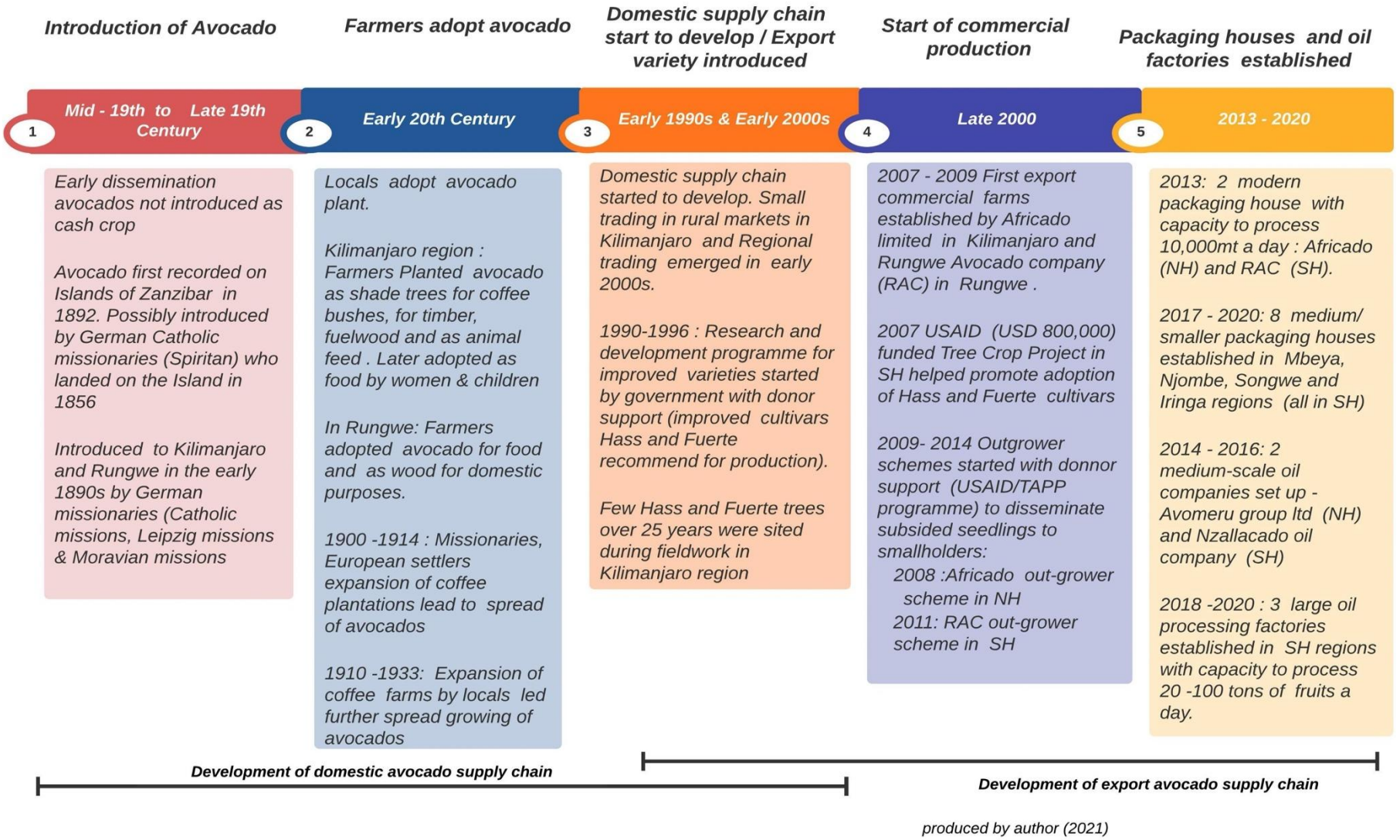


Figure 4.3: Timeline: Development of Tanzania avocado industry. *Source: interviews and secondary data*

From the interviews with farmers and documentary records of the activities of the missionaries in Tanzania, the missions' stations and their gardens played a vital role in propagating avocados and hundreds of exotic plants - "new green immigrants" brought into the country during German rule (Munson, 2013). As the Christian culture spread, so did these "new green immigrants" - the locals employed on the mission and settlers' farms took back experiences with new crops and techniques to their villages (Munson, 2013, p.265).

4.2.2.1.2 Coffee plantations and local avocado production

By the early 20th century, the locals had accepted the avocado, and there was a rapid expansion of its adoption among farmers due to the growth of coffee production (Figure 4.3). Coffee (*Coffea arabica*), first introduced at Kilema station in 1891, showed signs of good production. Therefore, many mission stations and European settlers established large coffee plantations as a primary cash crop (Munson, 2013; Danker, 2002; Iliffe, 1979). Due to its economic significance, local elite (chiefs, akidas and other nobles) and ordinary Tanzania's were supported by colonial administrators (the Germans and later the British) to start large coffee plantations (Iliffe, 1979; cf. Coulson, 2013, p.203). Coulson (2013) reported that by 1933, about six million Tanzania farmers owned coffee bushes, and about a third of all families living on the slopes of Mount Kilimanjaro was growing coffee. The avocado was planted to serve as windbreaks, and to provide shade for coffee bushes. The rapid expansion of coffee plantations and smallholder coffee farming facilitated the adoption of avocados in many parts of Kilimanjaro, Meru, and Arusha. Interviews with farmers in the Kilimanjaro region revealed that farmers' motivations for adopting the avocado were to provide shade for coffee bushes, animal feed (fruits & folder), fuelwood, and timber, as expressed in the quotes below:

> *[...] people used to have just 2-3 avocado trees on their farm to provide shadow [shade] for the coffee trees. It wasn't for the fruits, really; it was only to shadow the coffee trees. The tree was mainly used for timber by the farmers; […] the children will eat the fruits, the rest of the fruits…they give them to the cows and those who have got pigs, use it as pig feed [Female, aged 75, retired educationist/farmer, PTK_EF_0105]*

> *[…]. When the avocado tree is tall like this one, you see this one [the farmer points to avocado tree] is a good timber. I will try to cut the branches, but I do not want to lose it. Timber from an avocado tree was very lucrative in the olden days [Male, aged 70, retired veterinary officer/farmer; PTK_ELF_0101]*

As evidenced in the farmers' narratives above, in Ethiopia's Southern Highlands, smallholders grow avocados "as an integral component of the coffee and enset-based agroforestry systems" (Biazin *et al*., 2018, p. 127; Megersa and Alemu, 2013; Shumeta 2010). According to Scora *et al*. (2002, p.18), the West Indian and Mexican avocado varieties grow very tall (can reach 30 meters high, have very thick tree diameter and broad canopies) and are usually planted as shade trees in

coffee plantations. Biazin *et al*. (2018), in their study of local avocado (non-grafted) productivity in Sidama, Southern Ethiopia, reported a mean height of 17.57 meters for mature avocado trees (21-25 years old) under coffee-based agroforestry system, with some trees reaching 35 meters (ibid).

The farmers' narratives also collaborate with Munson's (2013) account, which indicates that the Chaggas of Kilimanjaro in the late 19th century cultivated new trees for - timber and wood for domestic uses (fuelwood and making farm implements – See Figure 4.4). Similar to what has been reported among Ethiopian smallholder farmers (Kahuranga *et al*., 1993). Access to fuelwood is still essential today in many rural villages where there is lack of access to portable cooking equipment. As one older participant (Male) commented during the conversation: "if you want to punish a woman, do not provide her with firewood" (Field Journal, July 2019). While this quote is quite 'uncomfortable' to read, it is reflection of the gender dynamics and gender roles in typical rural African context where women are responsible for provisioning of food for their families which is well documented in literature.

Importantly, Chagga farmers in avocado growing zones keep their animals in stables; therefore, the avocado tree provided the needed fodder/feed (fruits). To meet these needs, most farmers gradually replaced *masale* or *dracaena afromontana,* which was "used to mark their homestead's boundaries and to provide supernatural powers", with avocados (Munson, 2013, p.10; Rugalema *et al*., 1994) (see Figure 4.5). Biazin *et al*. (2018) found that in southern Ethiopia, besides avocado trees being part of coffee and enset agroforestry systems, individual avocado trees were grown around the courtyards to provide shade for people and livestock (see also Kahuranga *et al*., 1993). However, unlike the Chagga farmers in Kilimanjaro, whose initial motivations for growing avocados was for its non-fruit values. In Ethiopia, smallholders planted the avocado tree as an essential shade tree as well as for benefits from the sale of the fruits (Megersa and Alemu, 2013; Kahuranga *et al*., 1993; Shumeta 2010).

The avocado varieties that were introduced thrived because they were grown from the seed and required little or no technology in production (Scora *et al*., 2002) (see chapter 5). Most avocado production in tropical lowlands and temperate regions in Sub-Sharan Africa (SSA) and those grown as part of coffee-based agroforestry system are grown from seeds (non-grafted) and therefore grow tall (Biazin *et al*., 2018; Shumeta 2010; Gabrisch, 2005; Sotto, 2000). In Tanzania, these varieties

have become known as "*the local avocado - parachichi ya Kienyigi*[23]*" or domestic avocado* (Field Journal, 2018). However, what is considered "local" was not local to the Tanzania agricultural landscape. But, as a "new green immigrant," it has endured and become part of the agrarian landscape. Table 4.1 summarises the different varieties of avocados grown in Tanzania

Figure 4.4:Domestic avocado tree in the middle of a farm

[23] Their big fruit sizes, distinct flavours, palatability, and creaminess make these varieties the preferred choice for the domestic market as the fruit became widely accepted among Tanzanians.

Domestic avocado trees planted along boundary of farm purposely to provide folder (image show harvested leaves)– Rombo district

Harvested avocado leaves for folder in village in Kilema

Domestic avocado trees planted along boundary of farm and a pathway in village in Rombo district purposely for fodder for livestock

Figure 4.5: Domestic avocado trees planted to mark boundaries and to provide folder

Recent studies by Juma *et al*. (2021), Juma (2021), and Juma *et al*. (2020a; 2020b) on the morphological traits of avocados grown in in the SH [24] reported that the "local avocados" consist of cultivars from the three main avocado germplasm (Guatemalan, West Indian and Mexican) and hybrid crosses of these three germplasm (Table 4.1). The Hass cultivar is the main export variety grown, although Fuerte, Carmen, Ryan, Pinkerton, and Gwen cultivars are produced on a smaller scale (Table 4.1).

Table 4.1: Popular local and export avaocado varieties grown in Tanzania

Local cultivars ***(Parachichi ya Kienyeji)***	**Varieties (germplasm)***	**Export Cultivars** ***(Parachichi ya Kisasa)***	**Varieties (germplasm)***
Reed	G	Hass (main variety grown)	G/GxM
Tonnage	G	Carmen - Hass^	G/GxM
Nabal	G	Fuerte^	MxG
Ettinger	M	Ryan^	MxG
Pinkerton	GxM	Pinkerton^	GxM
Zutano	MxG	Gem^	MxG
X-iKulu	G		
Puebla	M		
Simmonds	WI		
Booth 7	GxWI		
G5 & G6	M		

Source: Interviews. Categorisation of varieties/germplasm from Hurtado-Fernandez *et al*. (2018).

Note* *Guatemala = G; Mexican = M; West Indian = WI. ^These varieties are grown in smaller quantities compared to the Hass variety. Fuerte is grown by a small number of smallholders in SH. Carmen-Hass and Gem varieties are grown in the NH by two large commercial producers (124 hectares) under special licence from Westfalia fruit. Ryan and Pinkerton are grown in the NH by one commercial producer for export (7.3 hectares)*

4.2.2.2 Being food: "How butter for dogs became butter for the nation."

As indicated in Figure 4.3, when the Chagga's first adopted the avocado, it was not considered 'food.' As Knight (2002, p.3) has observed, "the acceptance of avocado as food by local people and the success of its introduction varied around the world where it was introduced." Among the Chagga's in Northern Tanzania, many participants referred to the avocado as "*Siagi ya parachichi kwa ajili ya mbwa,"* which translate to ***"avocado is butter for dogs."***[25] This was succinctly expressed by a 75-year-old woman (retired educationist) as she shared her experiences of how avocado was used in the past compared to the present:

[24] Recent studies focused on morphological traits analysis and germplasm diversity of the avocado varieties in the SH of Tanzania concluded that "the population structure of the analysed avocado trees comprised of four genetic clusters that might represent the variety origin of three the germplasm (Mexican, Guatemalan, and West Indian) (Juma et al., 2021, p.18; Juma, 2020; Juma et al., 2020a; Juma et al., 2020b).

25 In the olden days, every farmer had a haunting dog, and because the dogs were starved from the meat they hunted, the avocados were their best food (interview conservation with farmer and leader of local NGO).

*[..] It is only these days that people are eating avocados. The Chaggas' used to say that it is '**only food for the dogs.'** Because the Chagga's were not used to eating avocados, it is only these days that avocado has become **a very special fruit**. Those days, only the children used to eat avocados, but the grown-ups, who is going to eat avocados! The importance of avocados was not known then, so people did not use [eat] avocados. The fruits just used to drop to the ground; you pick them and eat. **Nobody used to sell them; who is going to buy avocados?** Because they say it is food for the dogs, even up-till now, these avocados fall, and the dogs eat them. The **people who used to eat them are the children**, but the grown-ups, very few**. It was not a favourite fruit** for the adult […] the children will eat the fruits, the rest of the fruits they give them to the cows and those who have pigs, use it as pig feed [Female farmer, PTK_EF_0105]*

The avocado was considered "Whiteman's food, not for the African, it was alien to our diets" [Male farmer, PTK_DF_0141]. Interestingly, the quote above revealed the gendered nature of avocado consumption and social structures that shape food practices. Past family dinner time practices also shaped the gendered nature of avocado consumption. The excerpt below shows how family dinner times in the past and present, coupled with increased awareness, have shaped avocado consumption. As explained below by a retired veterinary officer and a farmer sharing his experience of how avocado was consumed in the past:

[...] *"In the last 20 years, people have changed due to education. Here in Kilimanjaro, it is primarily due to education because many people are going to school. Several people like us have known the benefit of eating avocados. We have been meeting different people and educating them about avocados. For [the] women eating avocado was not a problem; they ate everything. But men or the fathers, hmmm they do not, after tasting it they drop it. For example, when the men come home, the children will say, father, this avocado is a good thing; here it is! After tasting it, he will say, ah, what is this taste? When we come to the table for dinner, the fathers are not there because your father is spending time with other people [...]. Nowadays, you find people [families], father, mother, and children coming to the table together. Before, it was just the mother and children; the mother would cut a piece of avocado, other fruits [orange] and vegetables, and give it to the children. That is why we [children] became accustomed to the fruit. But the father himself, no!" [Male, retired vet officer and farmer; PTK_ELF_0101].*

However, its acceptance was gradual among men – male children who were introduced to avocado consumption later became advocates and promoters of the benefits of the fruit. Even when the avocado was accepted into the diet of Chagga people, it was considered a poor man's food[26]. As with the history of beans, the avocado was for those who could not afford meat (Albala, 2017). In many tropical lowland regions of the world, avocado has historically been consumed mainly by poor people (Cowan and Wolstenholme, 2003). Now, in Kilimanjaro and Tanzania, the avocado is consumed by all generations and gender due to increased education and awareness of its nutritional value:

[26] While in the NH (among Chagga's), the acceptance of avocado was gradual; the story is different in the SH. Farmers in the Rungwe district reported that the locals readily adopted the avocado as food when Moravian Missionaries introduced it

*[..] "But, these days, even the **adults** demand these avocados when they are eating, they ask whether you have ripe avocado there, give me eh. Even my **husband** is asking for avocados. If you tell the **men, I** am going to the market; they tell you don't forget to bring avocados. If you come from the market, they ask, did you bring avocados. **Everybody** is eating avocado because of the changes in knowledge, from the old to the new generation. Right now, it is catching up, the avocado thing" [Female, retired educationist/farmer; PTK_EF_0105].*

In the next section, I discuss the socio-economic and political context that led to the introduction and adoption of the export avocado variety in Tanzania's agrarian space.

4.2.2.3 Adoption of export avocado: Socio-economic and political context

The development of export-oriented avocado production in Tanzania has been slow (since the crop was introduced over a century ago), albeit with some progress in the last decade (section 4.2.4). This was because avocado was not regarded as a cash crop like coffee, tea, cashew, and others, which received government attention with significant research and support during the colonial period and after independence (Coulson, 2013; Bryceson, 1988; Lofchie, 1978). From Figure 4.3, the first attempt to introduce commercial export varieties was in the early 1990s with donor support (Mwakalinga, 2014)[27]. About 16 cultivars of germplasm were imported from Israel and the USA for trials within this programme. The Hass and Fuerte varieties showed promise of good production and were recommended for dissemination (ibid). However, uptake of the new varieties in the NH never happened as farmers and consumers did not like them (Mwakalinga, 2014)[28]. Nonetheless, in the SH, there was a moderate success – about 9,000 Fuerte and Hass seedlings were distributed to farmers in selected villages but mainly for subsistence production (Mwakalinga, 2014).

Commercial avocado production started in 2007 with significant private sector investments backed with considerable donor support to get smallholder farmers involved. The start of the commercial avocado production can be attributed to: lower coffee prices in the late 1990s, increasing global demand for avocados (in the global North, section 4.2.3), and shift in government agricultural policy to attract private sector investment in export-oriented commercial farming (primary policy like ASDP I & II and programmes such as *Kilimo Kwanza* and SAGCOT). Lower coffee prices

[27] In the early 1990s the Ministry of Agriculture – Department of Horticulture development with donor support from The Government of Netherlands and DANIDA provided the support for the programme in Northern and Southern Highlands, aim was to improve avocado productivity and preserve the germplasm. This research activities were undertaken by Tengeru Horticulture Training institute in Northern Highlands (Arusha) and Uyole Agricultural Research Institute and Sokoine University of Agricultural college in the Southern Highlands. Investment in research activities ceased when the DANIDA and The Government of Netherlands backed programme ended in 1996.

[28] During fieldwork in the Kilimanjaro region in 2018, a few trees of Hass and Fuerte varieties which are over 25 years old were spotted on some farms. Due to a lack of market, fruits were mostly used to feed animals and for home consumption (Field Journal, 2018).

coupled with structural adjustment programmes in the 70s and 80s resulted in the removal of inputs subsidies and the collapse of coffee cooperatives. Therefore, growing coffee was no longer profitable - for extensive review on the coffee industry and cooperative institutions see (Coulson, 2013; Cooksey, 2011; Cooksey and Kelsall, 2011; Ponte, 2002, p.38-94; Meertens, 2000; Masambichaka and Naho 1995; Putterman, 1995).

Commercial farmers in the coffee and tea industries were motivated to adopt export avocado variety (mainly Hass) to replace coffee farms in the late 2000s (Figure 4.3). In the hope of making good gains on the rising importance and favourable prices for avocado in the international market. Just like the California "agricultural speculators who discovered avocados in the early 20th century had hoped that the foodstuff would bring them riches and comfortable living on the lush Southern California estates" (Charles, 2002, p.131). Such sentiment is reflected in the quote below by the first private investor who had turned 137 hectares of abandoned Kifufu coffee estate[29] into avocado orchard in the NH:

> *"Well, I have an agricultural background, I used to grow coffee for 17 years, but there is no money in coffee now, bottom prices in the market. So, I was looking for other things to grow, avocado consumption growth was high, and the export market looked bright, and it was a good crop to be involved in" [Managing director of Africado ltd, PTK_MD_0151].*

Similar views were echoed by other commercial coffee and tea growers and smallholders – "high costs of inputs, labour intensive, lower prices made coffee unprofitable" [Male, Manager of commercial farm; PTK_EF_0080]. For instance, in the NH, one of the early adopters has converted his 75 hectares coffee estate (USA River) into avocado production (Figure 4.6). Similarly, in the SH, the first commercial orchard (60 hectares nucleus estate) was established by Rungwe Avocado Company (RAC). These early commercial farmers have been the driving force behind the growth and expansion of export avocado production in Tanzania. As the widespread adoption of the local avocados (among smallholders) was linked to the economic importance of coffee production, the widespread adoption of the export avocado among commercial and smallholders is unfortunately connected to the dwindling significance of once vibrant coffee industry (Coulson, 2013; Corskey, 2011).

[29] Kifufu coffee estate was originally developed by a German settler in Tanganyika, the was once the highest yielding coffee farm in Africa. The estate was nationalised after independence in 1972, but coffee production ceased in 1980. In 2007, under 30 years lease, Hass avocado production started on the estate through private investment (Africado ltd) and by 2012 the 137 hectares have all been planted with avocados. RAC is a subisdary of private WAKULIMA Tea Company which started avocado growing as research development project in 2007 and in 2009 after successful trials established a commercial farm.

Section of abandoned Kifufu 137 hectares coffee estate before avocado planting – with farm manager bungalow at the background – Courtesy Africado ltd

Map layout of the 137 hectares avocado orchard – courtesy Africado ltd.

image showing section of Kifufu avocado estate - courtesy Africado ltd

Image shows remanent of coffee trees stumps – from 75 hectares coffee estate (USA River estate) removed in 2009 to make way for avocado plantation

Image shows section of the 75 hectares avocado orchard (USA River estate)

Figure 4.6: Transformation of Kifufu & USA river coffee estates into Hass avocado orchard (pictures taken in August 2018, courtesy of Africado ltd & USA River farm

Development agencies (mainly USAID) were the driving force behind the early adoption of export avocado among smallholders. With promises of a "*better* life, improved livelihood, higher prices, and ready and secured markets for the product, many smallholders were motivated to grow export avocado" [Male, smallholder, PTK_EF_00074]. For instance, in the SH, the USAID funded Tree Crop Project (USD 800 000) in 2007 focused on temperate fruits, including Hass avocado. Between 2009 and 2014 under the Tanzania Agriculture Productivity Programme (USAID-TAPP), USAID helped popularise Hass avocado among smallholders in the NH through subsidised seedlings (Makwalinga, 2014; Mruma, 2013)[30]. Further, the involvement of smallholders in the export avocado production was a pre-condition for private investors to access ethical investments funds from development partners[31].

In the last five years, there has been significant growth in production due to the expansion by export company farms (e.g., Africado limited), strong growth in independent commercial farmers, and increased smallholder production (particularly in the SH). Although there is strong growth for the adoption of export avocado, the industry is in its infancy compared with countries like Israel, South Africa, and California, where advanced technology is applied, and there is rigorous development research. Currently, across levels of Government, there is no research and development programme for avocado production, and domestic research institutions lack the required skills and capacity to conduct research activities (REPOA, 2018; Mwakalinga, 2014). Research and development are left to private investors. The importance of these issues and how they impact waste generation in production are discussed in chapter 5. In the following section, I briefly examine the rising popularisation of avocados as a "superfood" to provide context for the current global production and consumption levels and production levels in the context of Tanzania.

[30] The programme also provided partial funding to fund staff costs (out-grower scheme in partnership with Africado ltd), establishing packhouses, and facilitated exporters access to targeted markets (Mruma, 2013).

[31] For example, the British Government, through AgDevCO, invested in Rungwe Avocado Company in SH. Similarly, the Norwegian Fund for Developing Countries - Norfund invested 12.8 million NOK in Africado ltd (in developing Kifufu estate). Recently, in 2019, the Finnish Fund for Industrial Cooperation - FinnFund invested 2.5 million Euros in Africado Ltd to develop a second orchard – Gararagua farm 176.9 hectares estate. AgDevCO Limited is incorporated in the UK as a private limited company registered in the UK, it seeks donor funding for investment in commercial agri-business development in sub-Saharan Africa, see https://www.agdevco.com/about-us/agdevco-history.html.
NorFund in 2009 invested 12.8 Million NOK in Africado plantation development – partly equity and loan (Africado started planting in 2008) https://www.norfund.no/investment/africado-ltd/ . FinnFund in 2018 invested 2.5 Million Euros in Africado https://www.finnfund.fi/en/investing/investments/africado/

4.2. Global avocado production and trade.

4.2.3.1 Popularisation of avocado as a "superfood."

Once considered a traditional staple food in many indigenous communities, avocado has become a "superfood" (Loyer and Knight, 2018)[32]. Avocado consumption started to gain popularity as a superfood among Western consumer cultures and foodways in the late twenty century (the 1960s onwards). However, at the turn of the twenty-first century, there has been substantial growth in demand for avocados globally due to: increased awareness of its inherently rich nutritional and health values[33], increasing health consciousness, and ethical concerns (particularly among Western consumers) and working-class in middle-income and developing countries (Carman, 2019; Loyer and Knight, 2018; Carman *et al*., 2013; Charles, 2002). Bhuyan *et al. (*2019) provides a detailed review of avocado's nutritional and therapeutic properties and bioactive compounds.

The rising importance and popularisation of avocados as a superfood can be linked to three critical trends. First, a concerted effort by producers and importers through research, marketing, and promotion of the 'natural' nutritional dense and healthy benefits of avocados helped to change the bad image associated with avocados - as having high fats and calories not particularly healthy. The bad image of avocados prevented its early acceptance among the general population in the US (a problem that persisted until the 1990s, see Carmen, 2019; Carman *et al*., 2013)[34] and in Europe (Donkin 2005; Vorster, 2004; Toerien *et al*., 1992). The research, marketing, and promotion by avocado growers' associations and exporters helped popularise avocado among Western consumers (Carman *et al*. 2013; Donkin 2005; Vorster, 2004; Charles 2002) [35]. According to

[32] While there is no precise definition of what 'superfoods' are, unlike other functional foods that are fortified, enhanced or altered to increase their nutritional qualities; superfoods are thought to be 'naturally functional' possess inherent good nutrients - have superior nutritional qualities, produced in 'natural' way with little impact on environment and are associated with indigenous people (Magrach and Sanz, 2019; Loyer, 2016); marketed for health benefits (Scrinis, 2013) with increasing in economic value (Mellentin, 2014).

[33] Avocados are rich in vitamins (A, B, C), minerals, potassium, phosphorus, magnesium, iron, and poly and mono-unsaturated fatty acids which help in the prevention of coronary heart diseases (Ameer, 2016; see also Vinha et al., 2020; Bhuyan et al., 2019; Myung and Kim, 2019; Ameer, 2016).

[34] For instance, in the US, although production started in the 1830s and 1910s in Florida and California, respectively. It was not until the late 1970s that avocados became acceptable at the tables beyond these regions and a regular item on groceries stores (Charles, 2002). Changing the consumers' perception about the wrong image of avocados has been a concerted effort of public relations skills of growers (such as California Avocado Commission - CAC, Hass Avocado Board-HAB, South Africa Avocado Growers Association - SAAGA)), exporters, nurserymen, lobbyists, and enthusiasm of few scientists (Charles, 2002).

[35] The California Avocado Commission (CAC) embarked on a series of research and marketing programs (funded by growers) focused on the nutritional and dietary benefits of avocados (Charles, 2002). HAB was formed in 2002 through the passage of the Hass Avocado Promotion, Research, and Information Act of 2000. HAB collects an assessment of $2.5 cents per pound on all domestically produced and imported Hass avocados sold on the U.S. market which is used for research and promotion. The HAB and its importers' associations (companies importing from Mexico, Chile, and Peru) spent 353.3 million US dollars on marketing and promotion between 2003 and 2017 (Carman, 2019).

Carman (2019), between 1962 and 2017, the CAC spent a total of 568 million US dollars on the program, which transformed the image of avocados to "heart-health, nutrient-dense, superfood" and became 'part of recommended healthy diet' (ibid, 2019, p .9). The combined efforts by CAC and HAB have resulted in a significant increase in demand for avocados in the U.S. – with consumption rising from merely 1.1 pounds (0.5 kg) per capita in 1994 to 8.0 pounds (3.6 kg) in 2018 (Carman, 2019; Ambrozek *et al.,* 2018; Carman *et al.,* 2013). Similarly, in Europe, Vorster (2004) reported that marketing activities by SAAGA in the UK led to avocado consumption in the UK doubling between 1995 and 1998[36] (see also, Donkin 2005; Vorster, 2004; Toerien *et al.,* 1992). Now, the World Avocado Organisation has the mandate to increase avocado consumption globally under the generic promotion "*Avocado - The Fruit of Life"* to make avocados a universal fruit (WAO, 2018; 2021).[37]

Secondly, the rising popularity of avocado as a superfood can be attributed to the global dietary transition from traditional diets to high refined sugars, fats, oils, and meats with health and environmental burdens and the need to transition to a more plant-based diet (Rust *et al.,* 2020; Willett *et al.,* 2019; Godfray *et al.,* 2018; Tilman and Clark, 2014; Pan *et al.,* 2012; Popkin, Adair and Ng, 2012). Therefore, among middle- and high-income consumers, particularly in the global North, there has been a surge in demand for plant-based functional foods or superfoods (Magrach and Sanz, 2020; Loyer, 2016). Avocados have become popular, especially among the younger generations – (in the 20s and 30s), due to social media, allowing easy sharing of recipes and cuisines (Zappavigna and Ross, 2021; Turow-Paul, 2020)[38]. Avocado's versatility and nutritional value make it an excellent superfood for vegans and vegetarian movements and their culinary cultures - which have gained traction among younger consumers in the global North (Zappavigna and Ross, 2021; Beck and Ladwig, 2021). Lastly, the ready availability of the fruit - all year round, through improvements in cold-chain technologies and new developments and innovations – especially "ripe and ready to eat" by supermarkets and retailers have fuelled an increase in consumption in the global North where emphasis on convenience food is high (Donkin, 2005; Friedberg, 2004)

[36]Between 2000-2004 avocado penetration in UK households increase from 16% in 2000 to 20.8%. All major producing countries have important branding and promotion programs to increase avocado consumption locally and internationally.

[37]In 2017, WAO launched the first-ever generic promotional and branding initiative for an agricultural product, "Avocado - The Fruit of Life", to make avocados a universal fruit. Under the new initiative, WAO joined forces with leading supermarkets and innovative foodservice companies to embark on a pan-European campaign across nine countries, including the UK, to increase growth in consumption for the next five years.

[38] See also, Yahia (2003; 2011) and Yahia and Woolf (2011)– different uses of avocados around the world

The transitioning of avocados from local staple food to a global superfood commodity means it is increasingly demanded in parts of the world far from their origin and cultural context in which they are traditionally consumed (Magrach and Sanze, 2019; Loyer and Knight, 2018). However, the increasing demand also means changes in the production systems - from subsistence and traditional practices to industrialised production systems with significant social and environmental impacts (Campbell *et al.,* 2018). The following section examines the global avocado production trends (4.2.4) to situate current production levels in Tanzania (4.2.5), after which I delineate the structure of the avocado supply chains in Tanzania 4.3.

4.2.3.2 Global avocado production and trade trends

As discussed in section 4.2.3.1, the popularisation of the avocado as a superfood and increasing economic value of the crop have resulted in growth in production and consumption since records began in 1961 (Knight, 2002). According to the International Trade Centre -TradeMap (2021), international trade of fresh avocado exports has risen by 60% between 2012 and 2020. Rising from over 1.1 million metric tons to around 2.7 million metric tons in 2020 with an estimated value of 6.5 billion US dollars. The USA has the largest share of the export market (the biggest importer), followed by the EU, where imports have increased by 61% (363,741 to 941,237 metric tons) between 2012 and 2018, with an estimated value of over 2.3 billion US dollars in 2018 (ITC, 2020). Leading exporting countries include Mexico (world-leading producer/exporter, accounted for 43% of the total avocado exports, worth US$ 2.4 billion in 2018), Peru, Chile, Spain, South Africa, Israel and Kenya (which account for 6.2% of export, worth US$ 346.9 million). In the case of Tanzania, its export in 2018 was 7,551 metric tonnes (worth US$ 8.5 million).

According to Knight (2002) between 1961 and 1996, global production levels increased more than threefold, from 697,869 tons to over 2.3 million tons (based on FAOSTAT 2001 data). The total cultivated land area increased from 76,770 hectares to 339, 141,000 hectares for the same period. Over the last decade, production levels have more than doubled, from 2.8 million metric tons in 2000 to 6.5 million metric tons in 2018 (Figure 4.7) at a growth rate of 3.2% per annum (based on FAOSTAT, 2020) [39]. In the same period, the total land area converted to avocado production globally increased steadily from 329,000 hectares to over 918,000 hectares (Figure 4.8).

[39] Caution on comparability of data. The FAO dataset are more often conservative when compared with other local sources. The data presented is at the global and regional level and therefore specific country level data might be slightly higher. For example, FAO database list 18 countries as avocado producing areas and this does not include Tanzania, where significant production occurs. In addition, FAO data indicated that in 2018, total production for South Africa was 127,568 metric tonnes, but the South Avocado Growers Association data shows that total avocado production in 2018

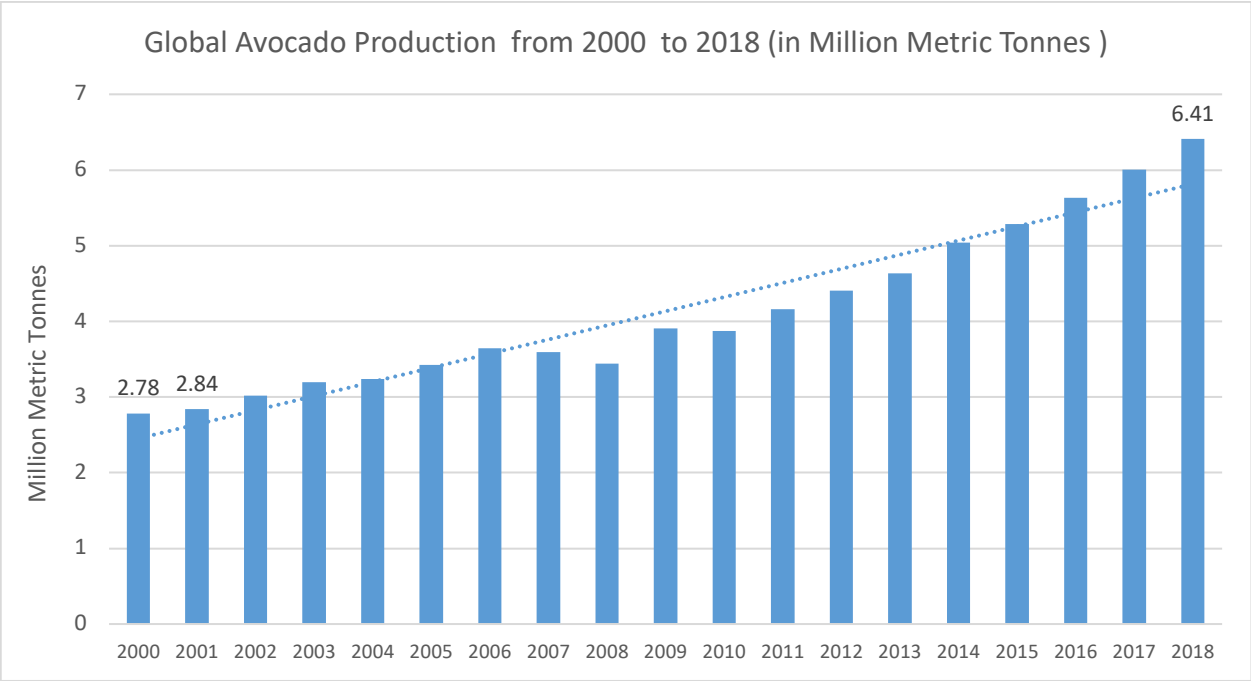


Figure 4 7: Global avocado production levels from 2000 – 2018. *Source: FAOSTATS, (2020).*

However, between 2017 and 2018, there was a sharp rise in the total plantation area from 592 000 ha in 2017 to 918,000 ha in 2018, representing a 35.5% increase in production area worldwide. This sharp rise can be attributed to the lack of detailed census on global avocado production yearly and late reporting of data particularly in SSA (Whitfield, 2012). There has been a recent increase in avocado plantations in Mexico and Central American countries. For example, in 2017/2018 alone, 231,000 hectares of avocados were planted in Mexico, compared with just 168 hectares in 2013/2014. Moreover, there is a significant expansion in new production areas in developing countries, particularly in Eastern and Southern Africa.

In Africa, avocado production has risen significantly but unevenly in the last decade. In 2000, production was nearly 500 000 metric tons, rising to over 800,000 metric tons in 2018 (Figure 4.9). Total land area under avocado cultivation remained under 100,000 hectares between 2000 and 2017; but rose sharply to nearly 400 hectares in 2018, representing a 220% rise (Figure 4.10). This apparent sharpness of increase over space of a year, could be explained by lack of a detailed yearly census on agricultural productivity and reporting in SSA (Whitfield, 2012).

was 169,243 metric tonnes, that is a significant difference of about 24%. Despite the variation and omissions, FAO statistics provide conservative scenarios of production levels globally and regionally, in absence of access to country level data.

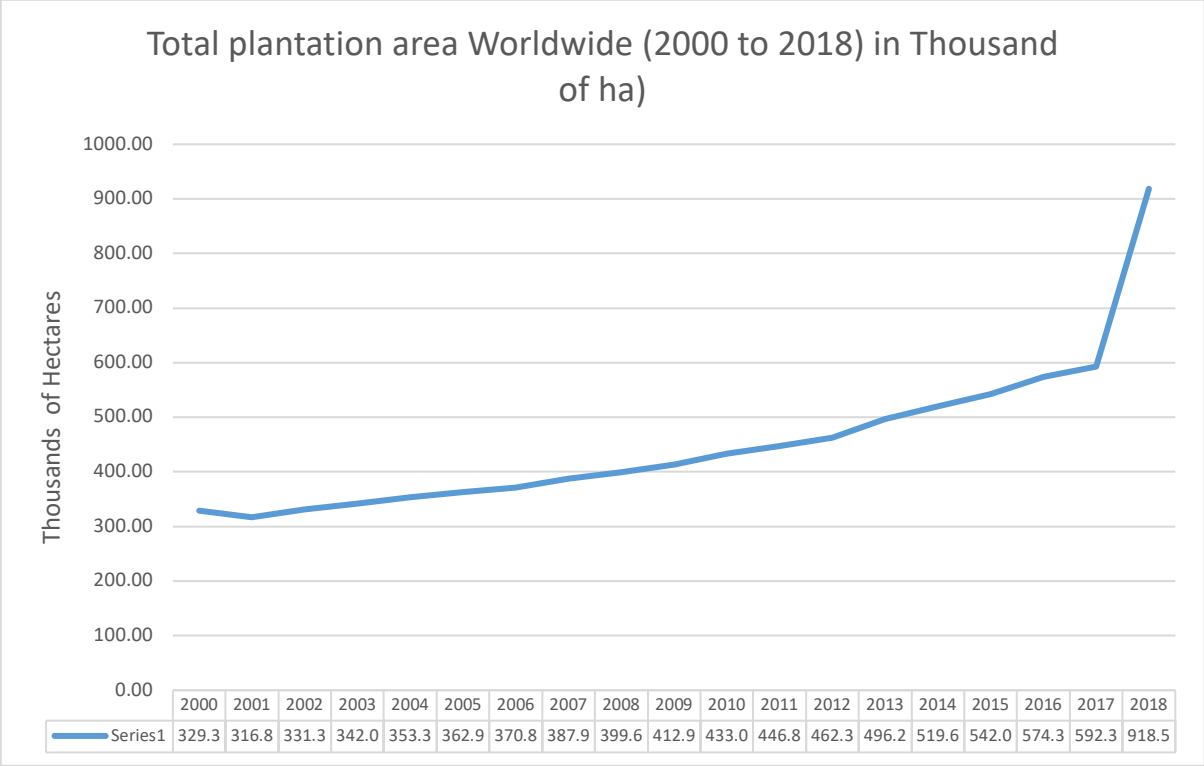


Figure 4.8: Global avocado cultivated area from 2000 – 2018. *Source: FAOSTATS (2020).*

Whitfield (2012), for example, observed that lack of reliable, accurate and up to date data on national agricultural statistics across SSA affect evidence-based policy in African agriculture. For instance, in the case of avocado production, FAO data (Figure 4.9&4.10) does not include avocado production from Tanzania because of the lack of data reporting and inadequate agricultural census.

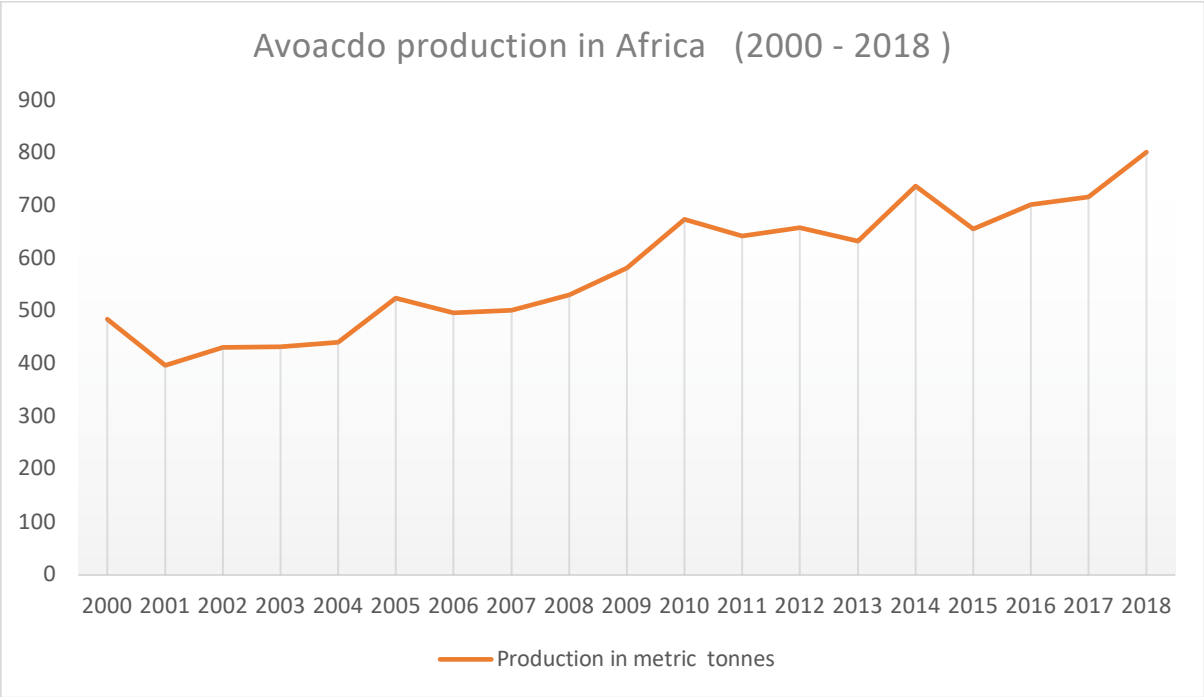


Figure 4. 9: Avocado production levels in Africa. *Source: FAOSTAT (2020)*

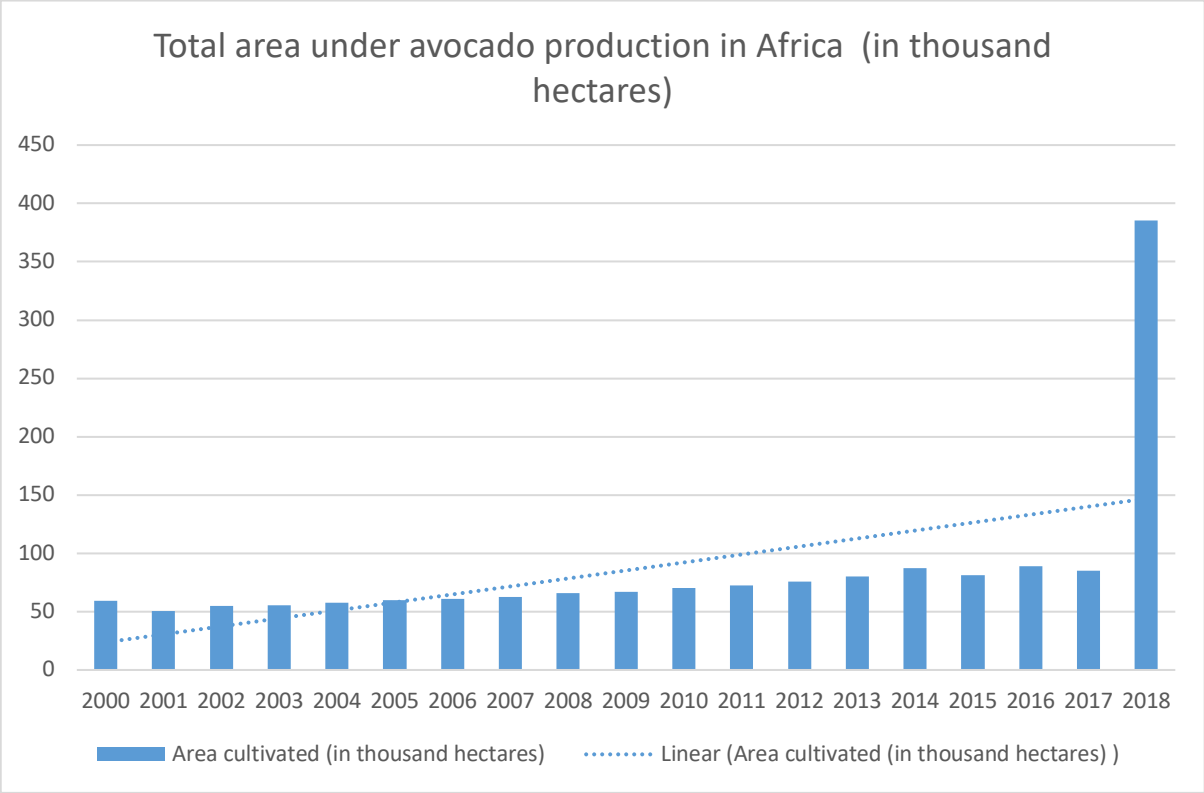


Figure 4.10: Total Area avocado production in Africa 2000-2018. *Source: FAOSTAT (2020)*

In Africa, domestic consumption of avocados is strong, and production in most countries is for domestic consumption (i.e., varieties that are not suitable for the export market). Nevertheless, domestic consumption is remarkably high even among exporting countries[40]. Total avocado export from Africa (Table 4.2) has increased since 2010 from 73,580mt in 2010 to 196,995mt in 2018 but accounted for just 8.1% of total global export in 2018. However, the total traded value increased by 22% to 305,729 million USD compared with the 2010 figure of 68.5 million USD (ITC, 2020). Export volumes are expected to rise in the coming years as new plantations mature in many emerging export-producing countries, including Tanzania

[40] South Africa which has been exporting since the 1960s (SAAGA, 2018), only about 45% of its total production is for export, 35% is consumed domestically, and between 10% - 15% is processed into oil or guacamole (SAAGA, 2018)

Table 4.2: Major avocado exporting countries in Africa (2010-2018)

Major Avocado Exporters	2010 Export Vol. (Tons)	2011 Export Vol. (Tons)	2012 Export Vol. (Tons)	2013 Export Vol. (Tons)	2014 Export Vol. (Tons)	2015 Export Vol . (Tons)	2016 Export Vol. (Tons)	2017 Export Vol. (Tons)	2018 Export Vol. (Tons)
Africa Total	***73580***	***59119***	***85473***	***80929***	***106985***	***110207***	***118054***	***121623***	***196995***
South Africa	51631	31566	55073	50729	65845	57665	57866	43492	89343
Kenya	20183	21974	26107	25002	28895	38858	46682	51507	71877
Morocco	1409	3967	1933	2013	7743	7533	6229	16397	16946
Tanzania*	**50**	**86**	**628**	**1393**	**1877**	**3279**	**3830**	**4374**	**7551**
Zimbabwe	179	251	591	718	1183	1404	1530	2746	5183
Burundi	14	21	392	49	383	701	1277	1225	2274
Côte d'Ivoire	1	90	410	119	216	147	297	761	2096
Eswatini		909	272	722	644	420	0	428	470
Mozambique	0	0	0	0	0	0	0	43	442
Uganda	0	0	0	4	60	122	128	191	337
Egypt	73	26	31	151	124	27	178	56	201
Rwanda	0	1	5	1	0	11	2	71	173

Sources: FAOSTAT (2020) and ITC (2020). ***Note:** Export data on Tanzania avocado is from ITC TradeMap.

4.2.4 Avocado production and export in Tanzania

Data on agricultural productivity in SSA are generally difficult to access, and when it is available, it often not reliable (Whitfield, 2012; Kelly and Donovan, 2008). This is particularly problematic, especially where the market is unregulated – as in the case of fruits and vegetables in Tanzania (Mwakalinga, 2014; Lynch, 1999). Regarding avocado production, while data on export volumes can be obtained through third-party export databases, information on domestic avocado production is sparse and unavailable, and often data on production levels – both export and domestic production are conflated together. According to Mwakalinga (2014), Tanzania produced some 20,000 metric tons of avocado in 2010/2011 and projected total production to reach 106,000 metric tons by 2019/2020. However, a recent national agricultural productivity census by the National Bureau of Statistics (NBS) for 2016/2017 estimated total production of 19,449 metric tonnes - lower than what was reported in 2014 (NBS, 2017). A more recent avocado profile document by the Tanzania Trade Development Authority-TANTRADE (2019) estimated that Tanzania produces an average of 190,000 tons of avocado a year. Inconsistency in data on production levels for the local and export avocado is remarkably high. As reported elsewhere (Whitified, 2012; Kelly and Donovan, 2008), lack of consistent, accurate, and reliable data on agricultural productivity across Africa has been reported.

Moreover, the available data on production levels do not distinguish between local and export avocado production. For instance, export data from ITC TradeMap shows that in 2016, Tanzania exported 3,830 tons, while in 2019, the total avocado export is estimated at 9,000 tons (Table 4.4). This means a sizeable proportion of the production data reported by the NBS survey in 2016 and TANTRDE (2019) is local avocado production. Table 4.3 summarises farmers engaged in the export avocado production and the total area (hectares) under cultivation. This information is based on data collected from farmer associations and independent commercial producers in the NH and SH.

Table 4.3 Summary of export avocado production levels

Types of farmers	Number of farmers*	Total trees	Total hectare	%Of farmers
Micro-scale	8694	194289	769.60	83.30
Small-scale	1673	94995	373.83	16.03
Large scale	70	351038	1127.79	0.67
Totals	*10437*	*640322*	*2271.21*	*100.00*

Source: Interviews. ***Note:** In the NH, up-to-date data was obtained through the out-grower association and commercial farmers and covers (Kilimanjaro, Arusha and Manyara regions). In the SH, the data was collected from the Njombe region, Mbeya region (only Rungwe and Busokelo districts.), Iringa region (1 commercial

farmer, no data on smallholders). The total number of trees consist of productive trees and young trees (under 3 yrs).

From Table 4.3, over ten thousand farmers are engaged in export avocado production, cultivating 2, 271 hectares of land. Of this, 99.33% are smallholders (classified as micro-scale or small-scale depending on tree ownership)[41] and are responsible for only half (1,143 hectares) of the total land under avocado production. Less than 1% (0.67%) of farmers are large-scale or commercial farmers who control half of the entire land under avocado plantations. In terms of the total land area under production, smallholders are squeezed out (particularly in the NH, where access to land limit smallholder from expanding the number of trees), most of the production is in the hands of very few large-scale private investors[42]. The data on the number of farmers collaborates with what has been reported by the Tanzania horticulture body - TAHA. According to TAHA, over 10,000 smallholders are involved in export avocado production (TAHA, 2020). However, there could be more farmers than what is presented in Table 4.3, as data on growers in some districts was not obtained (see note in Table 4.3). FruiTrop (2019), estimated that in 2018 between 1,200 to 1,400 hectares of land was under export avocado production with an estimated yearly growth rate of 300 to 400 hectares. With this growth rate, it is projected that avocado export could reach around 15,000 to 20,000 metric tonnes by 2023.

Tanzania exported its first commercial avocados in 2008 through Kenya exporters[43]. Since 2012 avocado export has increased steadily as more trees reached productive age and new production areas are developed (Table 4.4). Export volume more than doubled in 2013 from 627tons in 2012 to 1,393 tons in 2013. This was due to new commercial production – Rungwe Avocado Company (RAC) which started production in the SH with its first export in 2013 (Field Journal, 2019). Between 2013 and 2019, export volume has increased by more than 600%, from 1,393mt to over 9,000mt due to new commercial farms and a growing number of smallholder producers, particularly in the SH.

[41] Farmers are categories based on the number of trees planted, micro scale farmers have between 1-100 trees approximately one acre equivalent. Small scale farmers are those with between 100 and 1,200 trees that is approximately more than 1-10 acres. Commercial farmers are farmers with over 1200 trees.

[42] In the NH particularly in Kilimanjaro smallholders' avocado growers complained of access to land limiting ability to increase the number of avocados trees on their farms – some have to make hard choices of remove food crops – banana in order to make room for additional few avocado trees. In the SH, particularly in Rungwe district farmers complained of sharp rise in the cost of land in the last 5 years due to increasing expansion of avocado farms by both wealthy residents and private investors.

[43] Between 2008 to 2012 Africado ltd in NH was the only commercial producer and exported the fruits through Kenyan exporters (Tanzania had no processing facility until 2013). Therefore, export figures in those years may not reflect the actual volumes as in some cases the fruits were exported under Kenyan name.

Table 4.4 Tanzania avocado export volumes and value for the last decade (2008 -2020)

Year	Total export volume (Metric tonnes)	Total export value (US Dollars)
2008	100	7,000
2009	6	6,000
2010	50	25,000
2011	86	22,000
2012	628	418,000
2013	1393	1,918,000
2014	1877	899,000
2015	3279	1,293,000
2016	3830	2,147,000
2017	4374	4, 603, 000
2018	7551	8, 579,000
2019*	9000	12,000,000

Source: TradeMap ITC (2020). ***Note:** Tanzania has not officially reported its 2019 export trade to the ITC. 2019 figures are based on media report – by TAHA*[44]

Similarly, export earnings have increased steadily from a little under half (0.42) million US dollars in 2011 to 12 million USD in 2019 (Table 4.4). The EU is the largest export market for Tanzania avocados (Figure 4.11). In 2018, France and the Netherlands alone accounted for three-quarters of the total export from Tanzania, with a combined export value of 6.6 million US dollars. The UK is the third-largest destination for Tanzania avocados and accounted for 14% (1.5 million US dollars) of 2018 total export value. Export to the UK has more than doubled in recent years, and countries like Belgium, Germany, and Eastern Europe, which were previously not significant markets for Tanzania avocados, have gained importance (MARKUP, 2020).

[44] The Citizen, 2020, Report - Tanzania: Avocado revenues jump to Sh28 billions a year. Available https://www.thecitizen.co.tz/news/Avocados-go-from-zero-to-Sh28bn-a-year-crop/1840340-5548704-4mq520/index.html . Also see Freshplaza, 2020 report https://www.freshplaza.com/article/9216032/tanzania-avocado-revenues-jump-to-sh28-billions-a-year/ and

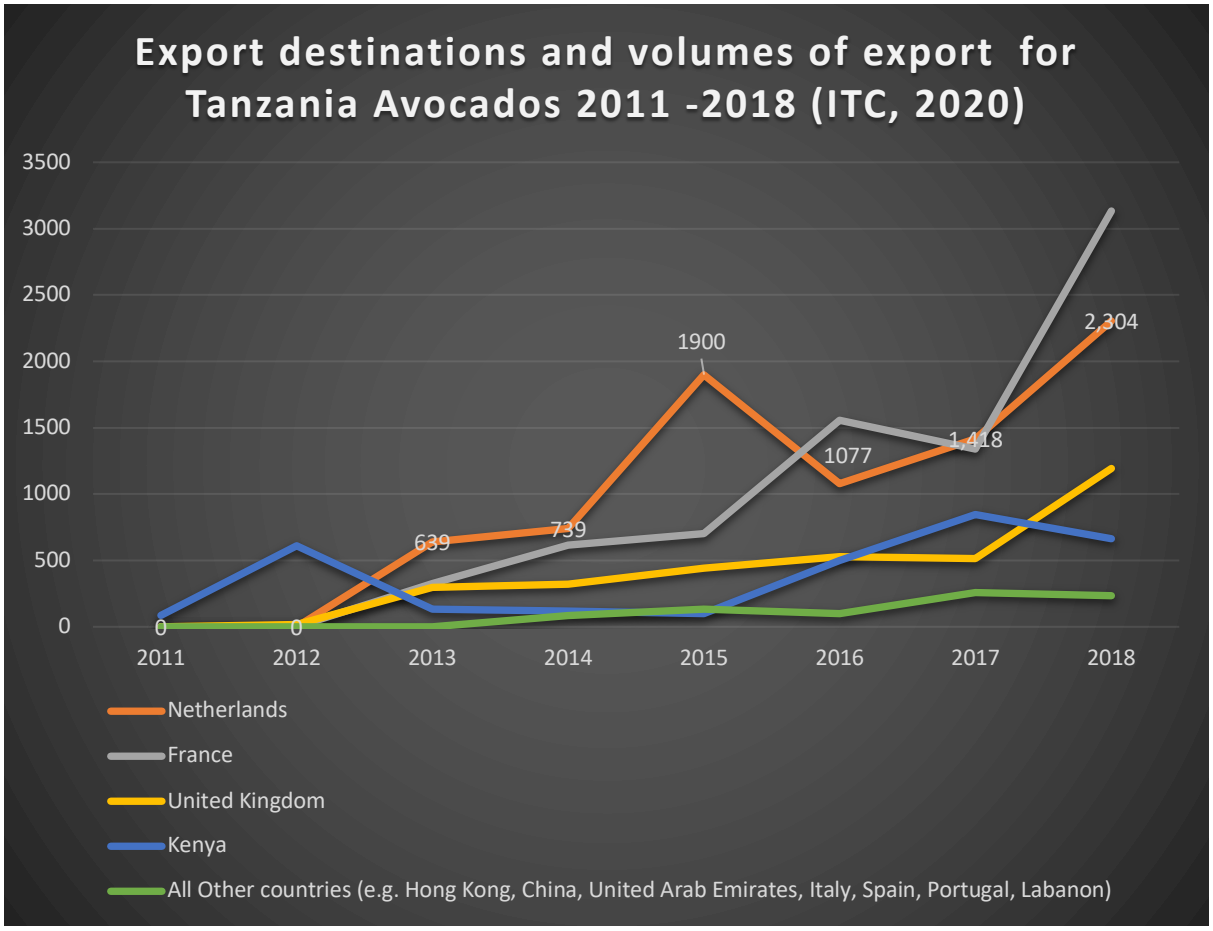


Figure 4.11:Tanzania top exporting countries. *Source: TradeMap, ITC (2020)*

Besides export to the EU, Kenya is the only major export destination in Africa for Tanzania avocados due to many Kenyan exporters sourcing fruits from Tanzania (see chapter 7). However, a recent normalisation of Phytosanitary rules between South Africa and Tanzanian could see South Africa as a significant importer of Tanzania's avocados, especially during the low season (Dec-Mar) in South Africa[45]. In the global market, Tanzania export of avocado is gaining prominence with 78% growth between 2014 -2015 compared to 20% growth globally for the same period (Tanzania Trade Authority, 2019). A recent report by MARKUP (2020) indicated that Tanzania's share of the world avocado market has increased from 0.1 % to 0.4% since 2013 (Figure 4.12).

[45] Mohamed I., 2021.*Tanzanian Avocado Exports Poised to Grace South African Tables*. The East African, AllAfrica Global Media. https://allafrica.com/stories/202108110310.html

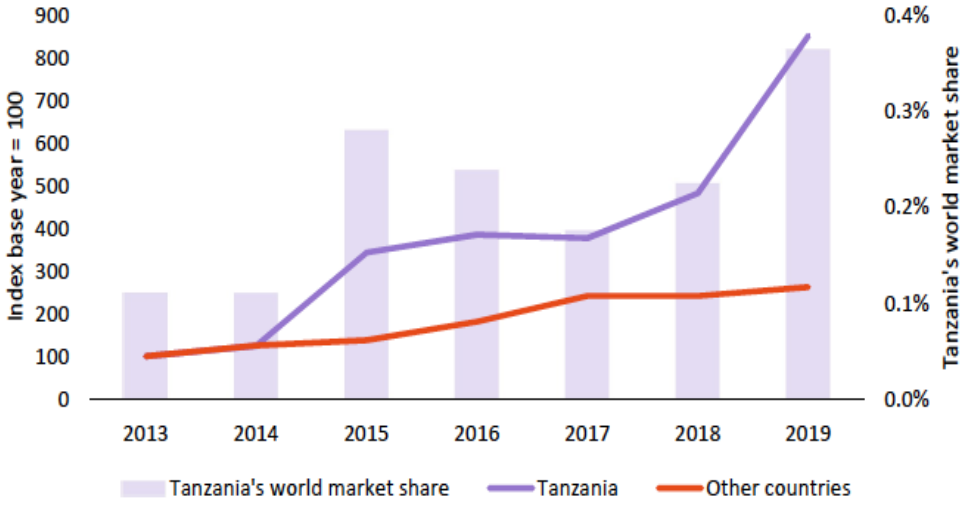


Figure 4.12:Evolution of total avocado exports, Tanzania vs rest of the world. *Source: Adapted from MARKUP (2020).*

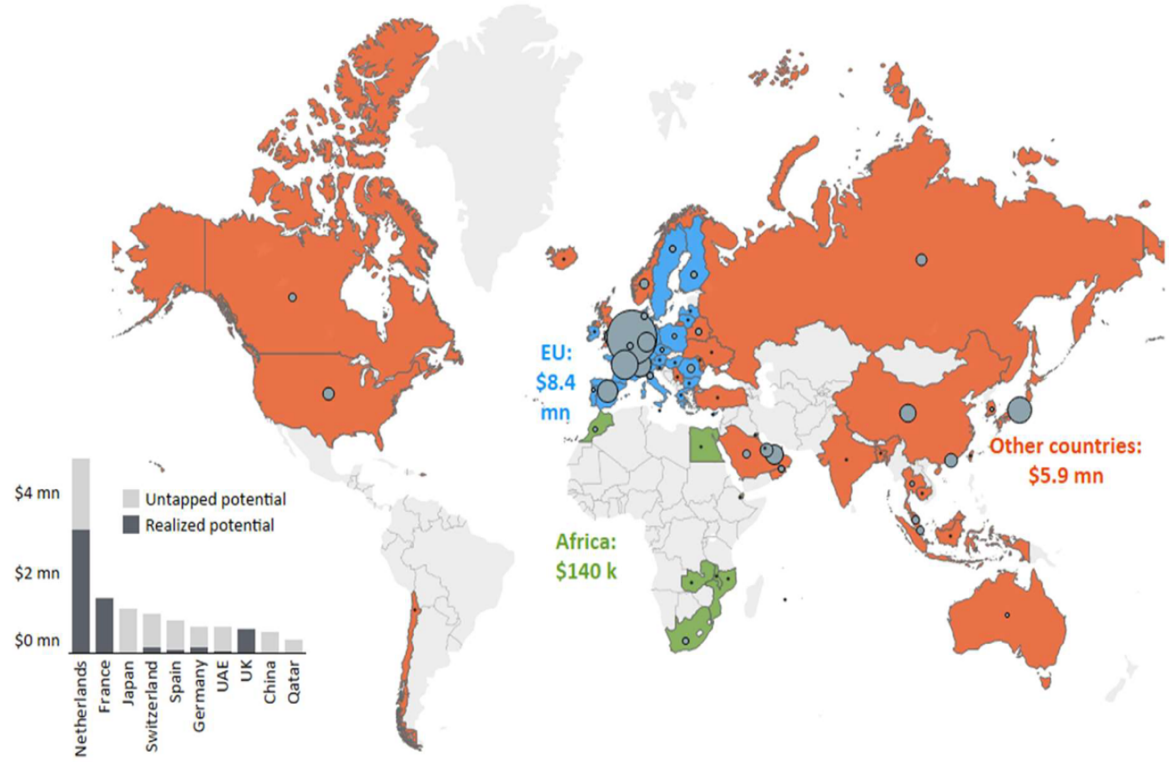


Figure 4.13: Export potential of avocado from Tanzania, by market. *Source: adapted from MARKUP, (2020)*

There are opportunities for further export growth in existing markets like the Netherlands and other emerging markets like Japan, Switzerland, Spain, Germany, the United Arab Emirates, and China where demand is high (Figure 4.13).

4.3 The domestic avocado supply chain structure: "Feeding the nation with butter for dogs".

This section examines how the domestic avocado supply chain have developed (Figure 4.3) and why NH was chosen as a case study for the domestic avocado supply chan. I draw on interviews with farmers, traders, and opinion leaders in the Kilimanjaro region to demonstrate how foodstuff (avocado) once regarded as "butter for dogs" has become the nation's favourite foodstuff and how the supply chain developed and is organised. From Kilimanjaro, the local avocados are shipped to the length and breadth of Tanzania - popular destinations include Dar es Salaam (major destination), Tanga, Dodoma, Morogoro, Iringa, Arusha, Zanzibar and to a lesser extent, export to Kenya:

> *[..] Many years ago, people were unaware of the local avocado; the farmers planted it only for home use as food and to feed their animals. But, recently, around the year 2000, that is when it started to have a market. Back then, it did not have a market. People [became] aware of the avocados and began transporting them to different big cities like Dar es Salaam, Tangan, Dodoma …That is how the demand increased in the big cities, and now framers have the market to sell their avocados [Chairman of a farmer group, Male, age 72; PTK_MVPC_0136]*

As indicated in Figure 4.3, the avocado started to gain economic value and exchangeability from the mid-1990s (1994/95) onwards when local women began to sell small quantities in local and nearby market centres leading to the development of the regional supply chain. Long-distance trading of avocado between the north and the south (e.g., Dar es Salaam) – national supply chain emerged around the late 1990s and early 2000s (Figure 4.3). However, long-distance trading of other fruits (e.g., pawpaw, banana, and oranges) between Dar es Salaam and other producing regions date back several decades as reported in several studies (see for example, Lynch, 1992; 1994; Sporrek 1985; Mascarenhas and Mbilinyi, 1971; Mbilinyi and Mascarenhas, 1973). As already discussed, the late development of the domestic avocado supply chain is due to the cultural perception of the fruit, lack of awareness of nutritional benefits, and its low economic value. With the fruit gaining economic exchangeability, it is now viewed as a supplementing smallholders household income. Mwakalinga (2014) reported that between 65% - 70% of avocado production in Kilimanjaro is sold by smallholders. The remaining is used for food and animal feed and 'other purposes like the ripening of bananas (Field Journal, 2018).

A general overview of key actors and a structure of the supply chain is presented in Figures 4.14 and 4.15. Agricultural marketing in Tanzania involves a chain of intermediaries; it relies on personal relationships between producers, traders, and brokers due to the lack of market

information and weak legal framework, formal market institutions (Mwakalinga, 2014; De Putter et al., 2007; Eskola, 2005; Lynch 1999; 1994). Like other horticultural or food supply chains, the avocado supply chain is based on personal relationships and trust; which has been described as fragmented and disorganised with little or no coordination among the actors (De Putter *et al.,* 2007; Mbilinyi and Mascarenhas, 1973), which disadvantage the producers (Mwakalinga, 2014;). As indicated in Figure 4.14, the supply chain comprises different actors whose relationships are loosely coordinated through short-term or long-term transactions (Mwakalinga, 2014; Akyoo and Lazaro, 2007), and transactions are based on personal trust (Lynch, 1994; Lyon and Porter, 2010)

The "current supply chain is based on the contacts and knowledge of the people involved in the trading and not just in the physical roads, buildings and vehicles" (Lynch, 1994, p.316). The role of trust – in this case, personalised trust in informal trade relations across the SSA have been observed in some studies (Amoako *et al.,* 2021; Lyon and Amoako, 2014; Lyon, 2000a; 2002; Lyon and Porter, 2010; 2009; Potts *et al.,* 2007). Since there is little coordination between actors (wholesalers, external/distance traders, bulking agents), there is a high level of free-riding and opportunistic behaviours. Actors act in ways to maximise their gains and seek their interests over the chain (Mwakalinga, 2014). The implications of how the social relations between the actors and opportunistic behaviours lead to losses and waste generation are discussed in chapter 6. As depicted in Figure 4.14, the supply chain is structured into two: grade 1 fruits and grades 2&3 fruits supply chains (see Table 6.1). A description of the actors and the social relations between them is discussed below

a) Farmers

The local avocado production system is mostly subsistence (small-scale), with farmers owing on average of 1 to 4 trees (Juma *et al.,* 2019; Field Journal, 2018; Mwakalinga, 2014). From Figure 4.14, farmers may sell their produce directly to a local broker, a wholesale buyer (including external trader), or rural and urban retailers. The crop is sourced either at the farm gate or the rural-urban wholesale markets [makeshift market point or *gulio)* which occurs twice a week in the producing regions. While some farmers transport their produce to the markets, most sell it to the local brokers at the farm gate. Usually, these are spot market transactions on cash terms (Eaton *et al.,* 2008; Juma *et al.,* 2019). However, sometimes farmers sell on credits to local brokers they have built trust and established long-term trading relations with. On some occasions, forward sales are practised, whereby farmers receive part payment for their crop before harvesting or the fruit matures (Akyoo and Lazaro, 2007) (chapter 6).

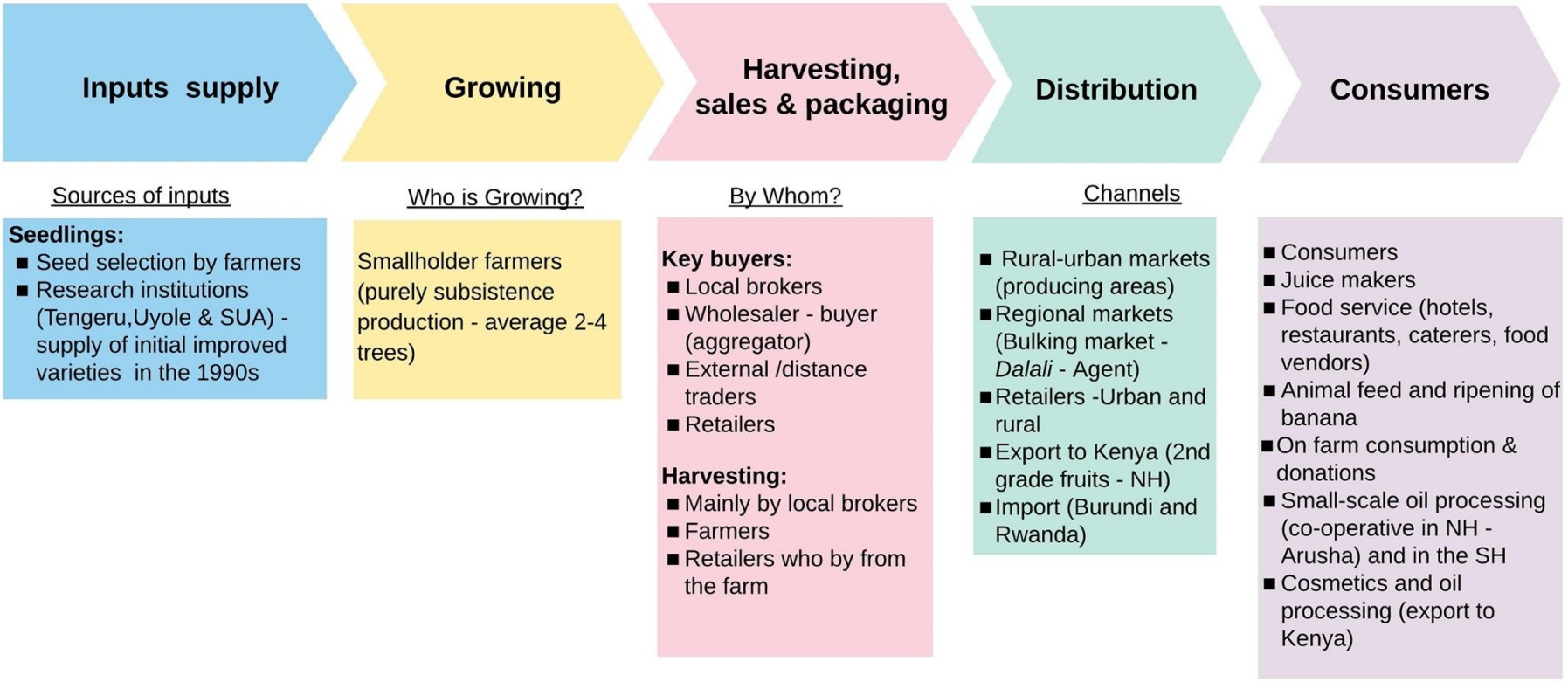


Figure 4.14:General overview of the domestic avocado supply chain *Source: interviews and observations.*

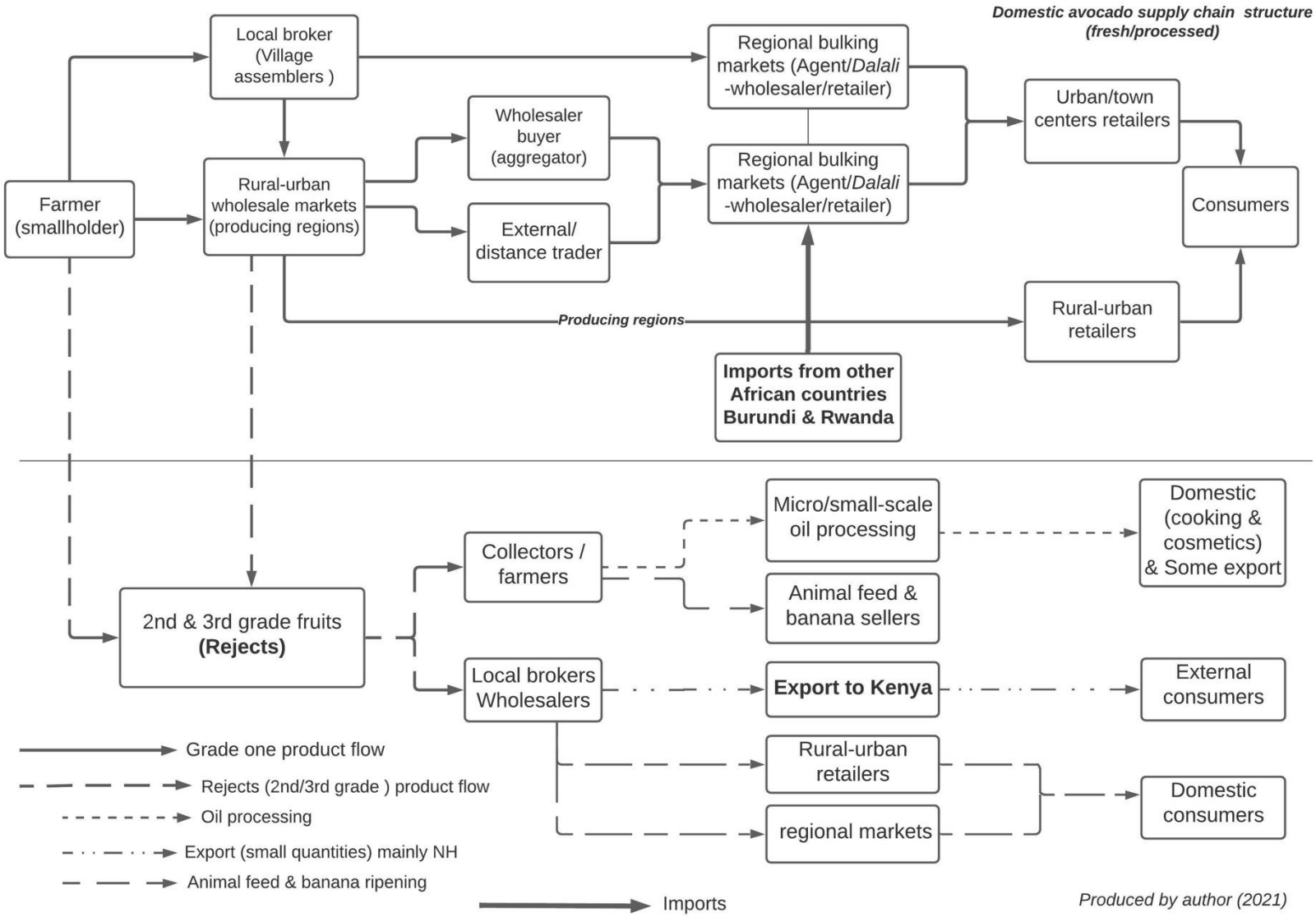


Figure 4.15: General overview of the domestic avocado supply chain. *Source: interviews and observation*

b) **Local brokers**

The local brokers are the primary assemblers or collectors who buy avocados from farmers at the farm gate and take them to the rural-urban wholesale markets. Compared to the 1990s when farmers, primarily women, took fruits to the local market, most farmers now sell their avocados to local brokers at the farm. The local brokers, mostly women, dominate this stage of the supply chain and operate with limited capital compared to wholesale buyers – primarily men due to high capital requirements (Juma *et al.,* 2019; Eskola, 2005). The gendered nature in the production and distribution of horticulture production systems have been observed in several studies. Lynch (1999), in his study of commercial horticulture in Tanzania, reported that "in the past horticulture has been regarded as 'women's work', as it was for subsistence purposes and therefore re-productive, rather than productive" (ibid, p.183; see also Donge, 1992). Juma *et al*. (2019), in their study of avocado production and trade in the SH of Tanzania, indicated that in the domestic avocado supply chain, about 72% of all traders were women, and in Kenyan, female traders dominate the local avocado retail trade (Oduol and Mithofer, 2014). Men tend to monopolise the more lucrative commercial activities as this requires substantial trading capital (Donge, 1992). There is a general perception that wholesale buying, and selling is 'men's work' (Lynn, 1999, p.183), leading to a gender split in horticultural activities.

The local brokers are well-known in the villages and region by the farmers, and they are themselves, farmers[46]. They serve as an essential interface between wholesalers, external traders, rural-urban retailers, and farmers (Figure 4.14) (Mwakalinga, 2014; van Ufford and Zaal, 2004). Because local brokers are known in the areas where they operate, most transactions are based on personalised relations and trust with the farmer, i.e., where long-term trade relations have been established (Gereffi *et al.,* 2005; Lyon and Porter, 2010). But short-term trading relations and spot transaction with farmers is also common. However, the relationships between farmers and local brokers and the norms around selling/buying practices can be used to exercise power in the relationship, which has implications for waste generation (chapter 6). Usually, local brokers take orders from the wholesaler buyers to harvest before the market. However, this oral contract does not involve advance agreement on prices, although quantities to be delivered may be agreed. Traditionally, in

[46] The local brokers are predominately women, mostly known to the farmers, lives in the villages and buy from farmers in the villages they live, but also from surrounding villages and sometimes further afield. Harvesting event usually involves walking for several kilometres of from village to village. Some of the women I worked with either do the business alone or some work together, about 2-3 women will team up in the business to buy from farmers - this increase their capital base and enable them to increase the quantity bags they can buy, share transport and reduce transaction cost and also share risk and losses. Although, some men participate in supply chain as local brokers, those who agreed to participate in the study, only agreed to be interviewed and declined the opportunity to be accompanied on harvesting events (Field Journal, 2018)

the context of SSA domestic markets, oral or verbal contract via face-to-face verbal conversations, telephone calls or text messages underpins the trade relationship between customers and suppliers (Amoako, 2019; Amoako and Matlay, 2014; Lynch, 1994;1999; Lyon and Porter, 2010; 2009; Eskola, 2005). However, these vague non-binding contract relations between the local broker and wholesaler buyer (no third-party witness) give rise to opportunistic behaviours by external and wholesaler buyers towards the local broker leading to exploitation and waste production (chapter 6).

c) Wholesale buyer (aggregator)

In the avocado production regions, the majority of the avocados are sold at rural-urban makeshift wholesale markets to wholesale buyers who aggregate the avocados from local brokers and farmers and transport them to regional markets in larger cities and urban towns. The locals (men and women) in the production areas are involved in the long-distance wholesale trade. However, male wholesale buyers dominate this segment of the supply chain because men who start as local brokers can leapfrog faster than women and, also men tend to have more capital than women counterparts as observed in other horticulture supply chains (Juma *et al.,* 2019; Lynch, 1999) and in other part of SSA (Lyon and Porter, 2009). Most wholesale buyers are local brokers who have leapfrogged as their trading capital increases, developed relations, and built trust with agents in the regional markets. Like the local brokers, they use their own capital to buy the avocados for onward selling to bulking market agents (*dalali*) in the regional markets. The transactions and sales agreements are primarily through oral contracts and transacted over the telephone – where quantities to be delivered and the price is agreed upon (Mwakalinga, 2014; FAO, 2010; see also Akyoo and Lazaro, 2007).

Besides procuring the produce with their capital, they also pay for the transport and labour costs (packaging, loading, and off-loading). A wholesaler buyer may supply several agents and retailers in a regional market. They are paid after the *dalali* have finished selling the consignment, therefore having a trustworthy *dalali* is critical for success (Lyon and Porter, 2010). The social relations, power imbalance, between wholesale buyers, agents (*Madalali)* and the practices embedded in the trading relations provide essential insights in understanding how losses and waste is generated, which has hitherto not received much attention in food waste studies (see chapter 6).

d) External / long-distant traders

The external or long-distant traders are wholesale buyers (see above) - they are inter-regional traders who collect avocados consignments from local brokers at the rural-urban market centres directly (in person). Interviews with traders in the Kilimanjaro region identified seven primary sources of these traders, namely, Dar es Salaam, Tanga, Dodoma, Arusha, Iringa, and Morogoro and Kenya. Other researchers have reported similar external or distant traders in the local avocado supply chain (Juma *et al*., 2019; Mwakalinga, 2014) and species trade (Akyoo and Lazaro, 2007) and other horticultural products in Tanzania (De Putter et al., 2007; Lynch, 1999;1994).

e) Bulking market *Dalali* - Agent

This is typically a broker at the central urban markets in the larger cities that sells the consignment delivered to the market by the wholesaler or by the external trader to buyers (retailers, consumers, restaurants, hotels and juice markers/caterers and street vendors). These agents or *Mdalalis* do not own the consignment; they work on a commission basis. The brokerage terms are that the seller (wholesaler or external trader) and the *dalali* agree on the selling price, in this case, per sack bag (100 kg) of avocados, after which the *dalali* take over the possession of the consignment. The seller is paid after the consignment is sold to buyers by the dalali, whose commission is based on the difference between the two prices. Leading bulking markets in Dar es Salaam include Buguruni, Mabibo, Temeke Vetenari and Temeke Sterio. Trust is essential in this trading relationship as the *dadalis* do not operate with their capital (chapter 6).

f) Import and export.

Imports from Burundi and Rwanda supplement supplies in Dar es Salaam during the lean season (August – October) when supplies are low in Tanzania (Mwakalinga, 2014). These imports are usually undertaken by well-established bulking *dalali's* who have trading partners in those countries. Regional export of the local avocados to Kenya occurs on a small scale in Kilimanjaro.

g) Retailers (urban and rural).

Retailers – include supermarkets in big cities like Arusha and Dar es Salam but are primarily traders operating in traditional open-air retail markets or makeshift sheds or tabletop/stands or street vendors in residential areas and urban areas responsible for selling the fruits to the final consumer (hotels, restaurants/food caterers, street food vendors, juice makers.

The domestic avocado supply chain is faced with many challenges from production to distribution and marketing. Regarding production, significant problems include lack of improved seed, extension services, and pest/diseases, which impact losses and waste. At the same time, the supply system is faced with poor infrastructure. The key challenges are summarised in Table 4.5.

Table 4.5: Challenges in the domestic avocado supply chain

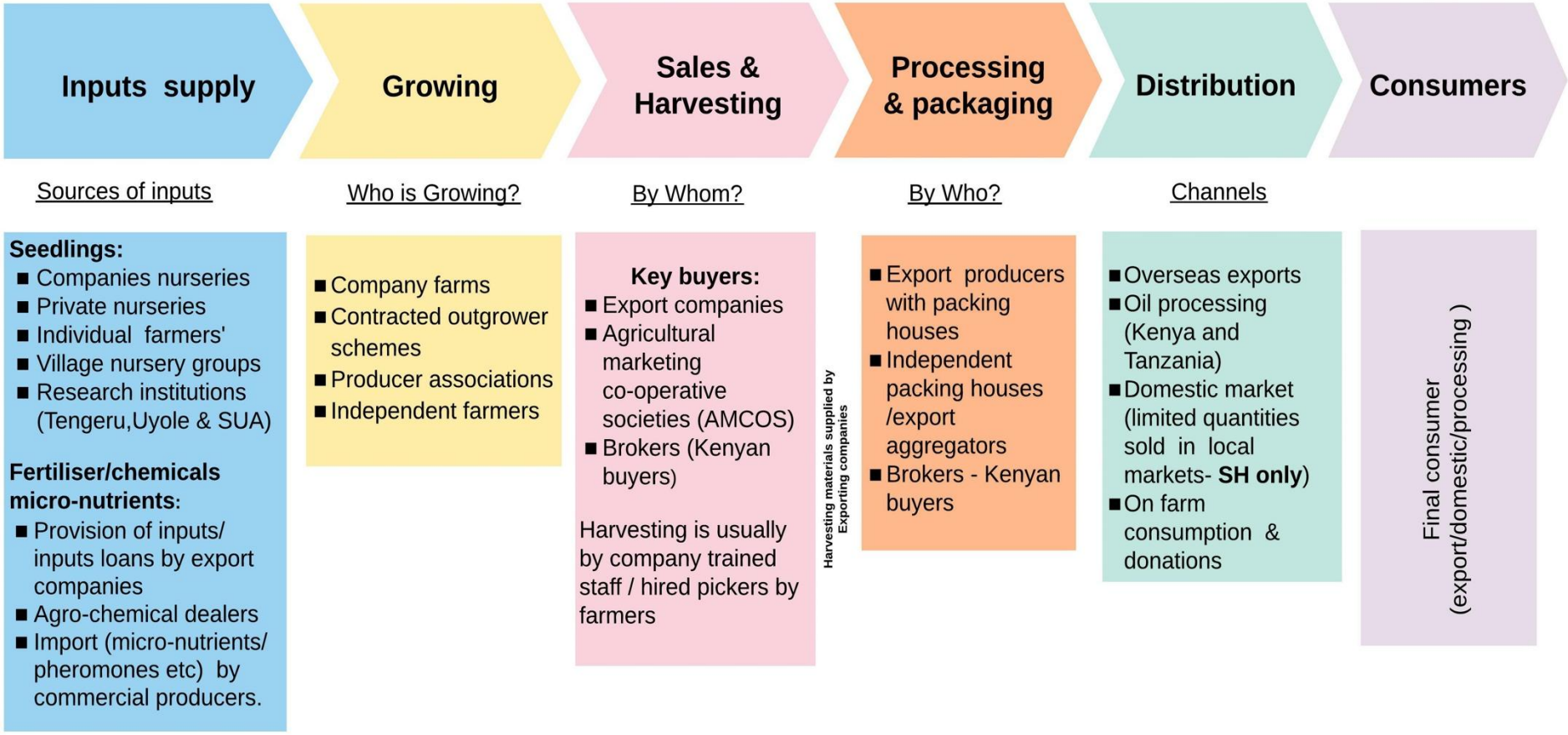
Areas	***Key challenges***
Production	• *No extension services* • *Lack of improved seedlings and planting material* • *Vulnerability to pests and diseases - especially Phytophthora root rot, sun blotch, anthracnose, red spider mite, false codling moth and fruit fly, which affect quality and quantity of produce*
Harvesting, packaging & distribution	• *lack appropriate harvesting tools and poor harvesting practices* • *Lack of grading system (absence of proper methods for sorting/grading of fruits* • *Limited knowledge and skills on harvesting and post-harvest handling of produce* • *Poor packaging material.* • *Poor or non-existence of market infrastructure/ total lack of cold-chain* • *Poor infrastructure and transportation system.* • *Lack of volume/weight measuring standards in the wholesale transactions* • *Delays on the road* • *Excessive market charges and taxes*

Source: Interviews and observations with elaborations from Juma *et al.* (2019) and Mwakalinga (2014).

4.4 The export avocado supply chain structure: The "Green gold".

Like the domestic avocado supply chain, the export avocado supply chain is characterised by low-level coordination and collaboration among the actors and faced with several challenges (TAHA, 2021; Juma, 2020; REPOA, 2018; Mwakalinga, 2014; Lynch, 1994). A general overview of key actors and the supply chain structure is presented in Figure 4.16 and Figure 4.17, respectively. Different marketing channels for producers are shown in Figure 4.18.

The Tanzania export avocado supply chain is structured into two chains (each with two sub-chains): 1) high-quality avocados (export grade) supplied through the international supply chains; 2) low-quality avocados (non-exportable grade or rejects) supplied through the domestic market (in the SH) and for oil processing (Figures 4.16 & 4.17). The export products must meet phytosanitary regulations and high-quality standards – size, shape, colour, ripeness, and appearance (Edewa, 2016; Coronado *et al*., 2015; Coronado, 2010; Stuart, 2009).



Source: produced by author based on interviews and observations March, 2020

Figure 4.16: General overview of the export avocado supply chain

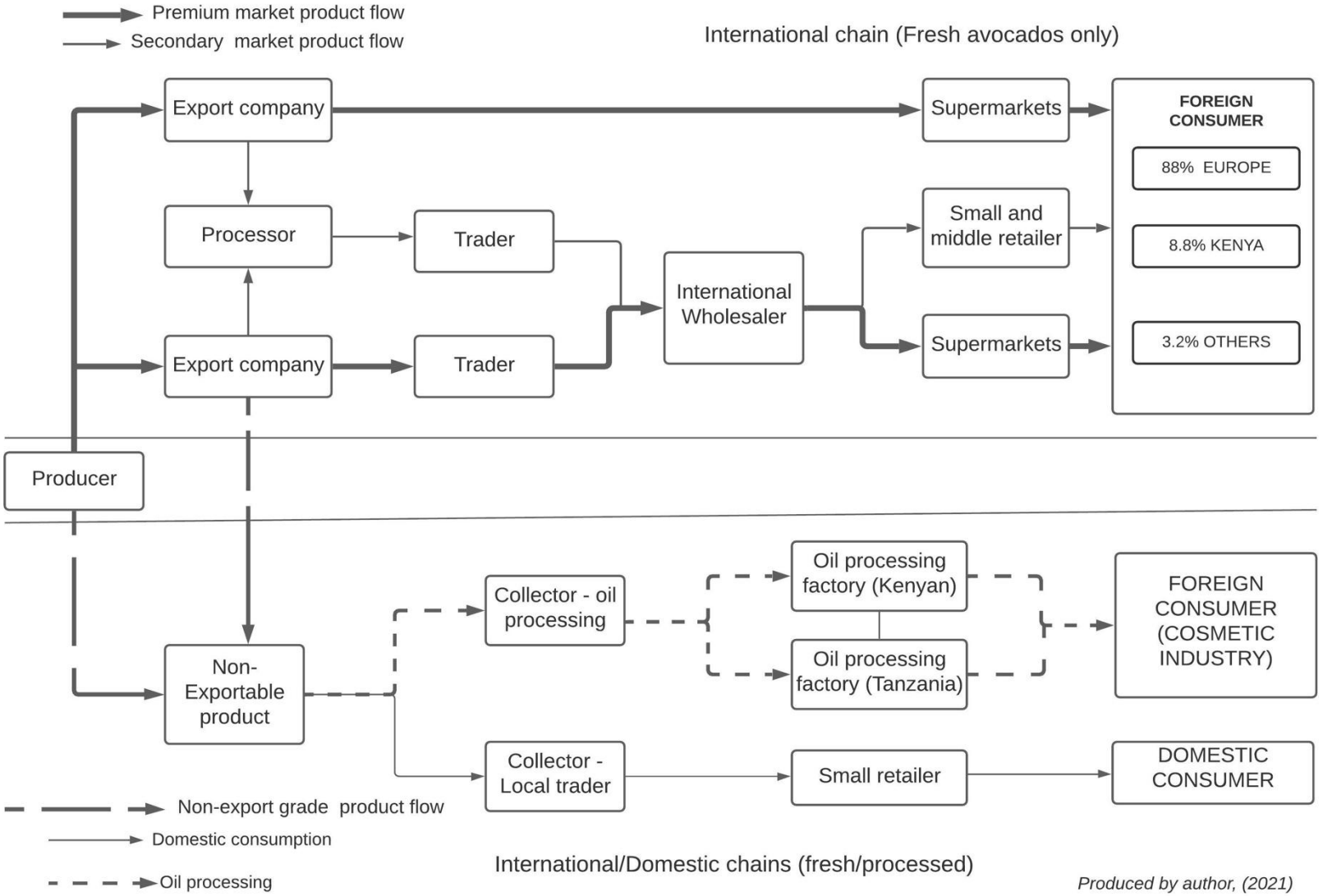


Figure 4.17: Structure of Tanzania export avocado supply chains. *Source: Interviews and observations*

From Figure 4.17 above, producers sell their product to export packers who operate two forward supply chain coordination strategies: a) exporters with direct forwarding integrated trading companies and b) packers who have established an alliance with export traders. As presented Figure 4.17, Tanzania's fresh avocado export supply chain consists of 'premium' markets - where exporters supply directly to supermarkets across Europe and 'secondary or wholesale' markets – where exporters supply to wholesale markets in Europe and in countries like United Arab Emirate, Middle East, and China. The structure of Tanzania's export avocado supply chain is similar to what has been identified by Barrett *et al*. (1999) in the Kenya's horticultural industry (fresh fruits and vegetables and flowers). Barrett and colleagues found that two supply chains operate in Kenya – the wholesale supply chain and the supermarkets supply chain. The wholesale supply chain which "links small and medium-sized growers into the export markets through series of agreements and contracts with growers, agents, exporters and freights agents" (ibid, p.164). The wholesale chain links growers to wholesale trade in UK where the produce is exported in bulk. They also observed that many of the links between the suppliers, importers are based on complex family connections, akin to what pertains in the domestic avocado supply chain where family connections, kinships, friendship, and close networks are essential for the maintaining trading relations.

In the case of the Tanzania's export avocado, the exporters operating wholesale chain are largely, a group of small and medium size packers/packhouses – see Table 4.6) who have close relations with trading partners (importers), which ensures the flow of market information - demand for a certain quality and quantity, prices, and customers requirement (Coronado *et al*., 2015; Coronado, 2010) and supply mainly to the secondary wholesale markets in the EU, UK, Asia, and other countries where certification and standards requirements are less strict (Barrett *et al*., 1999). These exporters/packers have agreements and, in some cases, written contracts with the importers based in the importing counties and are dominated by bulk loose sales rather than prepacks (according to size).

The premium or supermarket chains comprise mainly of large-scale commercial growers and exporters - export producing companies (e.g., Africado ltd and RAC, see table 4.6) which might be termed 'partially integrated' or 'fully integrated' systems - produce, process, and sell (Barrett *et al*., 1999, p.166; see also Gereffi *et al*., 2005; Gereffi, 1999; FitzSimmons 1986; Friedland *et al*., 1981). The fully integrated chain is characterized by the production, exportation and freight handling being controlled by one company (Barrett *et al*., 1999). These export producing companies have acquired the required phytosanitary standards, private and supermarket specific standards and certifications (some have more than six different certifications) and therefore directly

supply supermarkets (see Appendix 5.1 detailed certifications schemes). Supplying directly to supermarkets offers premium prices, but occasionally these companies also supply the wholesale markets with depending on the season and market conditions. The partially integrated chains are large-scale independent producers who have set up small-scale packhouses to export their produce but also buyer for smallholders (example of these packers include Lima Kwanza ltd, Kibidula farm ltd – table 4.6). The large-scale farms in the premium market chain use high technology most of it imported, in order to achieve high yields of uniform-quality produce, as demanded by the supermarkets (Barrett *et al*., 1999)

The second sub-structure of the export avocado supply chain involves the supply of non-export grade fruits to oil processing companies in Kenya and Tanzania. However, only a limited amount of non-exportable avocados is traded in the domestic market (mainly in the SH). There is a lack of general acceptance of export variety (Hass) in the domestic market because of its size and appearance (Field Journal, 2018; 2019; Mwakalinga, 2014) which present important challenge in terms of losses and waste generation.

a) Growers of the "green gold."

The export avocado production is driven by large commercial farmers (responsible for about 60 - 70 per cent of production), supported by smallholders and medium-scale farmers (Table 4.5). In the last five years, there have been significant increases in medium-scale and smallholders' production, with over 10,000 farmers engaged in the export avocado production (TAHA, 2021; Field Journal, 2019). There are four categories of growers: 1) elite growers[47] (include export companies with commercial farms and other commercial farmers; 2) out-grower schemes managed by exporting companies; 3) producer associations (farmer groups and cooperatives); and 4) independent farmers (Figure 4.16 & 4.18). Through horizontal and vertical coordination, farmers (commercial and smallholders) are integrated into the supply chain. Horizontal coordination involves producer associations with a membership structure, where the group negotiate on behalf of the members (chapter 7). The second and the most popular way farmers are integrated into the supply chain is through vertical coordination via contract farming (Gereffi 1999; Barrett *et al*., 1999; Eaton and Shepherd, 2001; Little and Watt, 1994). Exporting companies operate two forms of contract farming: a nucleus farm model with a contracted out-grower scheme (most

[47] Elite growers include export companies with integrated commercial farms and other commercial farmers that employ state of the art technology. These farms have farmer managers, and agronomists and have access to external technical support outside Tanzania

predominate) and a centralised/out-grower scheme where the export company is not a producer [48]. These contracts lead to new forms of institutional arrangement, often with some degree of support (technical advice and support services - supply of inputs/loans) and a commitment from farmers to produce avocados at the quality determined by the companies.

b) The exporters/packers

In Tanzania's export avocado industry, there are 10 packaging houses owned by 8 different exporters and packers - 1 in the NH and 7 in the SH (Table 4.6). This is a fraction of approximately 382 packers reported in the Mexican avocado industry (Coronado *et al.,* 2015; Coronado, 2010). Among the 8 packers, 2 large packaging houses use advanced computerised and automated processing machines and have quality management systems like GMP, BRC and ISO quality standards (Table 4.6). These packers are vertically integrated with international trading companies like Westfalia fruits. The rest of the packers operate with minimum certification (i.e., GlobalG.A.P.) and source fruits from smallholders and large-scale independent farmers, although 3 of these processors source fruits from their farms.

4.4.1 Marketing channels

Figure 4.18 shows elaborated marketing channels for avocado producers depending on the product quality. Usually, contracted out-growers (smallholder and commercial) must sell their fruits to the export company with whom they have a contractual relationship. But sometimes farmers' side-sell to independent packers and Kenyan brokers – 'suitcase exporters' to create value (higher prices and prompt payment) for their product (chapter 7). Independent growers and producer associations sell their fruits mainly to independent packers and Kenyan brokers. Since 2016, a significant.

[48] Contract farming forms include centralised model or out-growers scheme, nucleus estate model, multiparty model, and informal model. With the centralised or out-growers scheme, centralised packing house exporters buy from a large number of small farmers and large or commercial farmers. The nucleus estate model is similar to the out-growers model except that the exporting company also manages avocado plantations or estates (The multiparty model involves comprise of private companies and statutory bodies working together with farmers, while the informal model as the name suggests usually involves individual entrepreneurs or small companies which make simple production contract with farmers on a seasonal basis. (Sivakumar *et al.,* 2009; FAO, 2010).

Table 4.6: Typical characteristics of packaging houses.

No. of packhouse	Capacity (tons/per)	Technology used/certifications	Main market destination	Companies	Operational Area
2	Large packers	▪ Implemented Good Manufacturing Practices (GMP) ▪ Industry-specific standards/certification systems (GlobalG.A.P. BRC, GRASP, Tesco's Nature, Albert Heijn protocol (AH), Sedex Members Ethical Trade Audit (SMETA)) ▪ Computerised and automated cleaning, sorting, packaging, and refrigeration equipment ▪ Cold rooms for colling/storing, and cold chain with atmospheric control containers ▪ No integrated farmgate cold chain ▪ Specialised personnel responsible for planning harvesting and production needs ▪ Trading department -vertically integrated with International Fruit trading and marketing company (Westfalia Fruits of South Africa)	Premium market in Europe (including the UK), Secondary markets in Europe, UAE, Middle East, China	Africado ltd. Rungwe Avocado Company (RAC)	Siha district (Kilimanjaro) – NH Rungwe district – SH
3	Medium packers	▪ GlobalG.AP certification ▪ Organic certification (some processors) ▪ Use mechanic equipment and develop activities manually ▪ Manual sorting and grading ▪ Cold rooms for cooling and storing ▪ No integrated farmgate cold chain ▪ Cold-chain transport ▪ Specialised personnel responsible for planning harvesting and production activities.	Organic market (EU) Some premium markets (EU) Secondary markets in Europe, UAE, Kenya, Zambia, Russia South Africa	Kuza Africa ltd Four Seasons orchard ltd. Tanzanice Agrofood ltd	Rungwe -SH Njombe – SH Iringa – SH
5	Small packers	Same as above	The secondary market in Europe, Russia	Lima Kwanza ltd Proganic ltd Kibidula farm ltd	Mobozi district – SH Rungwe district – SH Njombe rural dist - SH Iringa - SH Iringa (Mafinga) - SH

Source: Interviews and observations.

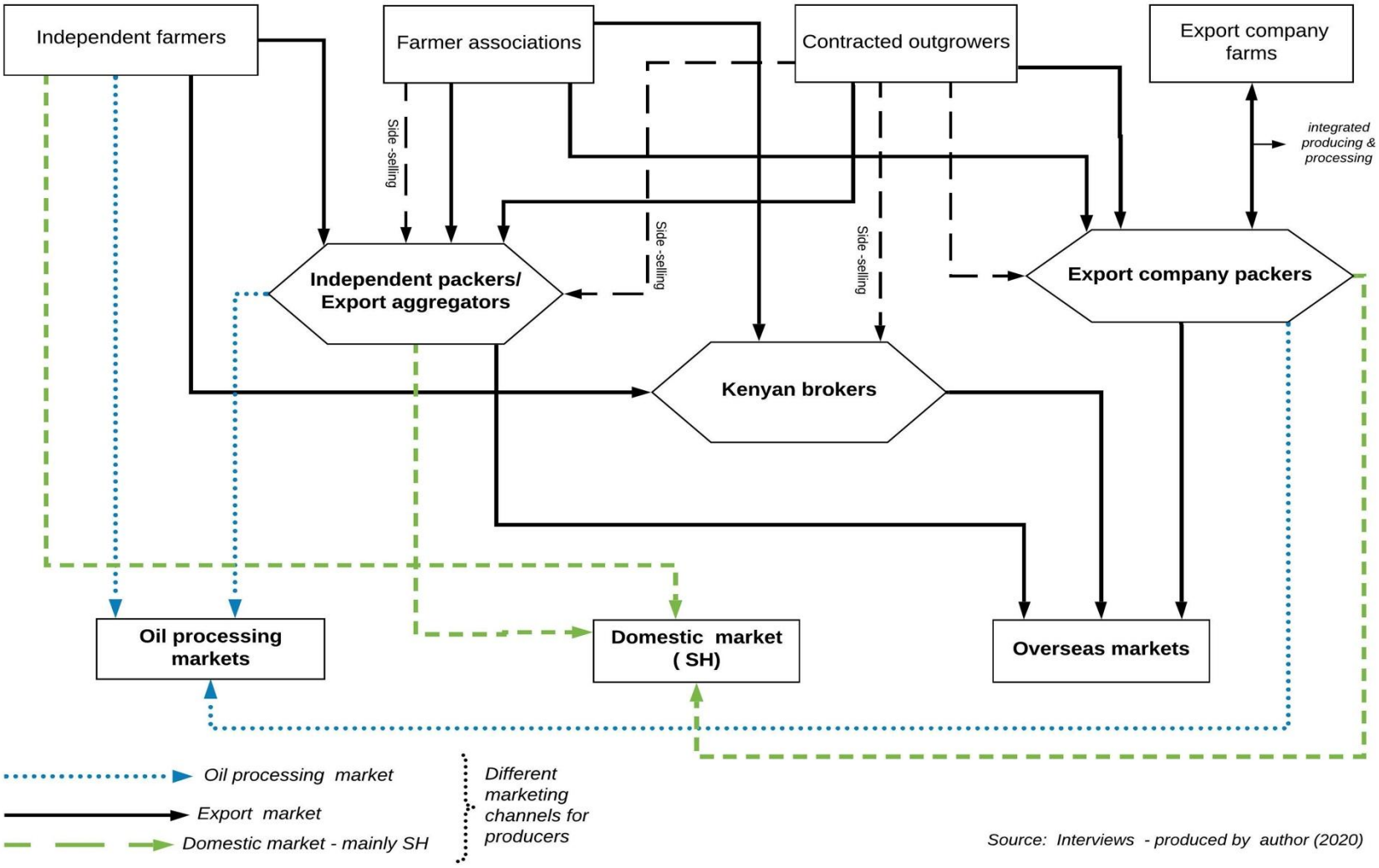


Figure 4.18: Export avocado marketing channels. *Source: Interviews and observations*

percentage of non-exportable fruits in the NH has been exported to Kenya for oil processing, although the market is not sustainable due to lack of capacity of the processing factories to take all rejected fruits from the packhouse in NH.

Before 2016 rejections from farms and packhouses were dumped, leading to food waste. In the SH, 3 large-scale avocado oil processing have been established recently, having started operation in 2019 (see Figure 4.3)[49].Although, two medium-size enterprises, Nzallacado oil company (SH) and Avomeru (NH), started producing avocado oil around 2013 and 2014, respectively, albeit at a micro-scale before scaling up. The selling and buying relations between different actors (farmers, producer groups and exporters) and how inequalities and power imbalance operate to generate waste in the production systems are examined in detail in chapter 7.

The export avocado supply chain faces many challenges due to a lack of coordination among actors and appropriate stakeholder support. A few studies have highlighted some challenges faced by producers and exporters (Ekka and Majwa, 2020; Juma *et al*., 2019; TAHA, 2020; REPOA, 2018; Match Maker Associate, 2017; Krymalowski *et al*., 2016; Mwakalinga, 2014). Table 4.7 summarises the critical challenges faced by growers, especially smallholders and exporters that impact losses and waste production. However, this thesis moves beyond these challenges to unpick how institutional arrangements between growers and exporters leads to new forms of social relations of production and how that influences agronomic practices and preharvest losses (chapter 5). But also examines how the social relations of buying/selling between farmers and export companies leads to waste production (chapter 7).

[49] Avomeru group – a social enterprise based in Arusha (NH) in 2014 started cooperative oil extraction with farmers in Aromeru and Meru Mountain areas. The group work with both local and export avocado producers to process rejects fruits into oil. Farmers in the cooperative are loaned a micro-oil processing machine and use percentage of the produced to off-set the cost of the machine. https://www.youtube.com/watch?v=iMoxSYyU_cg ; https://www.facebook.com/Avomerugroup/. Nzallacado oil company located in Iringa (SH) produce export avocado variety (Hass and Fuerte) on 8.1 hectares, started manual micro-oil extraction in 2013 faced with inability to sell their produce to the local market. In 2016, the company acquired a new 20 tons capacity avocado oil processing machine, avocado oil firm adds value to farm produce. The Citizen. Available online:https://www.thecitizen.co.tz/tanzania/news/business/-smes-digest-how-local-avocado-oil-firm-adds-value-to-farm-produce-3390370. Also see https://www.freshplaza.com/article/9319233/tanzania-local-avocado-oil-firm-adds-value-to-farm-produce/ .

Table 4.7: Key challenges in the export supply chain

Production stages	*Challenges*
Production	• *High cost of investment to develop commercial farm (approx. 8,000 – 10,000 USD to develop a hectare)* • *Lack of access to good and certified seedlings and planting material/ high cost of seedlings.* • *Unavailability and lack of inputs/ high cost of inputs (fertilisers, micronutrients, manure, and chemicals)* • *Lack of access to water irrigation* • *Lack of access to electricity and high cost of fuel (including electricity)* • *Lack of extension services.* • *Limited knowledge and skills in Good Agricultural Practices (GAP) among farmers (smallholders and medium-scale); poor record-keeping hinders GlobalG.A.P. certification and other voluntary certifications required for export production.* • *Vulnerability to pests and diseases - especially Phytophthora root rot, sun blotch, dieback, anthracnose, red spider mite, false codling moth and fruit fly, which affect quality and quantity of produce*
Certifications /regulations	• *High cost associated with certification schemes (private and public)* • *Limited local GAP auditing and certification organisation (in 2019, TAHA was accredited by GlobalG.A.P. as Licence Farm Assurance Company – now the only certifying body in Tanzania).* • *Duplicates of export certificates/documents and bureaucracy in the registration system*
Harvesting, processing, and export	• *Limited knowledge and skills on harvesting and post-harvest handling of produce.* • *Inadequate harvesting materials* • *High cost of packaging material (packaging materials are imported for Kenya)* • *Lack of equipped warehouses with packaging and cold-room facilities.* • *High operating costs for cold storage facilities – unstable electricity supply/high fuel cost.* • *Inadequate haulage and port shipping services limited storage facilities (cold rooms) to handle fruits at the seaports* • *Poor transportation and road networks and the rising cost of fuel.* • *Excessive export taxes/charges*

Source: Interviews with elaborations from SAGCOT (2019; 2021), Juma *et al*. (2019), Match Maker Associate (2017), Krymalowski *et al*. (2016) and Mwakalinga (2014).

4.5 Chapter summary

This chapter has discussed and chronicled the globalisation of avocado as a global superfood, its early dissemination around the world, the historical, socio-economic, and political context in which the crop was introduced to Tanzania and the supply chain structure for the domestic and export avocado production. In Tanzania, changes in cultural perception about avocados occurred due to increased education and awareness among the broader population in producing and non-producing regions, leading to the development of the domestic avocado chain. Different socio-economic and political dispensations shaped the two avocado production systems and supply chains. Tanzania consumers' taste and preference for the local varieties (bigger fruit size) reinforce the two distinct supply chains.

The rest of the thesis explores the complexity of the two production systems and their implications for food waste and inequalities. While the thesis discusses some of the challenges facing the supply chains, it moves away from the dominant view that focuses solely on technology and infrastructure as significant drivers for food losses and waste to highlight the interaction between materiality, practices, and institutions; and how social relations between the actors, and unequal power operate in both supply chains to produce food waste. Chapter 5 examines how the interrelationship between institutions and materiality shapes agronomic practices in the two different avocado production systems and its implications for pre-harvest losses and waste generation. The institutional and material context in which harvesting, selling, grading, and distribution practices occur in the domestic supply chain and how value creation, risk avoidance strategies, and power relations manifest in these practices to produce losses and waste are examined in chapter 6. Chapter 7 focuses on the export supply chain to investigate how agreements and social relations between farmers and exporters shape selling/buying relations; and how an imbalance of power, value extraction and inequalities leads to food losses and waste production.

Chapter 5

Institutions, materiality, and agronomic practices in Tanzania's avocado production systems: implications for pre-harvest losses.

5.1 Introduction

This chapter builds on chapter 4 to understand how the relationship between institutions and materiality shapes practices of avocado production and losses in domestic and export avocado production. Understanding farm loss and waste in agricultural production has hitherto focused on quantifying 'how much and where' (Gustavsson et al., 2011; Parfitt et al., 2010) with little attention to 'why' - the role of institutions, materiality, and practices (Gille, 2013; Alexander et al., 2013). There is limited focus on the interaction and the interdependences of the drivers - interactions among the genetics of the variety, biological and environmental factors, and the agronomic management of the crop and how that leads to pre-harvest losses and waste. Most studies tend to be single focus – biological and environmental, or agronomic and management practices. More so, there is little attention to the role of underlying systemic drivers from the wider supply chain, governance, and cultural factors on pre-harvest losses; and how power imbalance impacts farm losses (WWF-UK, 2021; HLPE, 2014; Gille, 2013; Alexander *et al.,* 2013). Understanding how cultural factors – norms, values, and framings (about the crop grown), food safety and quality regulations and standards shape agronomic practices and the implication for farm losses and waste has not been adequately investigated.

The chapter argues that consideration must be given to the dynamic relationship between institutions, materiality, and agronomic practices to understand why losses occur during avocado production. Institutions, be they rules, regulations, instructions, guidelines, norms or values, structure how planting and crop management practices are enacted, and what materials are drawn upon to perform tasks and activities. In the same way, materiality – nature and environmental factors, as well as the variety of avocado that is grown, also structure how practices are carried out. The dynamic interrelationships between institutions, materiality, and agronomic practices reveal that pre-harvest losses and waste during production are due to their interdependences and combined forces. Farmer's cultural norms, historical framing and values derived from the crop were found to strongly influence crop management practices. Taking institutional and practice perspectives helped analyse new forms of social relations

of production and how power imbalance experienced by farmers leads to pre-harvest losses in export avocado production.

The chapter starts with domestic avocado production; it discusses the institutions and materiality – values, cultural perceptions, and the growing conditions within which the tree thrives. It then analyses how these have shaped agronomic practices (section 5.2) and the implications for pre-harvest losses (section 5.3). Similarly, the chapter explores how rules, regulations, instructions and guidelines, and materiality shape the agronomic practices of export avocado (sections 5.4) and their implications for losses (section 5.5). Furthermore, it examines how the involvement of smallholders result in new institutional arrangements are used by exporters to and how these arrangements control growing practices (section 5.4).

The local avocado production system section draws on-farm visits and interviews with smallholder farmers, key informants, and broadly on 'go-along' ethnographic observation with local brokers (during harvesting events) as part of the fieldwork conducted in the Kilimanjaro region. The export avocado production findings are based on-farm visits and interviews with farmers (smallholders and commercial), key informants, and industry stakeholders in Kilimanjaro, Mbeya and Njombe regions to highlight specificities in agronomic practices that exist in the export avocado supply chain. Finally, the chapter concludes with a comparative discussion to illuminate how different value(s) underlying the different production system shapes agronomic practices and pre-harvest losses (section 5.6). Section 5.7 provides a summary of the chapter.

5.2 Materiality and institutions: Local avocado production system

> *On the 18th of June 2018, I was on a farm visit to Rombo to interview farmers and observe the harvesting practices for the local avocados. It was cloudy; as I travelled from Njia Panda village (where I stayed) in the lowlands of Moshi rural, through the Midlands to the Highlands, the thickness of the fog increased along the slopes of Mount Kilimanjaro. I could hardly distinguish the mist from the sky. There was much humidity in the air, and the temperature was cold, typical of Kilimanjaro cold months (June - August). As I walked on the Mountain's slopes from farm to farm, I came across avocado trees of different ages; some over 80 years old, some 40-50 years. The average age of a young avocado tree was between 25 - 35 years. In some villages and farms, bigger and older avocado trees have a few young avocado trees growing under and around them; also, many younger avocado trees grew along some village roads and footpaths and around homesteads. Most of these younger trees had barely any branches on them. They had been harvested to feed the animals and for firewood. Most farmers I visited owned 2 - 4 trees, but a few owned more trees (about six trees). The mature and older trees were tall, about 20-30 metres, and had big trunks and broad crowns providing shade for houses, huts,*

coffee, and banana groves. The trees are randomly planted in the homestead and grow well in the natural environment (Field Journal, 2018).

The above vignette gives a portrait of the growing environment, the uses of the local avocado and how it is grown by farmers. To understand how cultural norms and values have shaped the agronomic practices for the local avocados, I look at the value of the avocado tree to the Chagga farmer. In this regard, both its economic value (fruit) and non-economic values - other uses of the tree – animal feed, timber, shade for coffee bushes and fuelwood. As discussed in chapter 4, since the late 1890s, Chagga farmers have adopted and planted the avocado as part of an agroforestry subsistence system[50], primarily for its multi-purpose non-economic values. Historically, the avocado 'fruit' has been viewed as something of "no value" and "butter for dogs" regarding it being "food" and 'its economic exchangeability' (Appadurai, 1986, p.3). These cultural norms and values regarding the fruit and its exchangeability and non-economic values have shaped the agronomic practices enacted by farmers (Sachs, 1992; Appadurai, 1986; Ilbery, 1983). These cultural norms and values have not changed even after the avocado has been accepted as part of the Chagga's and the national diet and gained economic value and exchangeability in recent decades (since the 1990s).

In a recent study by Mwakalinga (2014, p.36) on the local avocado value chain in Siha district (Kilimanjaro region), he reported that "for the past decades", farmers pruned avocado trees intensively to feed animals. However, as the value of the fruit in the local market increases, now they view the fruit as a source of [additional] income". However, the "inscription of no value" and the cultural framing acquired by the fruit or ascribed to it, is still a socially relevant feature in its current exchangeability; and perhaps will be so in the foreseeable future when compared with the advent of the export avocado. "Value is not an inherent property of objects [products] but is the judgement passed on them by people" (Appadurai, 1986, p.3). During an interview with farmers, traders, and opinion leaders while discussing how trading of local avocados started, many of them described it as having low economic value. This is exemplified in the quote below by one of the farmers:

"First, when we planted the local avocados, we planted it for food; there was no business [value] during that time, but in recent years, buyers come to the farm to buy the avocados from us, but the price is very low when compared with the export avocado variety[..]" [Male, smallholder, aged 60; PTK_EF_0087]

To put the above observation in context, it suffices to compare the economic value of local avocado and that of the export avocado. In 2018, one of the research participants, a female farmer in her late 60s, harvested 12 sack bags [approx. 1,700 kg] from five local avocado trees. Each sack bag was sold

[50] For hundreds of years the Chagga people of Kilimanjaro have developed an intensive agroforestry farming system – "*Vihamba*". Fernandes et al. (1984) provide a detail description of the agroforestry system, the different canopy levels and which crops are planted at each level. The average land size for the home gardens is about 0.68 ha -with a range of 0.2 to 1.5 ha

for 10,000 TZS– farmgate price (i.e., 120,000 TZS) (approx. 5.19 USD per bag; 51.88 USD for the 12 bags). However, she harvested 1000 kg from 8 of her 36 export avocado trees and sold them at 850 TZS (USD 0.37) per kilo, earning 850,000 TZS (approx. 367.46 USD) (Field Journal, 2018).

The historical framings, cultural norms, and non-fruit values (shade, fodder for livestock, timber, and fuelwood) of the avocado tree as part of agroforestry practices (Kitalyi *et al.,* 2013; Duesberg *et al.,* 2013; Fernandes *et al.,* 1984; see also Sachs, 1992) provide the basis for shared norms such as: "*just plant it, throw the seed there, and it grows by itself, you do not have to do anything*. These norms have shaped how agronomic practices are enacted and highlight farmers' attitudes to crop management. In the next section, I focus on agronomic and crop management practices

5.2.1 Agronomic practices: "just throw the seed there, it grows, and we expect to get the fruit."

5.2.1.1 Selection of seedlings and planting material

> *"[..]Regarding the local avocado, farmers do not buy seedlings, people just go to the market buy the avocado or take it from a friend or another farmer; you eat, throw the seed on the farm, and grow into a big tree and bear fruits* [..]" [*Male, smallholder, aged 67; PTK_ELF_0101]*

The above quote is a description by a retired veterinary officer and farmer while we discussed how the seedlings for the local avocados on his farm were sourced and planted. His description exemplifies how farmers source and select seedlings. The selection of seedlings and planting material is significant in agricultural production and is influenced by cultural norms, values, and farmers motivations (Sachs,1992; Ilbery, 1982). Since the local avocado is grown as part of agroforestry practice and subsistence production system, the selection of seedlings is not only influenced by fruit with 'excellent eating quality' (such as 'taste, fat content) and fruit size (Mwakalinga, 2014). But also, the multiple values derived from the avocado tree – shade, fodder, timber, and fuelwood as well as the intrinsic value of agroforestry practices (Kitalyi *et al*., 2013; Hemp and Hemp, 2008; Fernandes *et al.,* 1984)[51]. As examined in chapter 4, historically, raising seedlings has been driven by the agroforestry values of the avocado tree[52] rather than the economic value of the fruit. Sachs (1992) argues that smallholders in Africa and Asia select seeds (maize and rice) not based on yields alone; but on stability, resistance to

[51] Agroforestry involves the integration of several multi-purposes and shrubs, food and cash crops, and livestock on the same piece of land. For instance, Oktingati et al. (1984), undertook a plants inventory of agroforestry systems on 30 farms in 6 villages in the Hai district of Kilimanjaro (part of thesis study area), they identified 111 plant species, of which 53 were trees species including avocado, which they classified uses as edible fruit, shade, and fuelwood & timber.
[52] Varieties with potential for good height and canopy spread.

diseases and multiple uses – values from non-grain products "like straw which is used for making thatch, mats, fodder for livestock and fuel" (ibid, p.7). Lynch (1999), in his analysis of commercial horticulture in rural Tanzania, underscored the importance of ecological and social or cultural reasons in the selection of cooking vegetables among farmers.

The selection of seedlings, driven by the agroforestry system intrinsic value and other values of the avocado tree, has resulted in a loss of limpidness (fruit quality) of the local varieties due to uncontrolled and natural propagation with inferior quality varieties with lower yields, and poor fruit quality. Natural seed propagation has been reported as a common problem with subsistence avocado production systems in SSA due to its low economic value, no market, and trade of the fruit. For example, dissemination of mixed unimproved avocado varieties, which impact on marketability and waste, have been reported in Ethiopia (Biazin *et al.,* 2018; Megerssa and Alemu, 2013; Shumeta, 2010), Kenya (Wasilwa *et al.,* 2004) and Burundi (Hakizimana and May, 2018). However, it is essential to consider the non-economic values, which have equally shaped farmers' seedling selection practices (Sachs, 1992; Miller, 2008). The question is whose and what 'value' matters.

5.2.1.2 Crop management practices

Since the avocado is planted as part of the subsistence agroforestry system, the avocado tree is treated "like any other tree" in the agroforestry system (Kahurananga *et al.,* 1992). Farmers, village leaders and key informants described cultural practices of growing the local avocados as:

> "*We just plant it, throw the seed there, and it grows by itself*; you *do not have to do anything, you just leave it to grow - no irrigation, no fertiliser/manure or mulch"*.
>
> *"With the local avocados, we just plant it, it grows, and we expect to get the fruit"; but [..] for the new avocados you must take care of the tree, if you do not follow the instructions and take good care of it, the avocados trees will not grow."*

From the above descriptions, farmers undertake limited agronomic practices – only pruning the tree to open the canopy for other crops to thrive and allow the avocado trees to grow taller (Oktingati *et al.,* 1984; Fernandes *et al.,* 1984). The agronomic practices have been shaped by a combination of cultural norms, values (both economic and non-economic), the natural environment and the avocado varieties, and the agroforestry system that has been handed over through generations.

For the farmers (past and present), whether they undertake agronomic practices or not, the values from the avocado trees as part of the agroforestry system are realised (Biazin *et al.,* 2018; Oktingati *et al.,* 1984; Fernandes *et al.,* 1984; Sachs, 1992; Gasson, 1973). These practices have acquired "an organisational structure" and "continuity over time and space" (Schatzki, 1996, p.98–102; Giddens,

1984, p.2) that even when the avocado have gained some economic value, the practice of growing the avocado remains the same. They do not see the need to undertake any agronomic practices (like fertilising, mulching, irrigation, and control of pests and diseases) because of the low economic value for the fruit and the purpose of production. Ngowi *et al*. (2007) and Ngowi *et al*. (2001) have noted that under the agroforestry system, practices such as mulching, fertilising and irrigation are performed in growing other cash and food crops (coffee, maize, and other food crops). So, the agronomic practices applied are shaped by the purpose of production and the value of the plant to that purpose.

However, there is conflict in how different values shapes agronomic practices. On one hand, the non-economic values from the avocado tree do not require any agronomic practices to a greater extent. On the other hand, producing good quality fruits requires adopting better agronomic practices (Juma *et al*., 2019; Biazin *et al*., 2018; Mwakalinga, 2014). Because of the cultural perception of "no value or low economic value", farmers do not see the need to put in any effort regarding enacting agronomic practices that improve yields and quality. This view was shared by most farmers interviewed. For example, a retired veterinary officer who grows both the local and export avocados) articulated how the low value for the avocado shapes growing practices:

> *"The old varieties [local avocado], they are now marketable, but its market does not pay [..]. We do not grow [plant] them, and you do not put manure, mulching or irrigate it; it just grows by itself. You see that it is scattered on the farm. When someone comes and says we need the avocados, they buy it [..]. However, the price they pay you is very low, so we do not take [see] it as a business. However, because the tree is there, you just sell it" [Male, smallholder, aged 67; PTK_ELF_0101].*

Even though the avocado is now marketable, the relatively 'low value – market price' for the fruit re-enforces the cultural practices that the non-fruit values have shaped. Lynch (1999, p.180), in his study, noted that social and cultural reasons were more significant in farmers motivations for deciding to grow fruit trees. He observed that where a farmer inherited land with fruit trees already growing on them, most farmers left the trees to "continue producing without any form of husbandry especially where the fruit is not in demand [..] but where the fruit tree is important to the local economy, the trees are viewed as a valuable asset and looked after". Thus, we can see two value rationalities here. Farmers' value of the fruit is inconsistent with commercial production value. These two systems will demand different production practices that impact the fruit's quality, quantity, and monetary value.

Besides the cultural norms and values discussed above, the materiality of local avocado varieties and climatic and edaphic conditions[53] also significantly shaped agronomic practices. As one female farmer stated:

> "*When I was young, my father planted two avocado trees…because the weather was good, the avocado trees bore many fruits, and the fruits were big sizes" [Female, smallholder, PTK_LF_0121].*

Farmers also mentioned that the local varieties are more tolerant to drought and diseases, such as *Phytophthora* root rot (Griesbach, 2005)[54] therefore, there is no need to irrigate or mulch the trees. Similar views shared by farmers have been reported by Mwakalinga (2014)[55]. Therefore, farmers' have built specific forms of knowledge - ways of understanding, knowing how, regarding practices of growing the local avocados – "a specific social practice contains specific forms of knowledge" (Reckwitz, 2002, p.253). An understanding and know-how which is historically and culturally ingrained in Chagga agroforestry systems. This way of understanding is collective and shared knowledge as was expressed by participants in - norms like: *"you just plant it", "you do not do anything to the tree", "it grows by itself"*, which defines the acceptable ways of growing the local avocado. The effects of agronomic practices on preharvest losses (from a valorised perspective) are discussed in the next section.

5.3 Implications for pre-harvest losses.

Losses in agricultural production occur at different points within the production process and can take different forms – loss of potential yield, reduction in yield, reduction in quality and loss of resources used in the production (Johnson, 2020; Johnson *et al*., 2019; FAO, 2019b; Florkowski *et al*., 2014; HLPE, 2014). First, from an economic value perspective, because farmers do not undertake agronomic

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[53] An essential criterion for a good avocado soil is that it must have "fast internal drainage and aeration" (Wolstenholme 2002, p. 82). The upland volcanic soils in Kilimanjaro and other highlands areas are generally fertile and well-drained with medium texture or water holding capacity (Fernandes et al., 1984; De Pauw, 1984; see also Young, 2016) making them ideal for growing avocados (Ben-Ya'acov and Michelson, 1995). The local cultivars – West Indian varieties have average water requirement, while the Mexican varieties have low water requirement, albeit at a higher elevation with low temperatures (Wolstenholme, 2002; cf. Gaillard and Godefroy, 1995). The variations in elevation, temperature and rainfall provide a natural environment for the different local cultivars to thrive. For instance, although the West Indian varieties are native to tropical lowlands climates with altitude 100m - 450m a.s.l, is adaptable to warmer humid tropical highland climates with higher temperatures and humidity (Wolstenholme, 2002 cf. Storey et al., 1986).

[54] The local varieties are more resistant to Phytophthora root rot, local varieties are used as rootstocks to raise seedlings for export varieties (Field Journal, 2018), a similar case has been reported in Kenya by Wasilwa et al. (2004).

[55] The West Indian varieties are native to Colombian lowlands (tropical lowland climate) at 100–450m a.s.l with mean annual temperature of 28.0°C, annual rainfall 1100 - 1500 mm and five months of winter/spring dry season. The Mexican varieties are native to "elevated montane forests" of Mexican subtropical highlands at 1400m-2700m a.s.l., with mean temperature averaged 15.9°C, and rainfall 860 mm with 6–8 months winter/spring dry period (Wolstenholme, 2002; cf. Storey et al., 1986).

and management practices related to irrigation, mulching, and fertilising, it results in loss of yield potential and reductions in yield and quality. Cultural practices of irrigating, mulching, and fertilising during production improve fruit yields and quality – visually, nutritionally, and in terms of size. Loss of potential yield among smallholder local avocado producers is estimated at 50% due to flower and fruit drop (Juma *et al*., 2019; Mwakalinga, 2014). Flowering and fruit development coincide with the dry season in Tanzania. Therefore, adequate irrigation and mulching are needed to prevent loss of soil moisture which reduces stress on the tree during fruit development, boosting yield and improving fruit quality (Bender, 2012; Bender and Whiley, 2002; Gazit and Degani, 2002; Wolstenholme, 2002). Moreover, avocado requires some 12 nutrients (macronutrients and micronutrients; see section 5.4.2) to be in the soil to produce good yields and quality fruits. Micronutrients have been noted to improve fruit quality and marketability and reduce fruit drops (González-Gervacio *et al*., 2019; Minchin *et al*., 2012; Bell and Dell, 2008; Wolstenholme, 2002).

Secondly, due to cultural norms and values, farmers do not undertake sanitation and insect pest control practices. Avocados are infested by many pests and fruit fungal diseases (major ones are thrips, false codling moth (FCM), fruit flies, scales, anthracnose, scab, and Cercospora fruit spot), which reduce yield and fruit quality. For instance, Odanga *et al*. (2017) found that during the avocado flowering (August – October) and fruits development, the population of common blossom thrips is very high among smallholder avocado production in the Kilimanjaro region; and the young fruits are infested by FCM[56] (Odanga *et al*., 2018; 2020; Grove, 2018; Ware *et al*., 2016; Grove *et al*., 2000). Once fruits are infested, they will either drop before they reach maturity or leave black scars (triangle-like) on the skin of the mature fruits, thereby reducing yield and affecting marketability (Ware *et al*., 2018; 2016). However, as Odanga *et al*. (2017; 2018; 2020) pointed out that among smallholder avocado growers in Tanzania and Kenyan, pest-infested fruits that drop are left on the field instead of removing them. The shared cultural belief among farmers is that the fruits will "return manure to the soil". The cultural norm of unharvested crop left on farms or tilled under, to return manure back to the soil have been reported in some studies in the global North (Soma *et al*., 2021). However, the practices as observed in this study creates a vicious circle of insect pests multiplying and infesting more fruits.

Thirdly, losses and waste occur if the varieties planted are maladapted to domestic market requirements - eating quality (creaminess and oil content) and size. For instance, during a harvesting event with local

[56] FCM, which is common to Sub-Saharan Africa, attack the immature avocado fruits by laying its eggs on the fruits. Once the egg is hatched, the larvae burrow tunnels beneath the fruit skin where it further develops, before dropping onto the ground to pupate under leaf litter. In Kilimanjaro, the peak population distribution of FCM has been reported to coincide with avocado fruit development (Odanga *et al.,* 2020, p.12-13). In the same way, insect pest 'scales' causes fruit drop, while fruit flies cause a distinct star-shaped crack on the skin surface of mature fruits reducing quality and yields.

traders, avocado varieties that produce fruits with higher water content were not harvested, and those that produce smaller fruit sizes though have good eating quality were also not harvested during the peak season due to low value (Field Journal, 2019 & 2018), leading to losses (HLPE, 2014; Megerssa and Alemu, 2013). Although economic exchangeability of the fruit and supply chain has developed since the mid-1990s (see section 4.4), many older trees/varieties planted several decades ago continue to dominate the landscape as part of an agroforestry system, which present structural and systemic problems leading to losses and waste generation. Lynch (1999) in his study of commercial horticulture in rural Tanzania reported that in Matombo and Lushoto districts, inherited fruit trees were left on farms unattended due low demand which resulted in large proportion of fruits been wasted on farms. For example, in Lushoto district, he observed that pears were grown as part of British colonial orders to produce temperate fruits for the growing expatriate population. However, after the expatriate left these trees remained in the landscape – due to low demand and the low value of pears, about 80% of what is produced is wasted on farms.

In the case of the local avocados in this study, the older trees and even much younger trees are propagated by seed, and the quality of varieties are lost. Juma (2020) and Juma *et al*. (2021) have reported high genetic diversity among the local avocado varieties in the SH. It has been established that avocados grown "from seed are of uncertain quality - not true-to-type"[57] (Griesbach, 2005, p.8). Importantly, as part of Chagga cultural norms and agroforestry practices, in protecting the Mountain and its environment, there is an adage, "do not cut down my trees when I die". Therefore, avocado trees that have been inherited from older generations are not replaced until the trees are harvested for timber or firewood.

In summary, to unravel nuances in pre-harvest losses and waste in agricultural production systems, there is a need to attend to how institutions and materiality shape cultural practices and how this might impact losses. Crucially important is how losses and waste might be locked in within the cultural and historical framing, norms, and value(s) (economic and non-economic values) and the production system in question (Miller, 2008; Graeber, 2001, Lynch, 1999; Sachs, 1992). In the case of the local avocado production, the historical and cultural framing of avocado – 'butter for dogs', 'no value', and other values from the tree, have shaped the agronomic practices. To farmers, the avocado tree means more than just the fruit but also its role in the social and cultural institution of the Chagga agroforestry system, which has been perfected and handed down the generations. Therefore, understanding losses at preharvest should not only be viewed within the prism of economic value; but through other values

[57] Avocados grown from seeds vary for example in their habit of growth, productivity, fruit quality and the time required before the trees start bearing fruit.

derived from the crop (Miller, 2008; Sachs, 1992; Ilbery, 1982; Glasson, 1973) [58]. Thus, the values that farmers derived from the crop affects what count as waste. This sheds critical insight on our understanding of how losses and waste occur at the farm level but also along the entire supply chain.

5.4 Institutions and materiality: Export avocado production system

5.4.1 GlobalG.A.P. and institutional arrangements for smallholders

The export avocado ("Hass variety") was introduced and adopted mainly for commercial production and economic value. The value is defined by quality rules, regulations, and guidelines determined by importing countries, international organisations, export companies, and packers (see chapter 4). Producing "good" avocados for export requires strict adherence to food safety and quality regulations and standards that mediate globalised food production systems (Gille, 2016; 2014; 2013; Smythe, 2009; Fuchs *et al*., 2009; Freidberg, 2004). These food safety rules, regulations and guidelines, and sanitary and phytosanitary (SPS) requirements come from supra-national organisations (FAO, WHO, EU), national regulations and supermarkets private certification schemes (Gille, 2016; 2014). Fresh fruit and vegetable exports are largely buyer-driven, and buyers determine the production conditions, consistency, and compliance to standards (Fuchs *et al*., 2009; Henson and Reardon, 2005; Morgan *et al*., 2006; Gereffi, 1994). A summary of standards and regulations that apply to export avocado production is presented in Appendix 5.1. These standards and rules affect the materiality of the production system, requires new investments, know-how and practical understanding, which creates new sets of uncertainties and dependencies for producers, particularly smallholders (Gille, 2016; 2014; Asafaw *et al*., 2007; Dolan and Humphrey, 2000).

At the production stage, the Global Partnership for Good Agricultural Practices (GlobalG.A.P.) standard[59] is the most commonly and globally accepted certification scheme by buyers and importing countries (minimum certification required for market entry). GloabalG.A.P. ensures that the production system meets quality and safety requirements, phytosanitary rules, traceability, environmental protection, and worker welfare required by importing countries and supermarket buyers (GlobalG.A.P., 2020; Kersting and Wollni, 2012; Fuchs *et al*., 2009). To supply certain supermarkets

[58] Nonetheless, during interviews and farm visits, some farmers growing the export avocado because of its economic value are dispositioned to replace local avocado trees with export varieties, especially when faced with space constraints and land access (Field Journal, 2018).
[59] GlobalG.A.P. is a pre-farm gate standard that defines the rules, guidelines and instructions that cover all processes of growing, from land preparation, inputs and application of inputs and agronomic practices, harvesting until produce arrive at the packaging facility

chains, large commercial producers and exporters must comply with the individual supermarkets' private standards like Tesco NURTURE, Albert Heijn Protocol, and other private standards like SMETA and BRC (Appendix 5.1) in addition to GlobalG.A.P. standard. However, complying with these standards comes with a high cost for both commercial producers and smallholders; and requires substantial investments, both capital and effort, in the production system (Reardon *et al.,* 2009; Maertens and Swinnen, 2009; Asafaw *et al.,* 2007; Dolan and Humphrey, 2000). It also requires a new institutional arrangement between smallholders and exporters (Holzapfel and Wollni, 2014; Kersting and Wollni, 2012) for GlobalG.A.P. certification[60].

The GlobalG.A.P. certification scheme requires smallholders and medium-scale producers to be organised into farmer groups – cooperatives or associations, either self-organised or through the exporting companies out-grower scheme. In this study, the export companies organise and manage smallholder groups for certification. This means the exporter manages the "Quality Management System (QMS)" for the out-growers (Holzapfel and Wollni, 2014; Kersting and Wollni, 2012, p.452). The implication is that the export companies own the certification and controls and determine the production requirements for farmers. This provides room for additional rules and instructions through which they exercise power and control over the production practices to meet their objectives of achieving quality and extracting value from farmers[61]. A sample of a farmer's contract and the growing manual is presented in Appendix 5.2. The exporting companies have a QMS team – an internal inspector and field officers who provide advice, training, and support to farmers and enforce compliance. Although farmers are not part of the QMS team, at the village level, there are 'lead farmer(s)' (in the case of NH) or 'village leader(s)' (in the SH) who coordinate group members and act as the focal point for dissemination of information between the QMS team and farmers. The type of institutional arrangement in place determines the sort of control that the QMS team wade over the production process of the farmers and what agronomic practices they can enact – see section 5.4.2 (Kersting and Wollni, 2012). In the next section, I discuss how the rules, regulations and standards shape growing practices in general and highlight the inequities in the production system due to the institutional arrangement between farmers and the exporting companies.

[60] GlobalG.A.P. has four certification options, option 1- individual certification (large producers); Option 2 - group certification which applies to smallholders, under options 3 and 4, individual farmers and groups can be certified as meeting an equivalent, national, or local (benchmarked) standard. Option 2 certification has become particularly important in developing countries since it allows smallholder producers to gain certification (Kersting and Wollni, 2012; Will, 2010), although there are debates among development researchers about the overall benefits of proliferation of food safety and quality standards for smallholders (Reardon et al., 2009; Maertens and Swinnen, 2009; Asafaw et al., 2007; Dolan and Humphrey, 2000).

[61] This is usually achieved through contracts, which set the terms of engagement with farmers (Field Journal, 2018; 2019). A sample of a farmer's contract and the growing manual is presented in Appendix 5.2.

5.4.2 Agronomic practices among commercial and smallholder farmers

5.4.2.1 Site selection and land preparation.

In commercial avocado production, as part of the site preparation, soil and water analysis are needed to determine macronutrients requirements and to decide on the pre-planting soil treatment as well as to establish the site history and risk assessment, as explained by a farm manager of an export farm:

> *"We take soil samples and send them to a lab for analysis; we are not so much interested in the soil micronutrients at the time of site preparation. We are more interested in the phosphorous (soil pH); if the pH is low, we fix it by adding lime. If the pH is normal but the Calcium is low, we add Gypsum. The soil analysis will allow us to know pre-planting treatment, whether we add agricultural lime, Gypsum, rock phosphate, or something else. Once these additives are added in, then the seedlings are planted, and the irrigation system is put in" [Male, farm manager; PTK_FM_0096].*

In high rainfall tropics and subtropical areas like the Tanzania highlands, the soils tend to be acidic (deficient in nitrogen and phosphorous), and lime is widely used to boost pH values in such avocado production regions (Gentile *et al.,* 2016; Griesbach, 2005; Wolstenholme, 2002). Soil pH level is essential for avocado production; the tree "perform well in soils with pH (H_2O) values ranging from 5 – 7" (Griesbach, 2005; Wolstenholme, 2002, p.85). Having the appropriate pH level in the soil increases yields improves fruit quality, and fights against *Phytophthora* root rot disease (Whiley and Schaffer, 1994; Whiley *et al.,* 1986). While export company farms and other large commercial producers (elite farmers) can afford soil analysis and apply pre-planting chemicals, not all growers can undertake soil tests and pre-planting soil treatment. The only pre-planting treatment that is allowed and recommended to smallholder farmers (contracted company managed out-growers and non-contracted out-growers) is to "mix the topsoil with one *debe* (20 kg per hole) of well-decomposed manure" (Appendix 5.2), which cannot regulate or increase the pH level[62]. In Kenya, smallholders are advised to add 250g of either Triple Superphosphate or rock Phosphate in the planting hole before refilling with topsoil - mixed with 20kg of manure (Griesbach, 2005; MOALF/SHEP PLUS, 2015).

5.4.2.2 Seedlings and planting material for the elite and masses

As part of the GlobalG.A.P. requirements, the seedlings and planting material must be "true-to-type" of the variety, sourced from a certified nursery with full traceability. In this study, two regimes of seedling and planting materials are available to farmers. Seedlings for elite farmers (sourced from

[62] Volcanic soils although rich in nutrients tend to be acidic and it has been noted that areas that support avocado production generally have acidic soils (Griesbach, 2005). It is advisable to have soil samples analysed prior to planting for pH, nutrients, and organic matter. Since most Tanzania soils are acidic and very often deficient in nitrogen and phosphorus and therefore PH levels needs to be regulated prior to planting by adding Calcium based fertilisers (e.g., lime) (Griesbach, 2005).

South Africa) and seedlings for 'other' farmers produced by export companies and private nurseries as indicated in the quote:

> *"On this farm, the variety of avocado is Hass. We purchased the seedlings from South Africa, and they are all* ***cloned seedlings*** *[..]. We have a great out-grower programme; we supply seedlings to out-growers at a subsidised price and then assist them with how to grow to take care of the trees; then they sell their fruit to us. The seeding we supply to the out-growers is* ***'a different type of plant'; it is Hass grafted on a wild [local avocado variety] rootstock****. Cloning involves two stages of grafting, being cloned; hopefully, the plant is cleaned through that tissue culture process" [Male, export company farm manager; PTK_FM_0096]*[63].

The advantage of having clonal rootstocks is that "there is little variation in the crop - similar tree sizes, flowers at the same time, and have high yield" [*PTK_COFM_0096],* have a high tolerance to *Phytophthora* root rot and salinity, which kills the avocado tree, and affects yield and fruit quality (Bender and Whiley, 2002; Pegg *et al*., 2002; Kremer-Köhne and Duvenhage, 2000). Recently (in 2017), some elite farmers expanded their orchards and planted a total of 205 hectares with a new 'Hass type' varieties - "Gem" and "Carmen Hass"[64] licenced by Westfalia fruit International and only an elite group of commercial growers are contracted to grow them through Westfalia Growers Association.

To expand avocado production to the masses through the out-grower scheme, a *"different type of plant"* is needed, something the poor smallholder farmers can afford. The seedlings are raised from the seeds of local avocado varieties (predominantly the Mexican and West Indian varieties) and grafted with Hass scions[65]. This provides a low-cost means of raising seedlings that are easy to propagate irrespective of their genetic variability (Ben-Ya'acov and Michelson (1995). Nevertheless, how the *"different type of plant"* is produced is essential. It must meet GlobalG.A.P. guidelines and rules to ensure seedlings are free from insect pests and diseases. In the NH, access, and production of the *"different type of plant"* is tightly controlled by the export company. All out-growers must source their seedlings from the company nursery as a pre-condition for membership of the out-grower scheme (Appendix 5.2). Thereby excluding farmers who cannot afford to buy seedlings from the company

[63]The first commercial orchards of 200 hectares (in the NH and SH) were planted with clonal seedlings from Westfalia fruit International in South Africa. Westfalia fruit have developed clonal rootstocks – Latas and Dusa as registered trademark, which has proven to show high tolerance to Phytophthora root rot and salinity. The Dusa clonal rootstock for example is proven to increase Hass yield substantially. https://www.westfaliafruit.com/for-growers/our-rootstocks/, accessed 28 May 2020. According to Bender and Whiley (2002) due to the severity of Phytophthora root rot in the humid subtropics of South Africa the industry has introduced nursery production schemes that provide growers with trees certified as Phytophthora root rot and sunblotch free.

[64] Gem and Carmen Hass varieties are trademark varieties marketed by Westfalia Fruit – Westfalia Technological Service (WTS). The gem was developed by the University of California, USA, and is a protected cultivar and can only be farmed and traded under licenced. WTS holds the exclusive worldwide Master licence for the production and trading of Gem avocado. While the Carmen®-Hass is licensed to WTS by Brokaw Nursery LLB, California, USA. WTS holds licence for its production in Africa, the Middle East and Brazil as well as its trade in the EU. See https://www.westfaliafruit.com/media-resources/cultivars/ ; for growers association https://www.westfaliafruit.com/for-growers/our-cultivar-clubs/ . Accessed 28 May 2020.

[65] Rootstocks of the West Indian race, have significant advantages of greater resistance to salinity and chlorosis, greater tolerance towards drought and nutritional deficiencies if Phytophthora root rot is not an issue. Mexican varieties are known to perform better against Phytophthora disease.

from joining the out-grower scheme. Farmers that were interviewed complained about the high cost of seedlings[66] and viewed the membership pre-condition as a form of control and exploitation. Even though the company approach ensures compliance with the GlobalG.A.P. full traceability requirement, it is a form of control over quality - to achieve some consistency in fruit quality and protect their market interest and reputation.

A less regulated or controlled approach was adopted in the SH to get more farmers to adopt the crop. Farmers were trained in how to produce *"different type of plant"* - "cheap seedlings", as expressed in the quote below:

> "*We had a training and grafting program in 2005 and 2006, so we run seminars to trained farmers how to graft, just to make cheaper seedlings. Not inferior seedlings, but something that they can afford. So, farmers can buy seedlings from the company or raise their own seedlings and then sell the fruit to the company. This makes the seedlings cheaper to the farmers" [Male, Manager of an export company; PTSH_MD_0129].*

For commercial and smallholder farmers, being able to produce their seedlings provides costs savings - especially for those planting tens to hundreds of hectares[67]. However, there are implications for the quality of seedlings. Avocado seedling breeding requires scientific and technical know-how to produce suitable quality planting materials (Newett *et al.,* 2002). Farmers and private nurseries owners lack education about common pests and diseases and the general physiology of the Hass cultivar – how to get quality scions and raise the seedling rootstocks, and sanitary conditions for seedlings (Schaffer and Whiley, 2002; Bender and Whiley, 2002). Because of a lack of education and practical know-how among private nursery providers and farmers, seedlings that are produced are possibly infected with pests and diseases. Unlike South Africa, which has developed strict protocols that registered nurseries must follow (Bender and Whiley, 2002) to ensure high-quality nursery trees, there is no national policy direction and regulation of avocado nursery production in Tanzania[68].

5.4.2.3 Irrigation practices

Traditionally, agricultural production among smallholders in Tanzania is rainfed. When additional irrigation is required, farmers irrigate using river or stream water, wells, and occasionally tap water.

[66]The seedlings produced by the export company is sold for 2.5 USD (TZS 6000) and 1.5 USD (TZS 3000) per seed to large farmers and smallholders respectively. During fieldwork, few smallholders have started raising their seedlings due to high cost and lack of access to seedlings from the company when they want to expand their farm. In the SH

[67] In SH the "cheap seedings" cost between 1.5 to 2.0 USD (TZS 3000 – 4000) per seed. Due to the high demand for planting materials in the Southern Highlands, private nurseries have become a lucrative business for nursery owners and smallholder farmers

[68] The Tanzania Seed Act 2003 provides guidance on seed policy, seed production systems, and regulate variety release and registration, implementation of such policy has not been done in the avocado industry. At the same time, this lack of regulation also opens-up access to farmers in a way that a more regulated system would not.

However, under GlobalG.A.P. requirements, farmers must irrigate with water that is laboratory tested (Appendix 5.2):

> *"We are advised to use clean tap water; we cannot use any other water. I have farrow water there, sometimes I regard it as not very good water, although the officers have not come to test the water. Sometimes I see some creamy substance in the farrow water; I do not know what it is. I would like to extend the pipe down there because my farm goes to the farrow so that I can irrigate trees in that area" [Male, lead farmer, PTK_ELF_0101].*

This presents cost implications and access challenges since not all farms have access to tap water, well water, rivers, streams, or springs. Per farmers' instructions and production guidelines, farmers must check soil moisture content before irrigating (Appendix 5.2). Nevertheless, not all farmers can determine the soil moisture correctly or even check it, which results in the trees either under irrigated or over irrigated and in some cases, not irrigated at all, which causes tree mortality (especially young trees):

> *"There are differences between the local and new [export] avocado because when we plant the local avocados, we just plant it, it grows, and we expect to get the fruit, but [..]* ***But for the new avocados, you have to take care of the tree; if you do not follow the instructions and take good care of it, the avocados trees will not grow. I planted 20 seedlings, but 5 dried up [died], I replaced them, and 3 died again. Now I have 16 trees. The seedlings died because of water; I was not irrigating. There was no water on the farm and my neighbour's farm, so it was difficult to irrigate, the trees need a lot of water 40 litres per week****" [Male, smallholder; PTK_EF_0082].*

Moreover, routinisation and normalising of the new practice of irrigating the avocado tree conflicts with farmers' normalised practices of irrigating other crops. Farmers must not irrigate directly at the bottom of the tree but at a circumference using the tree canopy as a guide. Adequate irrigation is critical during flowering and fruit setting to support fruit development since it coincides with the dry season:

> *"When the tree has flowers, you must irrigate the tree twice a week so that the tree does not lose the flowers. Also, when the tree has many fruits, you must irrigate so that the fruit does not drop. Even if the fruits do not drop, they will be very small in size, shrink and turn black, and not grow well.* ***For farmers who already have tap water at home, it is easy, but sometimes the day you want to irrigate, the tap water will not be available"*** *[Male, smallholder; PTK_EF_0074].*

Farmers must irrigate mature trees with 40 to 50 litres of water per tree/per week and 20 litres a week for younger trees. This requires significant farm labour and cost to enact irrigation practices depending on the number of trees. As expressed by a leader farmer who owns 45 matured trees and 20 young trees:

> *"I have tap water, but I cannot afford it, if I have to use tap water to irrigate, the bills will be too high for me to pay [..]; the weather has not been very favourable to those who cannot afford water; if you can afford water, that is excellent" [Male, smallholder; PTK_EF_0102].*

> *"[..] We have a problem, the main problem is water… because we use this tap water, you have to pay for the water, there is no local farrow from which we can get water" [Male, smallholder, lead farmer; PTK_ELF_0101].*

These views were shared by several farmers across different districts and villages in the Kilimanjaro region. Farmers who buy water from their neighbours leads to cost increases and dependence: "if you buy water from your neighbour when you need to irrigate, they will not be available, that is a challenge" [PTK_EF_0075]. The location of the farm (altitude, climate, and soil type) also impacts water demand; farms in midlands and lowlands zones have higher water demand than in highlands zones[69]. Thus, the blanket guidelines/instruction of irrigating 20 litres and 40-50 litres per tree a week (young and mature trees) does not meet water requirements for farmers growing in lower altitudes.

In the SH, particularly in Rungwe, farmers do not irrigate because they believe that the region receives adequate rainfall in a year (9 months of rain from November – July). Therefore, they do not see the need to invest in an expensive irrigation system. As indicated by a technical manager of an export farm while discussing the irrigation practices among growers in the SH:

> *"Our estate is irrigated by drip irrigation, but for the rest of the farmers, none of them can irrigate, so yield levels are low; they depend on what nature can help to provide" [PTSH_TMGR_0207].*

According to Juma *et al*. (2019), of 275 smallholders avocado growers surveyed in the SH (including Rungwe district) 98% of them depend on rainfall for their production. However, fruit setting and development occurs during the dry season (July – October), when irrigation is most needed to ensure increased yields and improved fruits quality (Bender *et al*., 2012; Lahav and Whiley, 2002). Krymalowski *et al*. *(*2016) reported that in Njombe, only young trees are irrigated, mature trees are not irrigated due to lack of access to water. In addition, the materiality of the growing environment – steep terrains inhibited irrigation practices in some villages.

5.4.2.4 Mulching practices

Unlike irrigation, mulching as a cultural practice is enacted by most farmers. The farmers use maize and sorghum stalks and trash, cut grass, and banana stalk and leaves as mulching material. Among commercial orchards, pruned branches of avocado trees are chipped and spread as mulch. For smallholders, obtaining mulching material is not difficult as they intercrop avocados with other crops and residues from these crops is used. Farmers that were interviewed underscored the importance of mulching - to preserve soil moisture, increase yields, improve fruits quality, and fruit size. Moreover, mulching plays a vital role; it increases bacteria and micro-organism activities, which fight against

[69] For instance, during a farm visit to a large commercial farm in the NH in August 2018, the 75 hectares orchard is set at a lower elevation and had installed micro sprinkler irrigation system. During season (July – October) the mature trees were irrigated 6 hours per week at a discharge rate of 50 litres per hour (i.e., 300 litres a week) and younger trees were irrigated between 2-3 twice a week at the same discharge rate.

Phytophthora fungus and provides "a well-aerated substrate and high water-holding capacity" needed for plant growth and production (Whiley, 2002, p. 231; Griesbach, 2005).

5.4.2.5 Fertilisers, nutrients, and pesticides management practices

> *"For the farmer to improve the exportable proportion of their fruits [production], the farmer must ensure that he/she produces clean fruit. To produce clean fruits … the farmer must follow a clear spraying programme" [Male, Technical Manager, Export producing company; PTSH_TMGR_0207].*

Growing export avocado requires following a regime of fertilisation/nutrients and chemicals or pesticides management modelled on the phenology of the avocado tree (Figure 5.2). At least 12 nutrients (6 macronutrients and 6 micronutrients)[70] must be available in the soils at different stages of the tree production cycle to ensure a healthy, productive tree. Table 5.1 shows a typical nutrients/fertilisers and pesticides/fungicides application regime on a commercial Hass orchard for a year. The application of fertilisers and chemicals requires practical knowledge, technical know-how and must follow strict rules and regulations to ensure safety and quality requirements as indicated by the export manager and farm manager:

> *"Yearly, before nutrients and fertilisers are applied, we do soil, leaf and water analysis using a recognised laboratory (in Tanzania and outside Tanzania). The laboratory results are then sent to agronomic consultant – Westfalia Technical Services (WTS) in South Africa, which then provides recommendations and guidelines of fertilisers and micro-nutrients to be applied" [Male Export manager, PTSH_TMGR_0207]*

> *"[..] Who authorised the chemical, when was it applied, was MRLs rules observed, is it within pre-harvesting intervals, are the personnel protected [right PPE], are they medically fit to do the spraying, (annual medical check-up needed), there is too much documentation for traceability and quality assurance" [Male, farm manager, PTA_COFM_0128].*

For commercial producers, "soil, water and leaf analysis cannot be avoided; it is crucial for GlobalG.A.P. certification" [PTK_COFM_0122]. This comes with a cost; for instance, a single sample test for soil, water, and leaf cost about 2000 USD (excluding consultant services), and more than one sample test is needed for a large orchard.

However, not all commercial growers can undertake these practices due to cost implications, technical know-how and lack of access to the approved inputs - most of the fertilisers and chemicals are "not registered in Tanzania", [PTK_COFM_0220] usually imported, limiting access to only big export farms and commercial out-growers. For instance, in the SH (Rungwe), some commercial farmers' have

[70] The macronutrients required are Nitrogen, Phosphorus and Potassium, Calcium, Magnesium and Sulphur. And micronutrients are Zinc, Iron, Manganese, Copper, Boron, and Chlorine (Bender, 2012; Griesbach, 2005). All nutrients must be available to the tree at the required amount or at least the minimum amount needed to ensure effective growth and yield (Bender, 2012; Bender et al., 2012).

an “orchard management service contract” with an export producing company, but fertilisers and pesticides are applied without test analysis because farmers cannot afford them. Besides, farmers depend on local agrochemical dealers who have little or no knowledge of the approved nutrients/fertilisers and chemicals for avocado production, which leads to misapplication of inputs - farmers “resort to trial and error” [PTSH_EF_0232].

5.4.2.5.1 Fertilisers, nutrients, and pesticides practices among smallholders

In the NH, smallholders are not allowed to use any artificial fertilisers/nutrients and chemicals as expressed below:

> *“Since I planted these avocados, I have never used artificial fertilisers or chemicals; we are instructed not to use it; we are only to use animal manure. The company has instructed us to use only manure; it has no chemicals, rather than artificial fertilisers, which contain many chemicals. For the animal manure, its origin is grass, so it is good.” [Female, smallholder, PTK_EF_0088*].

Some farmers stressed that there are consequences if you are caught using artificial fertilisers or chemicals: “the company will not buy your fruits, and you will be removed from the scheme” (Appendix 5.2). Although GlobalG.A.P. regulations do not prohibit artificial fertilisers and pesticide use among smallholders’ production, the export company does not permit their use among smallholders due to a lack of control, monitoring, and transparency. However, even the farmyard manure, which farmers are encouraged and allowed to use, is expensive for most farmers. In the SH, a ton of farmyard manure costs approximately “TZS 350,000 (approx. 153.71 USD)” (Juma *et al*. 2019, p.749). It can fertilise only 25 trees (40 kg per tree per year) – a quarter of an acre, Gentile *et al*., 2016), and the cost of manure can be more than TZS 1.4 million (612 USD) to fertilise an acre of an avocado

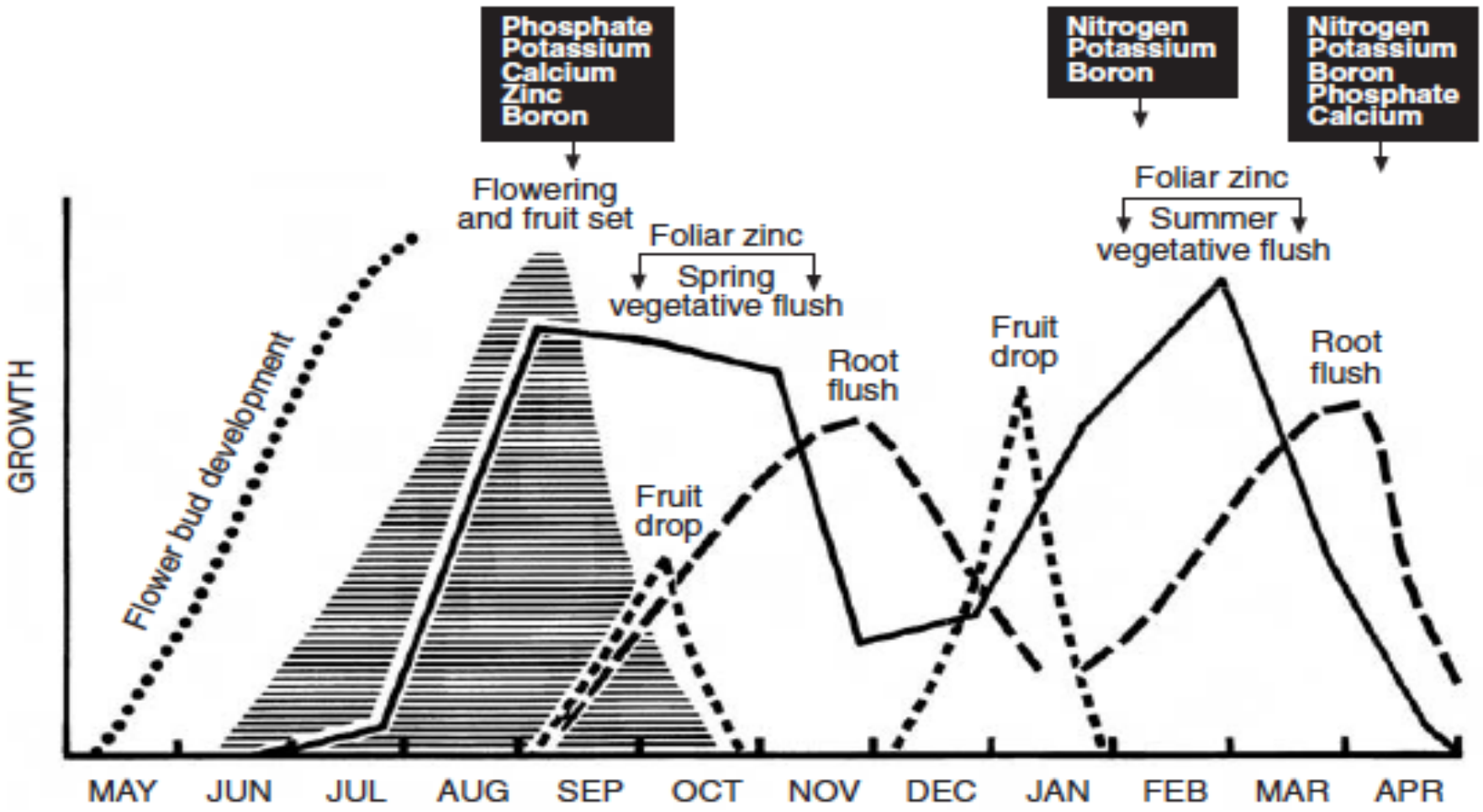

Figure 5.1: Phenology model for cv—'Fuerte" avocado. *Source: Adapted from Whiley (2002), cf. Whiley et al. (1988.)*

Table 5.1: Fertiliser and chemical (pesticides and fungicides) application on Hass Orchard –Export company farm (2018 -2019 crop year

Fertiliser & chemical types	*May*	*Jun*	*Jul*	*Aug*	*Sept*	*Oct*	*Nov*	*Dec*	*Jan*	*Feb*	*Mar*	*Apr*
Fertilisers/ Foliar			Boron (foliar)	Calcium ammonium nitrate	Calcium ammonium nitrate		Potassium sulphate	Calcium ammonium nitrate	Calcium ammonium nitrate	Calcium ammonium nitrate	Calcium ammonium nitrate	
			Potassium nitrate (foliar)	Calcium nitrate	Calcium nitrate			Calcium nitrate	Calcium nitrate	Calcium nitrate		
			Devisulphur (foliar)	Boron	Potassium sulphate			Potassium sulphate		Boron		
				Zinc sulphate								
Insecticides/ fungicides					Bullock	Runner	Copper	Copper	Chess			Copper
								Bullock				Runner
Plant growth regulator				UniQ								

Source: Interview

orchard in a year[71]. Besides, cow manure, the most widely used among growers, can provide only three of the six macronutrients - Nitrogen, Phosphorus and Potassium (Gentile *et al.,* 2016; Lesschen *et al.,* 2007). Thus, farmers do not fully benefit if the required quantities of all the nutrients needed by the trees are not available in the soil

In the SH, some export companies provide inputs loan contracts to smallholders where they supply fertilisers and undertake fungicides/pesticides spraying activities on behalf of the growers, and the cost is deducted from the farmers' harvest after sales (chapter 7). However, the "need to apply different micro-nutrients to a single tree many times (7 or 8 times)" [PTSH_TMGR_0220] (see Table 5.1) increases labour cost. Thereby disincentivising smallholders and some large-scale growers with limited knowledge and understanding of the quality requirements in the export market from undertaking fertilisers/nutrients and pesticides management activities that improve quality. Lack of limited access to inputs in other horticulture production in Tanzania has been reported in several studies. In avocado production, limited use of inputs among smallholder producers have been reported in Kenya (Oduol *et al.,* 2014) and Ethiopia (Biazin *et al.,* 2018; Shumeta, 2010).

Nonetheless, the institutional arrangements lead to new forms of social relations of production where exporting companies exercise control over the production practices of farmers with the explicit aim to control food safety and quality while protecting their market interest. In the case of out-growers in NH who are "not allowed" to apply any artificial fertilisers and pesticides. The blanket exercise of power protects the export company's reputation and reduces their risks - economic, biological, legal, and technological (Gille, 2013; 2014). Implementing standards and certifications transfer risks to growers which leads to pre-harvest losses and waste and create inequalities for farmers (Colbert, 2015; Feedback Global, 2014). In the following section, I discuss the implication of the rules and regulations and the institutional arrangement and agronomic practices associated with farm-level losses and waste.

[71] In Kilimanjaro most farmers keep animals as part of livelihood strategy, with majority of farmers owing 1-50 avocado trees, it is easy for them to meet some of the fertiliser needs. It is estimated a single cow can produce 1550 kg of manure a year which can fertilise 39 avocado trees – 40 kg per tree, if none of the manure is diverted to other crops (Gentile *et al.,* 2016; Lesschen *et al.* 2007). However, cost of manure can be expensive for medium and large-scale growers.

5.5 Implications for pre-harvest losses

Farm losses within the export avocado production system are necessitated by the interrelationship between institutions, materiality, and practices. Food lost in the production process can be loss of potential yields, reductions in quality, and losses during harvesting and grading (Johnston *et al*., 2019; Johnston, 2020; Kummu *et al*., 2012; Lundqvist *et al*., 2008).

First, there is a loss of seedlings or young plants due to how the seedlings are raised and agronomic practices relating to the planting process. Since the Hass cultivar is planted as grafted seedlings, it is more susceptible to diseases and pests (*Phytophthora* root rot), which causes tree mortality. Limited access to good quality seedlings and planting materials from certified nurseries at an affordable price has been identified as a bottleneck in the industry (Juma 2020; Juma *et al*., 2019; Mwakalinga, 2014). For example, in the Njombe region, farmers source seedlings from private nurseries: "there is a high percentage of mortality due to *Phytophthora* root rot" [PTSH_TMGR_0220], resulting in lower yields and poor-quality fruits. Seedling mortality is generally high among smallholders because of a lack of understanding of the required agronomic practices; farmers must follow specific instructions and guidelines (Appendix 5.2)[72]. However, farmers must break established cultural norms, knowledge, and know-how about growing the local avocado. As farmers internalised and routinised the new planting practices, they experienced fewer seedlings mortality. While some losses are preventable, the material environment also impacts plant mortality. Krymalowski *et al*. (2016) reported that farmers lost seedlings to frost and inadequate irrigation due to the terrain and landscape that makes it difficult to irrigate in parts of the SH – Njombe region.

Secondly, how agronomic activities such as irrigation, mulching, nutrients, and pest and diseases management are performed greatly influences pre-harvest loss, and loss at harvest and grading (Ramírez-Gil *et al*., 2021; Ramírez-Gil *et al*., 2019; HLPE, 2014). Mulching has been observed to improve yields and increase fruit size and fruit quality, increasing the packability of fruits (Whiley, 2002; cf. Wolstenholme *et al*., 1998; Moore-Gordon *et al*., 1997; 1996; Moore-Gordon and Wolstenholme, 1996)[73] . Increasing fruit size is vital in Hass avocado production to reduce rejections, as the variety produces medium and small fruit sizes (Wolstenholme, 2002; Bender and

[72] For example, the growing manual instruct that cow manure must not be applied to young trees (Appendix 5.2). However, it is the most common manure available to smallholders. Using manure which is not well decomposed create heat which damages the young plants.

[73] For instance, extensive studies in the 1990s, in South Africa, showed that by mulching Hass avocado trees with 150mm thick layer of composted pine bark, the mean fruit size increased by 12%. At the same time, mean yield per tree/hectare increased by 14.7% and 22.6% respectively (Whiley, 2002, p 233; cf. Wolstenholme et al., 1998).

Whiley, 2002; Newett *et al*., 2002). Thus, the nature of the cultivar is a potential cause of losses if the proper agronomic practices that support the production process are not performed. For instance, inadequate irrigation during flowering and fruit set leads to fruit drops and poor quality resulting in loss of potential yield at harvest. Drought, water shortages, high temperatures and cold temperatures have been reported to cause heavy flower and immature fruit drop among growers in the SH (Juma, 2020; Juma *et al*., 2019; Krymalowski *et al*., 2016). Losses are even more significant for farmers in lowland and midland altitudes because of higher temperatures and increased water demand. Besides, high fuel cost and unreliable/unavailability of electricity in some remote areas inhibit the use of pumps for well irrigation, impacting on losses (Ekka and Majwa, 2020; Juma *et al*., 2019; TAHA, 2019; 2018; SAGCOT, 2019; 2020; RAPOA, 2018).

Furthermore, inadequate and unavailability of inputs, the forbidden application of artificial nutrients/fertilisers, and pesticides coupled with inadequate knowledge and know-how result in high farm losses among smallholders and some large-scale growers compared to elite growers. As indicated below by senior staff of export companies:

> *"In terms of the general quality of the fruit, I can say our estate has the premium quality, followed by the commercial farmers…; the out-grower[smallholders] quality is on the low mark, it is still very far from the standard mark" [Male, Technical Manager, Export Producing Company; PTSH_TMGR_0207].*

> *"Fruit quality is an issue, with the out-growers [smallholders], they do get 50% of rejects of their fruits. Normally, commercial growers get between 20% to 30 % of their fruits rejected at harvest and grading. However, out-grower [smallholders] with lack of chemicals and inputs and lack of knowledge as well they get more than 50% of rejects" [Male, Managing Director, Export Company; PTSH_MD_0219].*

For instance, application of Boron reduces fruit drop, increases fruit size and yield, and improves quality – reduces deformity and misshaped[74], while Potassium and Calcium increase plant resistance to diseases, increase fruit size and quality (fruits cracking) (González-Gervacio *et al*., 2019; Ramírez-Gil *et al*., 2019; Minchin *et al*., 2012; Bender *et al*., 2012). Losses are higher for farmers growing in lowland altitudes because of inadequate soil nutrients and low organic matter, which reduces with decreasing altitude (Gentile *et al*., 2016; Jones *et al*., 2003).

[74] Boron application in the soil also increases fruit size, for example, in Australia, Smith et al., (1995; 1997) reported 11-15% increase in Hass fruit size and in South Africa, Bard (1997) recorded 10% increase in fruit size.

Moreover, lack of extension supports services impact practices. While the export companies and packers support farmers, this is inadequate[75]. At the government level, each ward in the district is assigned one extension officer - responsible for all kinds of farmers (some wards do not have extension officers). Further, these extension officers have limited knowledge about avocado production in general - traditionally, avocado has not been considered a valuable crop. Therefore, they cannot support farmers (Juma *et al.,* 2019; Krymalowski *et al.,* 2016; Mwakalinga, 2014). Lack of extension support services, education and training, have been reported in other export avocado producing countries as a significant constraint to smallholder production, including Kenya (George *et al.,* 2018; Mwambi *et al.,* 2016; Wasilwa *et al.,* 2004); Ethiopia (Biazin *et al.,* 2019; Faris, 2016; Shumeta, 2010); Burundi (Hakizimana and May, 2018) and in the Philippines (Sotto, 2000). Any losses, whether preventable or not, result in loss of revenue (Bara and Laing, 2020; Grove, 2019; Ramírez-Gil *et al.,* 2019; Ware and du Toit, 2018; Van Eeden and Korsten, 2013; Coates *et al.,* 2001).

Notably, the interaction between agronomic practices, environmental and edaphic factors do not only lead to preharvest losses but also post-harvest harvest losses. Post-harvest losses due to bruise damage; and diseases and disorders such anthracnose, stem-end rot, chilling injury, and lenticel damage in Hass avocado relate to different preharvest agronomic practices (Ramírez-Gil *et al.,* 2021; Ramírez-Gil *et al.,* 2019; FAO, 2019; Husseina *et al.,* 2018; Ferreyra *et al.,* 2016; Florkowski *et al.*, 2014; HLPE, 2014; Kader, 2002).

5.6 Discussion

This chapter has examined how the interdependence and interactions between institutions, materiality, and practices lead to preharvest losses and waste in the context of two avocado production systems studied in this research. The finding indicates that institutions (be they rules, regulations, instructions, guidelines, norms, or values) and materiality structure and shape agronomic practices in domestic and export avocado production. While norms, non-economic

[75] Contracted growers and non-contracted growers receive education and training, and advice usually delivered to the groups through the QMS team. However, this support and service is woefully inadequate. For example, the scheme in NH covers nine districts in three geographical regions, with over 2000 smallholders but has only seven field officers working with over 2000 smallholders. In the NH farmers who have young trees do not receive any visit in the first 3-4 years of the production stage (except group seminar). Besides, many of the farmers (90%) own less than ten trees which makes it costly for farmers to receive farm visits and advice from QMS teams, who tend to focus on farmers with more trees. In the SH, Juma et al. (2019) reported 73% farmers surveyed cited limited extension support service as one of the significant challenges affecting export avocado production.

values, cultural perception, and materiality of the avocado variety shaped the local avocado production practices. The agronomic practices for the export avocado production are shaped by formal rules, regulations, guidelines and instructions regarding food safety and quality and standards that mediate globalised food supply chains and the materiality of the Hass cultivar. Meanwhile, farmers' cultural norms, historical framing, and values derived from the crop strongly influence crop management practices and perception of what is regarded as a loss. Preharvest losses are non-existent in the context of domestic avocado production within agroforestry system, but losses occur in an economic or valorised production system (e.g., export avocado). The findings also highlight that farm losses in export-oriented production systems are shaped by safety and quality rules, regulations and standards, broader market structures, power imbalances, and inequalities. Integrating institution and practice perspectives helped analyse how new forms of social relations of production, and power imbalance leads to farm losses. From the forgone analysis and discussion of the empirical evidence presented in sections 5.2 - 5.5, key lessons can be drawn out to illuminate our understanding of the role of value(s) in agronomic practices and farm losses and interrogate the concept of loss (in a non-valorised production system).

5.6.1 Value(s), agronomic practices, and pre-harvest losses

From the analysis and discussions (sections 5.2 and 5.3), value(s) plays an essential role in how agronomic practices are defined and performed and their implication for farm-level losses (sections 5.3 & 5.4). In what follows, I discuss the role of value(s) to illuminate its effects on agronomic practices and pre-harvest losses in domestic and export avocado production.

In the context of the domestic avocado production system, agronomic practices are shaped by non-economic value (food, shading, animal feed, fuelwood, and timber) derived from the avocado tree, the socio-cultural and intrinsic value as part of agroforestry practice, and to some extent the 'no value' or 'low economic value' of the fruit. Lynch (1999) argued that cultural, social, and ecological reasons significantly shaped agronomic practices for fruit trees on inherited land or grown, especially where the crop has low value. How agronomic practices are enacted in agricultural production, have direct and indirect consequences for food losses. However, pre-harvest losses in agricultural production are often discussed without attending to the values that underlie the production and how it has been shaped. In the case of the domestic avocado production system, it is essential to look at pre-harvest losses in the light of cultural norms, low market value and other values derived from the avocado tree. If pre-harvest losses are viewed through the prism of non-valorised subsistence agroforestry system or non-economic values, as in this case, then the

concept of 'loss' requires further interrogation. For instance, farmers prune the avocado trees for a fodder, use immature fruits that dropped and mature fruits with scars and blemishes (harvest losses) to feed their animals.

Also, pest-infested fallen fruits that farmers cannot use as animal feed are left on the field to "return manure to the soil" (Odanga *et al*., 2018). Therefore, they do not see it as a loss of yield or reduction in yield because they are able to derive other values from it. This is where the relationality of the concept of 'losses' becomes pertinent. What is considered loss in valorised commercial production is not considered loss in a non-valorised production system that is engrained in a subsistence agroforestry tradition where every part of the production process is viewed as an essential and integrated part of the whole system (Biazin *et al*., 2018; Kitalyi *et al*., 2013; Hemp and Hemp, 2008; Kahurananga *et al*., 1993; Oktingati *et al*., 1984; Fernandes *et al*., 1984). For instance, if we view losses from a commercial production perspective, then the cultural practice where pest-infested fruits that drop and fallen branches are not removed but left on the farm to decompose would create a 'vicious cycle' leading to more significant losses. Infested fruits and dead branches harbour spores thus, allowing pests to breed and multiply and infest more fruits resulting in more losses and waste from a commercial perspective. Nevertheless, from the non-economic perspective, those fallen fruits return manure to the soil benefiting the avocado and other crops in the agroforestry system.

Conversely, in the local avocado production system, losses (loss of potential yield and reduced quality) can better be framed as loss of ecosystem services in the agroforestry system. Kuyah *et al*. (2019), in their meta-analysis of agroforestry practices across SSA, found that agroforestry reduces trade-offs between food production (crop yield as an indicator of ecosystem services) and soil fertility, erosion control and water regulation (as indicators of regulating/maintaining ecosystem services). They found that, on average, agroforestry systems in SSA increase crop yield while maintaining delivery of regulating/maintenance of ecosystem services (ibid). Moreover, Cerda *et al*. (2020) noted that among smallholder coffee producers in Costa Rica, agroforestry systems was the most promising for reducing losses in coffee production (yield and economic losses) and other ecosystem services: production of agroforestry products (bananas, plantains, other fruits, and timber), maintenance of soil fertility and carbon sequestration. Nonetheless, a recent study by Biazin *et al*. (2018) noted that while local avocado (non-grafted) trees planted as an integral part of coffee and enset based agroforestry systems had the highest fruit yield, farmers complained that the yield of coffee and enset grown directly under the avocado trees resulted in production.

In the context of the domestic avocado production, where farmers view the domestic avocado as part of the agroforestry landscape essentially not for its economic value but also non-economic values, there is no incentive to undertake agronomic practices that reduce pre-harvest losses as conceived in an economic production system. Again, because of the low economic value of the fruit, they "do not see growing local avocado as a business". The effort required to perform agronomic practices does not commensurate with the economic value of selling the fruit (Duesberg *et al.,* 2013). Farmers' strategy is to gain as much value as possible with little or no effort - minimise their inputs and maximise their yield (Graeber, 2001). In this case, farmers look at the combined "value"[76] from the tree – economic and non-economic values (Miller, 2008, p.1122-1123). The low economic value of the fruit does not motivate farmers to change practices as farmers decisions are usually based on 'ordering of values', not solely on the economic value which is promoted mainly for market and trade (Duesberg *et al.,* 2013; Miller, 2008; Lynch, 1999; Sachs, 1992; Ilbery, 1983). In this case, from an economic production perspective, the pre-harvest losses can be seen as 'lock-in' within the production system.

Therefore, to reduce the perceived economic pre-harvest losses, a change in production orientation is fundamental - a change in cultural norms and framings concerning the local avocados. The local avocado trees must not be viewed like "any other tree" to achieve intrinsic and social agroforestry practice values (Kitalyi *et al.,* 2013; Duesberg et al., 2013; Hemp and Hemp, 2008; Oktingati *et al.,* 1984; Ilbery, 1982). It must be seen as a decent, reliable earning potential to ensure full-scale adoption of production practices that reduce economic losses and maximise the benefit to the farmer. This will require investments in time and resources, training, and education (Juma, 2020; Juma *et al.,* 2019; Biazin *et al.,* 2018; Johnson, 2020; Johnson *et al.,* 2019; Mwakalinga, 2014). There is also the need for farmers to be paid fair prices by local brokers and wholesalers to increase the economic value of the avocados (chapter 6).

In light of the discussion above, the export avocado production system takes a bottom-line approach – where the production is purely viewed from an economic value perspective and does not consider other values (Miller, 2008; Lynch, 1999). As argued by Miller (2008) bottom-line approaches to value only focus on economic value (price). In this context, buyers create and determine the value through safety and quality standards, certification regimes, and buyers' expectations for the avocado's appearance, shape, size, and nutritional content, which then create specific agronomic practices (section 5.4.2). The introduction of quality standards and assurance systems have played

[76] The kind of "value" that Miller (2006) argue is used in everyday life to bridge the gap between economic value and non-economic values.

a significant role in restructuring agri-food sectors in developing countries, particularly export-oriented production systems (Reardon and Barrett, 2000). As argued by Pretty (2002, cf. Morgan *et al.,* 2006), non-market quality criteria de-valorised primary production and drains culture away from agriculture; and introduced new complexities for farmers (Humphrey, 2006; Reardon and Farina, 2002). Quality is controlled through intermediaries (such as certification bodies, exporters, packers etc.) that place stricter control on the quality of the product (Marsden, 1997), and these controls are often enforced at the point of production – particularly corporate retailers own quality protocols (Henson and Reardon, 2005).

Avocados are affected by unfavourable climatic such as drought, pest, and diseases, which affects the quality and yield. To achieve somewhat homogenous quality fruits that meet quality standards, producers must invest in the production process (Holzapfel and Wollni, 2014; Gille, 2016; 2014; Asafaw *et al.,* 2007; Henson and Reardon, 2005; Dolan and Humphrey, 2000; Gereffi, 1999). Failure to invest in the specific knowledge, practical know-how and tools required to produce fruits that meet the specified value–defined by the 'quality standards' (Busch, 2000) leads to pre-harvest losses (Colbert, 2015; Feedback Global, 2014). Therefore, any approaches to understanding farm-level losses must attune to the role of value in the production process. The agronomic practices that are shaped by rules, regulations, instructions, and guidelines are set by actors outside the farmers' control; and power is exercised and experienced by farmers through these rules, regulations, and standards in ensuring compliance (Gille, 2016; 2014; Fuchs *et al.,* 2009; Smythe, 2009; Morgan *et al.,* 2006; Freidberg, 2004). Most studies focusing on farm-level losses fail to recognise the imbalance of power inherent in such an export-oriented production system where few large producers and exporters dominate the production – see sections 4.2.4 & 4.5 (Table 4.6) (Howard, 2016; Clapp and Fuchs, 2009). As evidenced in this study, only a few large commercial and elite producers and exporters (0.67% of total growers) who control more than half of the primary production and processing can invest in the demanding quality standards that create the value demanded by the market (Morgan *et al.,* 2006).

The few large commercial producers control access to inputs and know-how needed for the production; smallholders who account for 99.33% of growers do not have access to inputs. In some cases, they are forbidden from using inputs that can reduce pre-harvest losses and improve yield to extract value – intrinsic value linked to traditional agroforestry and production practices that are considered organic. However, the bottom-line value approach that underpins the commercial export avocado production system and its associated quality criteria contradicts practices already acquired by farmers (local avocado production practices), leading to losses. Growing the export avocado

requires growers to be recruited and socialised to acquire specific forms of knowledge, understanding, know-how and new ways of thinking and valuing the avocado to perform the practices required for producing quality fruits. Hence, there is a kind of tension between the two value systems and their practices - one underlies non-economic values, and the other underlies economic value.

The bottom-line value approach can also be viewed from the point of view of commercial investors introducing commercial avocado production to smallholders to supplement their market needs/interests, add value to their business without due attention/support to technical and infrastructural needs (chapter 4). In doing so, the following challenges have arisen, resulting in pre-harvest losses: 1) access to resources, 2) cumbersome and expensive production practices, 3) personalised and varied interpretation and application of standards, and 4) excessive burden and responsibility on the farmer, little on the export company - shifting new burdens to smallholders (Gille, 2013; Clapp, 1994; Little and Watts, 1994). Thus, most preventable losses are 'locked-in' to the production system for smallholders due to an imbalance of power in access to technology and required inputs. This contrasts with large commercial export producing companies and other elite producers who can access inputs and the required technology outside Tanzania. This shows how market practices frequently maintain asymmetric power balances favouring big players over smallholders, leading to significant farm losses (WWF-UK, 2021).

The findings from this study highlight that, while farm-level losses have often been approached from the environmental and biological perspective, it is vital to bring the human element of the supply chain and the values underlying the production system into the discussion (WWF-UK, 2021). The study also shows that farm-level losses are connected to broader market institutional structures. In the case of the local avocado production system, the broader structural inequalities in the supply chain must be addressed to achieve a shift in the production system that reduces farm level waste. Therefore, understanding pre-harvest losses should not only be viewed within the prism of economic value; but through other values derived from the crop (Miller, 2008; Sachs, 1992).

5.7 Chapter summary

This chapter has discussed how institutions, materiality and practices shape agronomic practices for two different avocado production systems and their implications for pre-harvest losses. The chapter has highlighted that to understand losses in agricultural production systems, it is imperative to consider the role of institutions (formal or informal and conventions) and materiality and how these shape practices. The chapter illuminates our understanding of the of role value - economic and non-economic values - plays as a critical underlying driver in the two avocado production systems, significantly influencing how practices are enacted, and how pre-harvest losses occur. While non-economic values from the avocado tree and its intrinsic value as part of agroforestry practices strongly determine agronomic practices for the domestic avocado, an economic value defined by safety and quality standards executed through rules and regulations, instructions and guidelines, and certifications influences export avocado production. The organisation and implementation of these rules and standards in growing practices result in losses in the production process.

Furthermore, the chapter has highlighted that imbalance of power through control over the production process of smallholders in export avocado production, leading to inequalities and pre-harvest losses and losses at harvest. The bottom-line value approach to the export avocado production leads to value capture where export company farms and elite producers dominate and control the production space. The chapter has demonstrated the need to attune to the interactions and interdependences of institutions, materiality, and practices in understanding pre-harvest losses. The following two chapters (6 & 7) build on this chapter by focusing on how social relations and arrangements in the buying and selling cause losses and waste in the two avocado supply chains.

Chapter 6

Institutional arrangements and materiality: Exploring risk, value, power relations, and losses and waste in Tanzania's domestic avocado supply chain.

6.1 Introduction

The issue of food loss and waste at harvest and post-harvest have received greater attention in recent decades in SSA, particularly with the establishment of the African Postharvest Losses Information System (APHLIS)[77], for reporting food loss and waste (Sheahan and Barrett, 2017). Often, lack of appropriate technologies, poor and inadequate infrastructure (transportation, storage, packaging, marketing systems, e.tc.) are cited as the drivers for food loss and waste (Ali *et al.,* 2021; Fabi *et al.,* 2021; Magalhaes *et al.,* 2020; Elik *et al.,* 2019; Sheahan and Barrett, 2017; Affognon *et al.,* 2015; FAO, 2011). Without attention to the why? For example, the cultural norms that reproduce specific handling and packaging practices or how power dynamics between actors result in food loss and waste. Besides, when quality standards are examined as potential drivers for food loss and waste generation, they fail to illuminate the nuances and subtleties that elusive quality criteria like 'fruit size' provide for exploitation and exercise of power.

There is a dearth of empirical studies using a social relational approach to understand how institutional arrangement- buying/selling relations, materiality, and power relations among traders and farmers operate to produce loss and waste in domestic or national supply chains in SSA. This chapter addresses the knowledge gap and takes a social relations approach to examine how the institutional and material context in which selling/buying practices occur leads to FLW. Using qualitative in-depth interviews, informal conversations, and 'go-along' ethnographic observations and 'follow the thing' approach, the chapter explores the role of risks, value, norms, and power relations and how they manifest in selling/buying practices to produce losses and waste at the farm and in the market spaces. The chapter draws on insights and lived experiences from interviews with farmers, fruits pickers, packers, traders (local brokers, wholesalers, agents) and key

[77] In 2009, the European Commission funded the creation of the African Postharvest Losses Information System (APHLIS), a network of cereal grain experts in eastern and southern Africa charged with accurately estimating PHL for grains across the region

informants/opinion leaders; and go-along ethnographic observations during harvesting and selling different in market spaces (rural-urban wholesale markets, retail markets and regional wholesale/retail markets in Kilimanjaro and Dar es Salaam).

The findings show that the institutional arrangements and the social relations between brokers and farmers structure buying/selling and harvesting practices in Tanzania's domestic avocado production, which has implications for the ways losses are generated during harvesting. I argue that the social relations of buying/selling between farmers and local brokers, wholesalers and agents provide an avenue for value extraction and exploitation, which have intended and untended consequences for losses and waste production (sections 6.2 and 6.4). Furthermore, I contend that cultural norms concerning the avocado's material state at harvest (firmness – '*solid as stone'*) and the traders' desire to extract value influenced handling and packaging practices, causing further losses at the regional/retail markets (section 6.2). Further, the materiality of the avocado firmness (state of ripeness or softness) provides a means for accessing value and determining when the avocado crosses the culturally acceptable level of firmness in the regional/retail markets to end up as waste (section 6.3).

The chapter provides empirical evidence of how quality criteria such as 'fruit size' can be an elusive standard in an informal supply chain and through which inequalities and power are exercised and experienced by different actors, resulting in losses and waste (section 6.3). Furthermore, I argued that the materiality of the avocado - its perishability, is used as an object through which power is exercise either to sanction or to extract/create value - e.g., local broker versus the farmer (section 6.4). However, the exercise power or which actor holds power, shift along the supply chain as the avocado is traded. For example, at the farm, local brokers use the avocado's perishability to exercise power over the farmers, but in the wholesale market, a wholesale buyers use perishability to exercise power over the local brokers. Besides, risks avoiding strategies by different traders and the social relations between them lead to losses and waste generation as they seek to reduce their risks and extract value. I argue that the informal market institution – "credit system" arrangement, which underpins the functioning of the domestic supply chain, provides an avenue for exploitation and losses and waste production.

Taking a social relation approach helped to analyse food loss and waste through the lens of power relations, value creation and inequalities, which has hitherto been missing in food waste discourses, especially in the global South. Theoretically, it contributes to and extends our understanding of the food waste regimes concept (waste production) put forward by Gille (2013) in a more practical

way. The chapter is structured into six sections, the introduction (6.1), followed by a discussion of the main findings in sections 6.2 to 6.4. Section 6.5 discusses the main results in the context of other literature and conclude with a summary (section 6.6).

6.2 Institutional arrangement and buying/selling practices

6.2.1 Buying agreement and practices at the farm level

As discussed in chapters 4 and 5, the local avocados are produced as part of the subsistence livelihood. Culturally, women are responsible for selling foodstuffs[78], while men are primarily responsible for selling cash crops. Here, I focus on the social relations between the local brokers and farmers to highlight the buying arrangement and practices and how power dynamics play out in those relations to produce losses and waste.

Three forms of informal institutional arrangements or agreements exist between local brokers and farmers that structure the buying/selling relations and price negotiation process: long-term trading relations, short-term trading relations, and spot buying arrangements. In the case of a long-term arrangement, the local brokers have an agreement with the farmers - *'an understanding which allows them to own the avocado trees*' [*PTK_LB_0015]* and buys from the same farmer every year. This kind of trading relationship between brokers and farmers is exemplified in the quote by two local brokers as we discussed their buying process and strategies during harvesting events:

> *"**Since we started this business ten years ago, for some farmers, we have secured [Kushikilia] or hold the trees, and we buy from them every year**. **And we will continue to buy from them so long as we are in business**. We have an agreement with the farmers, and every year when we come to harvest, we negotiate the price with the farmer" [Females, two local brokers, Siha; PTK_LB_0015-0024].*
>
> *"[…..] **Yes, I have an agreement with some farmers, whom I buy from all the time**; others I just go around the villages, and when I see the avocados, I negotiate with the farmer, if the farmer agrees to the price, then I buy it" [Female, local broker, Siha; PTK_LB_0063]*

The social relations described above by the local brokers are based on personal trust and relationships between the farmers and local brokers (De Putter et al., 2007; Lynch, 1994). While long-term personal trust between the farmer and broker is used to hold the avocado trees intrust of a local broker. Sometimes, the arrangement requires a financial commitment whereby the broker

[78] Since the local avocado is not viewed as a cash crop like coffee or the new export avocado, selling and price negotiations are predominately left to the women.

pays a deposit to *'secure the tree'* before the fruits reach maturity and the final price is negotiated at harvest:

> "*Before the season starts, I go around and negotiate with the farmers that I will buy their fruits, pay a deposit to secure the avocado tree" [Female, Leading local broker, Rombo; PTK_LB_0063].*

With short-term relations like that one described in the quote above, the arrangement is seasonal – the broker secures the tree for the harvesting season, but the farmer may decide to sell to another broker the following harvest season. Sometimes the short-term relations can just be a day or two where the broker negotiates the price and pays a deposit to secure the avocado tree (so the farmer does not sell the fruits to another buyer) before harvesting – 'a kind of spot buying relation'. In most cases, farmers sell their avocados through spot relations (repeated transactions). The farmer has freedom of choice in spot buying relations and may sell to any broker offering a reasonable price.

Farmers price or measure their avocados through three modes: measure/pricing using a bucket *(debe),* sack bag, and pricing 'per tree' (the broker estimates the volume of fruits and negotiates the price). The method used for pricing determines who bears the losses from the harvesting process (rejects due to damaged fruits). If the farmer agrees to price per sack bag or bucket, the farmer bears the losses – any rejected fruits at harvest is given to the farmer. However, if it is priced per tree the local broker bears the losses – any rejected fruits go to the broker. If a broker decides to price per tree, they usually consider the surrounding environment and arrangement around the avocado tree (e.g., things like rocks, fallen branches, etc., that can damage fruits) in the price negotiation (6.2.1). Most brokers price per bag; however, more experienced brokers (see Box 6.1) prefer pricing per tree for two reasons: 1) To avoid an argument with the farmer after the price has been agreed; 2) to extract more value since most farmers cannot accurately estimate how much fruits are on the tree. Deciding on the most appropriate pricing method depends on the broker's experience in the trade and how that creates maximum value/profit margins:

> *"[…] It depends on what each broker is comfortable with; if the broker thinks that by buying a tree, they will make a profit or loses. So, it needs experience; brokers who understand and are used to the situation and have been in business for many years will know exactly how to estimate; maybe from this tree, I will get this much. So, if I buy by a tree, I will benefit; but I prefer to purchase either using sack bag or bucket. I know my profit and loss" [Female, leading local broker, Rombo; PTK_LB_0042].*

Inevitably, some farmers prefer 'pricing per the tree' to create value - if they cannot derive other values (animal feed) from the losses, and to prevent disagreement ['*ubishi'*] over price – as some local brokers tend or have been known to change the agreed price once the fruits have been picked[79].

Box 6.1: Mama Abba buying strategy

Mama Abba is local broker in her early 50s with over 20 years of experience in buying and selling avocados in the Rombo district. She works with her two sons and a helper [picker and packer]. Mama Abba's preferred mode of buying from farmers is by pricing per tree. During harvesting event on 18th June 2018, with Mama Abba and her team, she offered the farmer the first farmer 30,000 TZS (13.00 USD) for the fruits on two trees. She regularly buys from the farmer. The farmer complained that the price was too low and there many fruits on the trees. Mama Abba argued that there are a lot of rocks on the farm and around the avocado trees, which will cause fruit damage. After bargaining for a while, they agreed on 32,000 TZS (13.79 USD). Although, there were big rocks under the avocado trees and the soil was compacted due to a footpath under the avocado tree, Mama Abba reduced her losses by hanging makeshift trampolines under the avocado trees (Figure 6.3). The first of its kind in my harvesting expeditions with local brokers. We harvested 3 large sack bags from the trees (each large sack bag from the farm equates 1.5 sack bag at the local wholesale markets), which gives Mama Abba one extra (large sack) bag. The farmgate price for a large sack bag was 15,000 TZS, for Mama Abba, her strategy to extract value from farmers is to buy the fruits on the tree. But it takes experience to be able to make such gains in the trade.

Field Journal, June 2018.

Inequalities exist in the buying process irrespective of the farmer's preferred mode of selling. For instance, differences in the size of sack bags and how it is loaded can be used to extract value from farmers. Lack of standardization in measurement means the farmer is always disadvantaged (Mwakalinga, 2014). I examine how the materiality of the avocado is used to exploit and exercise power in the selling relations and the implications for waste production in section 6.2.1.3.

6.2.1.1 Mode of measurement/pricing, materiality, and losses at harvest

At the farm gate, prices are decided following bargaining between the farmer and the local broker. An important factor affecting farmers bargaining power is access to price information. Therefore, sharing price information between the broker and farmer is essential, but this is only possible where a personalized trust-based relationship exists (Lyon and Porter, 2009). However, some farmers visit

[79] Typically, if the mode of selling is priced per bucket or sack bag, the final price is decided after the fruits have been harvested and sorted, and some local brokers choose to pay a lower price than what has been agreed on with the farmer

the wholesale markets to gather price information or depend on the network of neighbours and relatives in the villages to access price information.

The mode of pricing or measurement influences harvesting practices resulting in loss and waste generation[80]. For example, in the case where the broker price the avocado per 'bucket or sack bag', the broker will not take any action (such as removing fallen branches, stones under the avocado tree or hanging of trampolines under the avocado tree) which could potentially reduce the amounts of fruit that can be damaged because any damaged fruits is left to the farmer (Figures 6.1)[81]. In contrast, where the broker preferred method of pricing is 'per tree', the broker enacts practices such as putting dry banana leaves under the avocado tree (Hakizimana and May, 2018), or removing stones and fallen branches, and hanging a makeshift trampoline under the avocado to reduce their losses (Figure 6.3). Besides, the pickers are poorly paid, and their actions can also influence losses at harvest[82]. Damage fruits at harvest is not the only losses that the farmers experience, the harvesting practices lead to other losses, such as loss of potential yields (next crop season) due to damaged flowers, immature fruits, or broken branches (during harvesting). A concern expressed by farmers involved in the study:

> *"When they shake the tree, the following year, it does not bear any fruit…; the local brokers and the pickers do not care about the farmer. All they are interested in is buying the avocados from you; they do not care about next year, whatever happens, is not their concern" [Female farmer, 55-year-old, Moshi rural,* PTK_LF_0048*].*

While the mode of selling and pricing determines who bears the cost of losses and influences harvesting practices that can reduce or increase waste at harvest, sometimes, irrespective of the pricing method, a favourable material arrangement on the farm can lead to fewer damaged fruits (Figure 6.2).

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[80] The historical framing, cultural norms, and the values derived from the avocado tree shape agronomic practices, allowing the avocado tree to grow taller. This poses a severe challenge in harvesting the fruits. To harvest the avocados, the pickers – known as 'tree shakers' climb the tree and shake the branches, which causes the fruit to 'freefall' to the ground. Objects such as stones, rocks, fallen branches, exposed roots (of the avocado tree), matured coffee trees, structures (animal pens, house/kitchen), compacted soil around the avocado tree can result in a higher percentage of damaged fruits. The harvesting method also lead destruction of new flowers and off-season (immature) fruits and other crops are destroyed.

[81] Losses are high in situation there are many objects around and under the avocado tree and the mode of pricing is by using sack bag or bucket (Figure 6.1). On the other hand, losses can be lower, if the avocado tree is sited in relatively soft loose soil - recently turned soils or recent rainfall before harvest. If the surrounding area is cleared of weeds, and there are no stones or other plants under the avocado tree (Figure 6.2). In rare cases, losses due to mechanical damage can be lower than 1% of the total harvested fruits from the tree (Figure 6.3). Besides visible mechanical damages (cuts, scratches, and cracks) that results in losses on farm; the harvesting technique also causes internal injuries (localised softening) to fruits which causes further losses (HLPE, 2014; Bill et al., 2014).

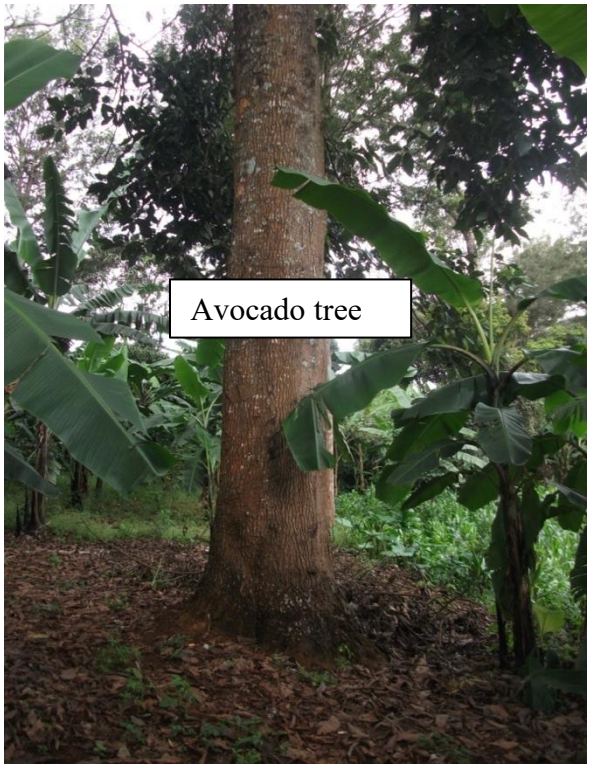
[82] Fruits pickers are poorly paid, in Siha district, they are paid between 1000 TZS - 2000 TZS (0.43-0.86 USD) per tree, in rare cases two fruit pickers interviewed reported charging 5,000 TZS (2.15 USD) per tree "....it depend if it's one tree I charge 5,000 TZS and if there are many tree I can reduce the price 10,000 for three trees" (male , 32 years old, fruit picker). Interviewees recounted cases of injuries, sometimes lifelong injuries (paralysed) and in extreme cases 'dead' of fruit pickers – which I witnessed during the fieldwork (Field Journal, 2018). Because of the risk of falling, the use of children as pickers is widespread, as reported in other avocado subsistence production systems - in Ethiopia (Faris, 2016; Megerssa, 2013) and in Burundi (Hakizimana and May, 2018)

<u>Losses due to pricing by sack bag /bucket and material arrangement:</u>

Harvesting in Arumeru village, Siha district:
The avocado tree was about 40 years old and 30 meters tall. Objects under and around the avocado tree include stones (3 big sizes and smaller size), a sizeable broken avocado branch, old coffee trees, exposed roots, and banana plants. The soil has not been turned recently. A total of **1,172 pcs of fruits (approximately 400kg - 2.5 big sack bags)** was harvested from the tree. Of this, **340 pcs (representing 29%)** was rejected by the local broker due to mechanical damage. Because the mode of **pricing and measurement was by sack bag**, the broker did not care about how much fruits got damaged. This was a loss to the farmer; the value of rejected fruits is about **9,000 TZS (3.88 USD).**
Field Note, 25th June 2018.

Harvesting in Maringa village, Rombo district:
Like the above case, we harvested **440 pieces** from 3 avocado trees on the same farm. The brokers rejected **120 pcs of fruit (27.3%)** due to mechanical damage caused by similar material arrangements under and around the avocado trees. The brokers did not remove any of the material objects under the avocado tree because the mode of pricing was a bucket.
Field Note, 18th June 2018.

Figure 6.1: The material arrangement on the farm and the impact on losses.



The avocado tree is about 45 years old. There was no expose root (of the avocado tree), no rocks/stones and very few coffee trees around and under the avocado tree. The soil was soft, it had rained two days before the harvesting day.

A total of **1,100 pcs of avocados** was harvested from the tree; and **100 pcs (about 10%)** was rejected due cracks and bruise damage.

The 65 years old male farmer was delighted that he had a small number of losses because of the rains. He tells me "I will give some of the rejected fruits to my neighbour and daughter in-law; and feed the animals with the broken fruits"

Field Note, 15 June 2018, Samaki Maini village, Siha.

Figure 6.2: The material arrangement on the farm and the impact on losses.

Losses due to pricing by tree and material arrangement

Harvesting in Rombo Mashati, Rombo district:

Image A: above show a typical loose and recently turned soil under an avocado tree. There were no stones or any other materials under the avocado tree. Losses due to mechanical damage was less than **1%** of the total harvested fruits.

Image B: shows makeshift trampoline hang under the avocado trees to reduce mechanical damage to fruits due to stones, rocks and footpath and other trees around and under the avocado tree. During this harvesting event, the broker on many occasions, carried inspection and where possible removed all fallen branches, stones and any object that might cause damage to fruits and spread dry banana leaves under the avocado trees to reduce damaged to the fruits. The broker preferred mode of purchase is by price per tree (see Box 6.1).

Field notes 18th June 2018.

Figure 6.3: The material arrangement and harvesting practice

6.2.1.2 Recovery of losses and waste at farmgate

At the farm gate, many strategies are used to recover the losses depending on whether the farmer or the local broker is bearing the losses. If the farmer is responsible for the loss (depending on the volume of rejects), fruits with less visible damage are used as food by the farmer's family, some donated to other relatives and neighbours, and fruits with more visible damage is used as animal feed. Since a considerable portion of the losses is due to damage to fruits, most of it is used as animal feed. However, if the local broker bears the losses, rejects are usually sold at the rural-urban wholesale market as feed to animal keepers and to banana sellers who use it to ripe their bananas.

6.2.1.3 Materiality and power relations among local brokers and farmers

In section 6.2.1.1, I examined how institutional arrangements between local brokers and farmers structured the buying and price negotiation process. However, local brokers use the 'perishability' of the avocado to perpetuate inequalities (to extract a value) against vulnerable farmers. Since most farmers sell their fruit either by using buckets or sack bags, the final price is negotiated after harvesting. Brokers take advantage once fruits have been picked and often change the agreed price, leading to disagreement. As one farmer put it, the greatest challenge is disagreement over price:

> *[…] these local buyers, the problem is that they determine their price [..]; the challenge is the disagreement or contention [ubishi] over price. After you have agreed on the price with the buyer, they sometimes change their mind about the agreed price after they have harvested the avocados, which usually turns into an argument. When this happens, the buyer will say, I do not want to buy the avocados anymore. And you have harvested the avocados; if you cannot sell, what are you going to do with the avocados? The avocados will decay, so you sell at any price. It is like they are exploiting you to sell the fruits at any price [Male, smallholder, PTK_LF_003].*

For fear of not being able to sell the avocados (spoilage)[83], farmers are indirectly forced to sell at any price once the fruits have been harvested. Besides, the remote location of most farmers makes them vulnerable to exploitation. Due to high transaction costs, farmers are forced to sell to the brokers who use their position and ability to aggregate fruits from many farmers to extract more value and exploit farmers. Similar findings have been reported by Dube *et al*. (2019) and Mayala and Bamanyisa (2018) – both studies noted that in Tanzania, fruits and vegetable farmers prefer to sell their produce to brokers/wholesalers because they buy large quantities over a short period, saves farmers time, and minimise transactional costs.

However, in some cases, farmers fight back and may change their minds on the agreed mode of measurement after fruits have been harvested:

[83] The local avocado varieties reach full ripeness between 2-5 days after it has been picked, while the export variety (Hass) which can take up 2 weeks to fully ripened after harvest (Field Journal, 2018)

During harvesting observation in Arumeru, Siha, the local broker had already agreed with the farmer on the price and method of measurement (sack bag) a day before the harvesting event. However, after harvesting and packing, the farmer decided she wanted the avocados to be measured with a bucket (felt cheated by the broker). An argument ensued between them, resulting in unpacking, counting, and repacking [Field Journal, July 2018].

Such power relations led to multiple handling, which caused further bruise and internal damage to the avocados. Thus, power relations between the local brokers and farmers and the exercise of power to either extract or create value from the avocados can result in losses and waste generation.

6.2.2. Buying and selling relations at rural-urban wholesale markets

As discussed in chapter 4, wholesale buyers buy mainly from local brokers in rural-urban markets (production regions). There are two forms of selling/ buying relations between the traders: a) a spot buying relation, b) long-term trading relations. In the case of long-term trading relations – the wholesalers usually communicate and place an order with the local brokers before the market day. However, there is no guarantee that the wholesaler will buy the avocados they bring to the market; wholesalers buy avocados that they think will give them more value (see section 6.3.2).

In the wholesale markets, prices are agreed upon following bargaining between the broker and the buyer. All transactions are cash-based, where personalised trust exists in the long-term trading relations; local brokers sell on credits (typically with part payment). Yet, access to information (price, demand, and supply) in the regional markets can be problematic. While wholesalers depend on their trust-based trading agents [*Madalali*] networks, relatives in the regional markets and colleagues to obtain price information. The local brokers and farmers have limited access to price information, which impede their bargaining power, and the final price is determined by wholesalers, who are somewhat organised. As expressed by a leading wholesale buyer and local broker:

"We determine the price…; because we know each other, we decide on the price ahead of the market day. We make phone calls to each other, those wholesale buyers here in Kilimanjaro and those buyers come from Dar es Salam and other big cities, to decide how much we are going to pay for a sack bag at the market" [Wholesale buyer, Sanya Juu market, PTK_WS_0059].

"As local brokers, we just have to accept whatever price the wholesale buyers offer; there is nothing we can do because the buyers have already agreed on the price that they are going to buy from the market, and you have the avocados; what are you going to do if you do not sell it?" [Local broker, Mwika market; PTK_LB_0048].

The wholesale buyers have the bargaining power, and price changes can be at short notice. The wholesalers use the materiality of the avocado and power imbalances to exploit local brokers,

which has implications for waste generation (see section 6.3.2). However, the materiality of the avocado, cultural norms and perception and traders desire to extract value influence handling practices which leads to further waste generation at the retail stage of the supply chain (6.2.2.1).

6.2.2.1 "Solid as stone": materiality and packaging practices.

An accepted norm among traders, fruit pickers, packers, and loaders, is that the unripe avocado *"is as solid as a rock"*, which has shaped packaging and handling practices such as pounding, standing, sitting, walking, and jumping on unripe avocados during packaging, loading, and off-loading at the farm and the wholesale market (see Figure 6.4).

Figure 6.4: A local broker mixing avocados at Mamsera wholesale market, Rombo

The local brokers try to get many avocados into the sack bag at the farm to increase their profit margins[84]. The packing process involves shaking, lifting, and pounding the sack bag on the ground several times and pushing the avocado against each other (while packaging), which causes mechanical damage to the fruits (Kassim *et al*., 2013; Kader, 2002). The practices are the same in the wholesale markets when sorting, and grading is done as explained by different actors in the quotes below:

> *"When packing, we ensure that a lot of avocados can go into the bag, we fill the bag well so that it is solid and compact…. So, that when avocados reach the market in Dar es Salaam, the quantity will be the same" [Packer, Sanya Juu market, Siha;* PTK_FP_0065*].*

> *"[…] We jump on the avocados while loading it into the truck, to makes it compact because we pack the bags in the middle of the truck" [...] [Loader, Sanya Juu market, Siha;* PTK_LB_0067*].*

[84] Each sack bag can weigh between 150 - 180 kg depending on the size and how it is packed. The practice among the brokers is that every packed sacked from the farm must give them 1.5 sack bag at the market.

[..] "And jumping on the avocado does not cause any damage to the fruits" [..] [Female wholesaler, 14 years in the trade. Mwika market; PTK_WS_0068].

At the rural-urban markets local brokers spread and mix different avocados (sizes, appearance and eating quality) - medium/regular size fruits are put beneath the pile, and large size avocados are placed on top. A practice that ensures they can attract potential buyers and sell other avocados, which on its own will not be attractive This practice of missing avocados standing on the avocados and spreading it was unique to the markets in Moshi rural district and Rombo districts. However, the practice causes further mechanical injuries to the avocados (Field Journal, 2018).

These practices are perpetuated and reproduced because of traders' desire to extract more value through the process. However, the fragile nature of the avocado is concealed in its firmness at harvest, which makes it impossible to imagine when firmness is viewed as *"solid as stone"* by actors who handle the fruits. The fragile nature of the avocado only becomes evident as its firmness decreases with ripeness – usually at the regional and retail markets[85]. The avocados are handled with care at the regional markets - traditional bamboo baskets (*Tenga*) and polythene bags used to pack fruits for customers are lined with dry banana leaves (Figure 6.5).

Retailer packing avocados into 'tenga' lined with dry banana leaves. Ilala Boma wholesale market – Dar es Salaam. 19 July 2018

Avocados packed in 'tenga' lined and covered with dry banana leaves. Ilala Boma wholesale market – Dar es Salaam. 19 July 2018

Figure 6.5: Ripe avocados packed in a traditional basket lined with dry banana leaves

[85] The rough handling causes internal injuries which speed up ripeness as soft spot generate ethylene production. The ethylene production, coupled with packaging material (sack bag) generates more heat resulting in the ripening of fruits during transportation to regional markets (HLPE, 2014). Ripening of fruits during distribution was reported by wholesalers and agent traders in regional markets as a major cause of losses and waste. Moreover, those who perform the hash task of loading, and unloading are unqualified and poorly paid - averagely packers are paid 10,000 TZS (4.31 USD) a day; and pickers between 1000 – 2000 TZS (0.43 – 0.86 USD) per tree (including collecting and ferry avocado to the roadside). Therefore, there is no incentive to handle the avocado with care, and often wages depend on the volume of avocado handled.

The dry banana leaves serve as a cushion and ensure that the avocados get to the next destination in good condition and reduce waste (WLFO, 2010; cf. HLPE, 2014)[86] .Thus, norms about the material state of the avocado firmness influence different handling practices by actors at various stages of the supply change. However, the rough handling practices at the farm and wholesale markets in the production due to norms about the material state of the avocado lead to waste further losses down the supply chain (in the destination wholesale/retail markets and at the consumer level) as the damage is hidden until the fruit is ripened.

6.3 Market institutions, value, materiality, power, and waste

In this section, I examine 'value' in the context of 'quality criteria and standards' used by traders to evaluate and define 'good and bad avocado', and how it is used to extract value and the implications for losses and waste production. I draw on Zsuzsa Gille's (2013) food waste regime concept, which assumes that there is value and waste circulation in every economy and that the two are interdependent. She argues that there is no value without waste and that waste chains themselves participate in maintaining value chains. In this case, waste production can be viewed as the "dynamic interrelatedness of value chains and waste chains, with risk avoidance strategies as a connection between the two" (ibid, p. 27-28). The quality criteria and standards (Table 6.1) used by the traders can be conceptualized as an essential risk avoidance strategy that 'constructs waste and value' in domestic avocado production (Zsuzsa Gille, 2013; Power, 2007).

The traders have developed a set of informal quality criteria and standards that they use to evaluate the avocados. These criteria and standards are used as a risk-avoidance strategy to create or extract value, leading to losses and waste on the farms and through distribution channels. Broadly, the criteria and standards used to evaluate the avocado can be grouped into fruit maturity, eating quality (taste/palatability) and appearance criteria (Table 6.1). The most common external indicators used to assess the maturity level are "skin colour change, easiness to pop-off stem/stalk and hear the sound of the seed when you shake the fruit[87]" [Female, local broker, PTK_LB_0024]. But for some avocado varieties, the seed does not wholly detach from the flesh (mesocarp) at full maturity.

[86] Practices of using liners in rough containers (baskets / wooden boxes) have been reported to reduce damage and losses up to 35 per cent (WLFO, 2010; cf. HLPE, 2014).
[87] The maturity level at the time of harvest is an essential determinant of fruit quality– both external and internal eating quality - of a ripe avocado (Magwaza and Tesfay, 2015). Quality criteria and standards – acceptable shape, size, appearance, firmness, flavour, and nutrient composition of avocado fruit are set at harvest (Fuchs et al. 1995).

Therefore, further internal quality checks are required to evaluate the maturity level (Table 6.1; Figure 6.6). The internal quality checks use a destructive method that creates waste, as some fruits are sacrificed. Also, using the sample to represent all fruits on the tree or bag/batch could lead to the harvest of immature fruits causing losses as environmental factor such as temperature and exposure to sun influence different maturity rate.

Eating quality is generally determined by flavour, texture (creaminess and smoothness) and oil content, which is influenced by fruit maturity and stage of ripeness. The oil content and the nutritional value increases with maturity level, though it depends on the variety (Magwaza and Tesfay, 2015; Carvalho *et al*., 2014; Donetti and Terry, 2014; Hofman *et al*., 2013; Kaiser and Wolstenholme, 1994). Since avocado does not ripen while still attached to the tree, brokers check oil content by scrubbing a piece of fresh avocado at the back of their hand. The higher the oil content they can feel and see on their skin and the dryer the fruit flesh (mesocarp), the better the eating quality (creaminess and smoothness) when the fruit is ripened. Through this embodied practice, local brokers differentiate between varieties with a high-water content - "watery avocados" from varieties with high or medium oil content.

Besides maturity, fruit size is used by traders as the final criteria in their buying decision. Notably, among wholesale buyers, bigger size tends to influence purchase decisions irrespective of the eating quality once avocado passes the maturity criteria. The bigger fruit sizes attract better prices in Dar es Salaam and other destination markets. In what follows, I discuss how different traders use the quality standards as a risk-avoidance strategy to extract value and the implications for losses and waste production.

Table 6. 1: Criteria used by traders to define and describe quality standards in the domestic avocado supply chain

Quality criteria	*Local brokers Quality criteria*	*Wholesale buyers' Quality criteria*	*Agents Quality criteria*	*Retailers Quality criteria*
Maturity	▪ Depending on the variety, the skin colour must change from shining green to dull /pale green or dark green, reddish, or purple. Shining green skin colour indicates immature fruit. ▪ it should be easy to pop off stem/stalk from the fruit ▪ When you shake the fruit - you should hear the sound of the seed. ▪ The seed coat is dry, dark, and somewhat shrivelled, not pale whitish and must be attached to the flesh. ▪ The inside colour of the fruit flesh should be yellowish-gold or yellowish-white. ▪ Must ripen within 3 – 7 days after harvesting.	▪ Depending on the variety, the skin colour must change from shining green to dull /pale green or dark green, reddish, or purple. Shining green skin colour indicates immature fruit. ▪ The inside colour of the fruit flesh (mesocarp or pulp) should be yellowish-gold or yellowish white	▪ The colour of the flesh (mesocarp) should be yellowish-gold or yellowish white, not pale white ▪ Depending on the variety, the skin colour must be black, brown when the fruit is ripe ▪ Evenness in ripeness /firmness ▪ Must be ripe within 3 – 5 days	▪ Depending on the variety, the skin colour must be black or brown when the fruit is ripe ▪ Evenness in ripeness /firmness
Size	▪ Bigger sizes preferred ▪ Medium size ▪ Small sizes - low supply season	▪ Bigger sizes – first grade ▪ Medium sizes – second grade ▪ Smaller sizes only in low supply season	▪ Bigger sizes preferred ▪ Medium sizes	▪ Bigger sizes ▪ Medium sizes ▪ Smaller sizes (if it has excellent eating quality.
Eating quality (taste/palatability)	▪ Medium to high oil content ▪ Flesh dryness/creaminess and smoothness. ▪ High water content varieties are not preferred.	Flesh dryness /creaminess is not considered significant if the fruits are larger sizes. ▪ Eating quality is considered when buying medium or small size fruits.	▪ Consumers/buyers who know the different varieties look at the eating quality – smoothness/creaminess/good oil content ▪ Most buyers just buy based on the size	▪ Medium to high oil content ▪ Creaminess - the avocado should be dry and not watery

Appearance	▪ Good appearance, no blemishes ▪ Medium scratches/bruises ▪ Minimum visible cracks ▪ Avocado varieties which the skin remains green after-ripening are not preferred – varieties	▪ Good appearance and attractiveness – can it attract a customer/buyer? ▪ Minimum scratches /bruises ▪ No visible cracks ▪ Avocado varieties which the skin remains green after-ripening are not preferred – varieties	▪ Good appearance – little or no wrinkles, or shrivelled ▪ Not over-ripened ▪ Fruits must not shrivel and ripe abnormally (immature fruits do) ▪ The outer skin of ripened avocado must be brown or black	▪ Good appearance – little or no wrinkles, or shrivelled outside ▪ Not over-ripened ▪ Fruits must not shrivel and ripe abnormally (immature fruits do) ▪ The outer skin of ripened avocado must be brown, black or purple.

A: Matured avocado without seed attached to the flesh

B: Matured avocado with seed loosely attached to the flesh

C: Immature avocado, colour of the flesh is whitish pale as well as the outer skin of the seed and the seed firmly is attached to the flesh

B: Matured avocado with yellowish gold flesh colour and seed loosely attached to the flesh

Figure 6.6: Inside colour of matured and immature avocado

6.3.1 Value and waste production at the farm-gate

Local brokers use quality standards to extract value from farmers, create value (regarding price negotiation and bargaining power) at the wholesale markets, and reduce risks – loss of trading capital or reduced profit due to rejections by wholesalers. Therefore, local brokers adopt strategies that reduce their risk during harvesting, exemplified by Anita's harvesting strategies (Box 6.2). Local brokers, like Anita, do not buy any fruits that do not meet their quality criteria and those of the wholesalers resulting in losses at the farm.

Losses at the farm occurs in three ways: Firstly, avocados that do not meet size requirements irrespective of maturity, eating quality, and appearance are not harvested by brokers in the peak season [April to early June]. For instance, a variety like Puebla, which produces small or medium-size fruits (Figure 6.7, image A and B) but has excellent eating quality compared to other types, would not be harvested, thereby causing food loss and waste (see Box 6.2). Thus, Anita's efforts to extract value – leaving fruits unharvested for a better price, leads to losses and waste production at the farm and at the wholesale and retail stages due to over-maturity of fruits once it is eventually

harvested (Hofman *et al*., 2013). Similar cases like the one presented in Box 6.2 were observed during harvesting events in the Rombo district:

> *On the first harvesting event, as we walked, one of the brokers pointed to an avocado tree and commented: "We have seen this avocado and its' not good for us…., because of the size we are not going to harvest it. Buyers from Dar es Salaam won't buy; it's not marketable" although the fruits were matured. On the second occasion, the brokers have approached the farmer and decided to buy the avocado; after picking a few fruits for quality checks, they decided not to harvest because of the size: "If we buy it, it will be a loss to us, 'if you do not have an order from a buyer, its' impossible to sell small size fruits" The brokers can only buy if they have a buyer from Kenya or Arusha. Kenya and Arusha buyers like small size fruit. Informal conversations with traders during observation events at markets, similar sentiments were expressed by the traders [Field Journal,* June 2018].

The low value of small and medium-size avocados in the peak season makes it a high risk for local brokers to buy; the returns do not justify the cost of harvesting and transporting it to the market. Thus, 'good quality avocados' are not deemed valuable when they do not meet the required size criteria demanded by wholesalers (Figure 6.7). As a risk avoidance strategy, local brokers and wholesale buyers applied stringent size criteria during the peak season leading to higher losses.

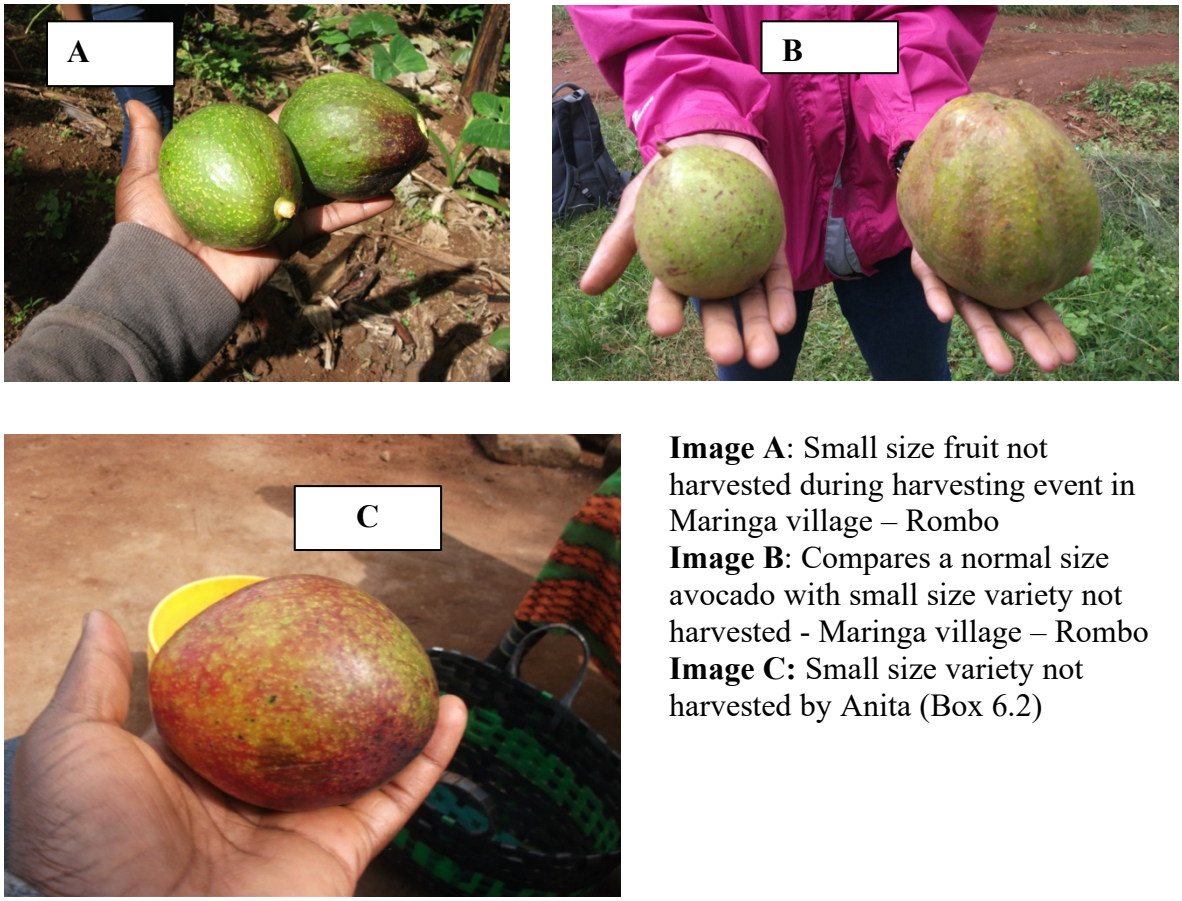


Image A: Small size fruit not harvested during harvesting event in Maringa village – Rombo
Image B: Compares a normal size avocado with small size variety not harvested - Maringa village – Rombo
Image C: Small size variety not harvested by Anita (Box 6.2)

Figure 6.7: Small size fruits not harvested

Box 6.2: Anita's Harvesting strategies.

Anita is a local broker in her early 40s, she lives in Makiwaru village in the Siha District, Kilimanjaro, and has been in the business for about 6 years. During the harvesting observation event with her in Makiwaru and surrounding villages, she shared her experience and risk avoidance strategies. Excerpts of this informal interaction presented here, mirrors what happens at stage of the supply chain.

The first thing I consider, is to buy avocados which when I take to the market the wholesalers will buy. I look at the maturity, has it change colour? I also look at the size. The avocado should be good quality and have good taste - it should not be watery it should be dry have good oil content. Avocados which are small size, I will not buy them. Even when the avocados are matured, but the size is small, the wholesale buyers will just throw them away [rejects]. Can you see the fruits on this avocado tree? I will not harvest it today because the fruits are small sizes, and there is no good price for small fruits now. I have already pay deposit to the farmer, to secure the fruit on the tree. The avocado has a good taste, its oily and matured; but it does not have market now. I will harvest it in a month's time. Small fruits like these ones, have good price, around late July, and August.

When I come to the farms to harvest, I'm very careful of that type of avocados I buy. I look at the taste of the avocados, so that if the buyer rejects them; I can take it to the local retail market, here in Sanya Juu, and because of the taste, I will be able to sell it. Last week when you saw me at the market, I had avocados that the trader [wholesale buyer] did not want to buy because he said it is the variety of avocado which does not change colour when it is ripened […]. The wholesale buyers prefer avocados which changes colour like the one we are harvesting now [….]. So, I took the avocados and stored in one of the stores in the local retail market and sold in small quantities. But some of fruits decayed, about 3 buckets. The greatest challenge is when you have harvested the avocado, taken to the market and you do not get any trader to buy your avocados and you do not have money to transport it to another market or keep it safe.

Extract from field journal (25th June 2018; PTK_LB_FJ_007)

A critical factor influencing local brokers' decision-making is the ability to exchange the avocado at the rural-urban wholesale market. Value creation in this sense is non-interactive but takes an exchange view of value - embodied in the avocado and measured in terms of price (Echeverri and Skalen, 2011; Miller 2008, Appadurai, 1984). Thus, quality criteria and standards create value and waste, providing a vital conveyor belt between waste and value chains (Gille, 2013).

Secondly, losses and waste production at the farm level are due to the poor appearance (blemishes cause by insect pests and fungus infestation), avocados with green skin and high-water content (see Appendix 6.1). The avocado's skin colour and appearance are essential quality standards consumers use to judge its acceptability (Li *et al.,* 2018; Hofman *et al.,* 2013). Among agents

[*Madalali*], retailers and consumers, quality criteria for a fully ripened avocado skin colour should be brown, black, or purple (depending on the variety). Therefore, local brokers view green-skinned avocados as an economic risk, leading to losses and waste at the farm (as demonstrated in Appendix 6.1, Box 6.3). If they cannot extract value from the avocado due to lower prices or difficulty in selling, they will not buy, resulting in losses, as shown in Box 6.2. Any rejections at the wholesale market mean "loss of economic days". They must spend several days selling the avocados in smaller quantities (at the local retail market) instead of harvesting for the next market day. "Selling in smaller quantities leads to either a reduced profit or no profit" [PTK_LB_0064].

Further, brokers could risk reputational damage if they buy avocados that do not meet the criteria of wholesale buyers (Table 6.1). A sentiment expressed by a broker as she shared her 10-years' experience during harvesting observation:

> *"[….], If the avocado is watery, and the wholesaler buys and find out later that it's watery, the buyer will complain to all [the] traders in the market, that you supplied him /[her] with bad avocados. The buyer will disgrace you and damage your reputation in the market; you will lose other buyers, and he[she] may return the avocados to you. In some cases, you may have to buy a good avocado from the farm and supply it to the buyer at the next market to replace those bad avocados. It is like a double loss to you as a broker" [Female, local broker, Siha; PTK_LB_0014-0024].*

For fear of being subjected to shaming and reputational damage and loss of potential buyers, local brokers decide not to buy sub-standard avocados: "We do not buy avocados which we consider are not good and will not sell in the market" (Female, broker, Rombo; PTK_LB_0048).

6.3.2 Value and waste production at the rural-urban wholesale markets

The wholesalers evaluate the avocados against several quality standards, with fruit size being the most important criteria as this creates better price when they sell at the retail market (Table 6.1). As explained by a wholesale buyer during a market observation event:

> *"The first criteria I look at is the size of the avocado; it should be big size, then the appearance of the avocado, there should not be any blemishes […]. Size is important because the agents [Madalali] and consumers in Dar es Salaam prefer bigger sizes […]. People do not like avocado juice in the cold and rainy season; they prefer eating the avocados as fruit…; therefore, they like bigger fruits." [Female wholesale buyer, Sanya Juu; PTK_WS_ 0066]*[88].

[88] In the wholesale markets, there is a three-stage sorting and grading. Local brokers do the first stage of sorting and grading – (avocados that have started to ripe, fruits with medium visible cracks and bruises are graded as rejects). The wholesale buyers and their hired packers do the second stage grading while packaging. The packers are required to follow strict quality criteria (size and appearance) set by the wholesalers: "We train the packers how to remove small size avocados because we just need the bigger one" (Female, wholesale buyer, Rombo - Mamsera; PTK_WS_0068).

"[…..]. Last week, when I was buying the avocados at the market, I did not look at how packers were packing, so they packed a lot of small fruits. When the agent received the avocados in Dar es Salaam, he complained about the sizes. He said he would pay me 30,000 TZS [12.92 USD] per sack bag just to make sure I recover my capital, but not to make any profit; because now there are a lot of good fruits [big fruits] from Bukoba" [Wholesale buyer, Sanya Juu market; PTK_WS_0069].

In Dar es Salaam and other urban cities, consumers prefer large fruits; therefore, wholesale buyers create value through size. Tanzanian consumers like large size avocados, and this perception is culturally ingrained in the domestic avocado market; large fruit provides value for money to the consumer. As expressed by one of the stakeholders "with large family size, if a consumer buys just one or two fruit(s), it can be cut into pieces, and the whole family can share" [PTSH_DAO_0193]. Avocados are priced based on size (not taste) in the retail markets. Large size fruits have high value(price) and sell faster than medium and small size avocados (6.3.3).

However, determining what counts as a small or big 'size' avocado is not a 'static feature' as there is no standard measurement. Determination of what is large or small is a subjective judgement of the buyer; it is more fluid and varies among buyers and at various wholesale markets as well as the varieties of avocado themselves (see Figure 6.8).

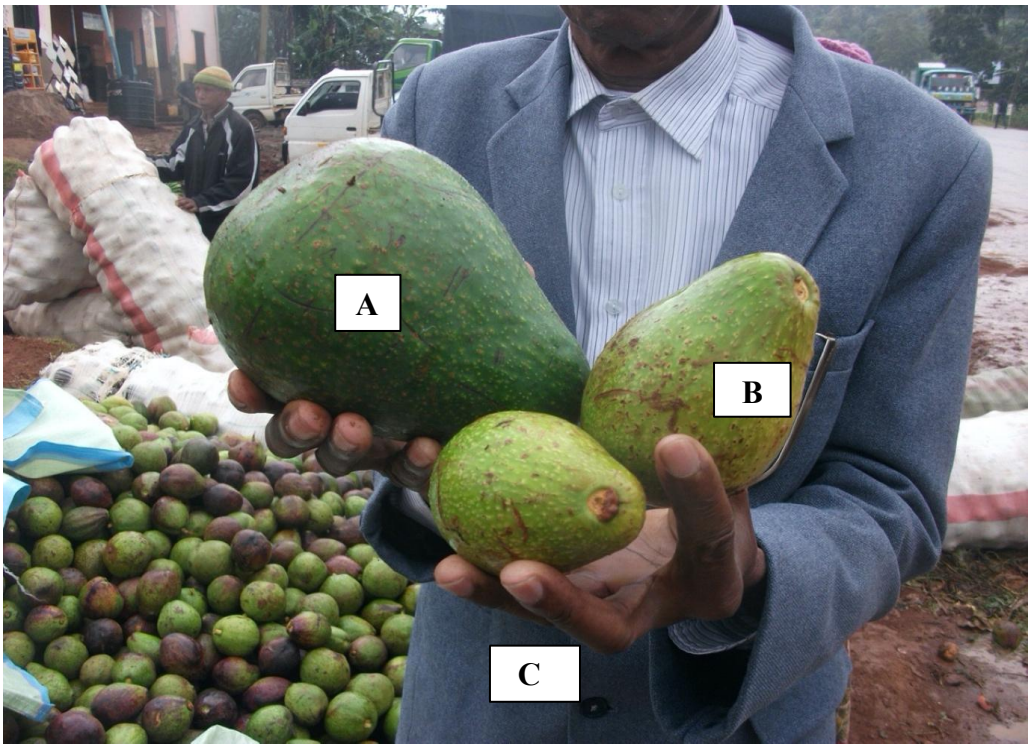


Figure 6.8: Different sizes of avocados at Mamsera market, Rombo District

For instance, avocados from Moshi rural and Rombo districts tend to be generally larger sizes than avocados from Shia and Hai districts due to local climatic variations. There might be variations in sizes for even avocado varieties that produce bigger fruit sizes (Figure 6.8). Which makes 'fruit

size' an elusive quality standard through which buyers can exercise inequalities and power relations. Figure 6.8 shows three different sizes of avocado in Mamsera market (Rombo district) – larger size (A), medium/standard/regular size (B) and small size (C). For example, 'standard /regular' size avocado may be considered small by one buyer but not another in the same market. Besides, what is regarded as a standard or regular size in one market might be considered larger size (A) in another market. The nuances about size lead to losses at different local markets. For instance, at Mamsera market, fruit size 'C' (Figure 6.8, image C) will be rejected by wholesale. But in Siha and Hai districts, the same fruit size (image C) would be considered a regular size.

6.3.2.1 "Do not buy blue avocados": Value and immature fruit

More experienced wholesale buyers use 'coded messages' such as "*blue avocados*" to ensure they do not buy immature fruits. During observation in Mamsera market, the wholesale buyer I was working with tells his friend who was inspecting avocados, "be careful and make sure we do not buy blue avocados". Meaning he should not buy avocados that are immature (Field journal, 2018). Higher prices for avocados during the lean season (August - December) provide incentives to local brokers who travel long distances to harvest any avocado they find – mostly in cooler high altitudes. However, avocados in cooler high altitudes reach "higher oil content, when they are not fully matured" (Hofman *et al.,* 2013, p. 370). Therefore, traders can easily buy immature fruits if they rely solely on oil content as maturity criteria. Immature fruits do not ripen to an acceptable quality, have poor eating quality and are therefore not sellable leading to losses and waste at the destination markets in Dar es Salaam (Hofman *et al.,* 2013; Sivakumar, Jiand and Yahia, 2011; Kader, 2008) Economic loss from immature fruit is a concern for wholesale buyers and their agent traders in Dar es Salaam.

6.3.2.2 Strategies for dealing with loss and waste at wholesale markets

In the wholesale markets in Kilimanjaro region, rejects are categorised into two - second grades (medium/small size avocados and avocados with minimum cracks/scratches, ripe avocados) and third grades (over ripened avocados, and avocados with large cracks /scratches). The second grades fruits are resorted and sold at reduce price to buyers from Arusha and Kenya Kenya and retailers (for the local retail market. According to the traders interviewed at Mamsera market:

> *"Consumers in Arusha and Kenya prefer small size avocados because they are less expensive and are sold in small packs; but also, in Kenya, the avocados are sold to cosmetics producers" [Wholesale buyer, Mamsera market; PTK_WS_0085].*

Also, 'newbies' in the wholesale trade with limited capital or have not yet established enough trust with local brokers start their business by buying second-grade avocados. For instance, they start by buying smaller size fruits which are rejected by wholesale buyers see Box 6.2)[89]. "As I observed during my visits to markets in Dar es Salaam, it is not because consumers in Dar es Salaam do not like small size avocados, but it is an issue of value creation" (Field Journal, 2018). After second grade have sorted, whatever remains is sold to juice makers, banana sellers and as animal feed. In some local wholesale markets - Siha and Hai districts second grade fruits are sold in small quantities at the local retail market by local brokers and third grade are sold as animal feed. Figures 6.9 and 6.10 shows sorting and grading in the local wholesale markets in Kilimanjaro region.

[89] Despite losses and waste at the wholesale market experienced by local brokers', selling to wholesaler buyers has boosted their trade: *"The business is good/lively (changamka) compared to selling at the local retail market; if we were to sell to in retail markets, there would be a lot of losses and waste" [a leading broker, Mwika market; PTK_WS_0068].*

Sorting and grading at Mamsera market: losses and waste

Sorting and grading

No sorting facility at the local market.

However due to lack of value and basic understanding of the perishability, the fruits are poorly handled.

Rejected avocados due size and damage

Reject fruits are be sold to local retailers or banana sellers in bucket or sack bag. For example, a bucket of the rejects avocados is sold 1000- 2000 TZS.

Figure 6.9:Sorting and grading at Mamsera market: losses and waste

Sorting and grading at rural-urban wholesale at Lymombobi market: losses and waste

Sorting of fruits by local traders. This particular broker was overheard lamenting that she was going to lose about 50% of avocados. She bought the avocados a day before the market day, but almost all the avocados are ripe because of over-maturity of the fruits and due to the

Rejected avocados because they are two small, ripe has bruises. Rejected avocados are sold to local retailers at the market or sold to banana sellers

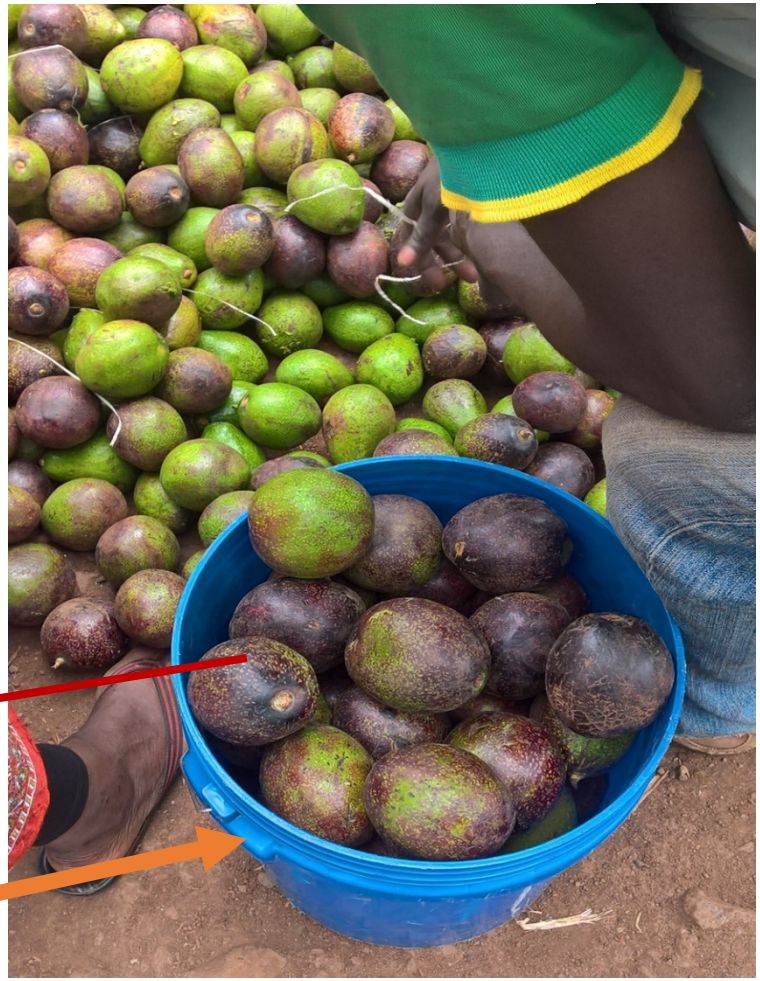


Figure 6.10: Sorting and grading at Mamsera market: losses and waste

6.3.3. Materiality and power relations among local brokers and wholesalers

The wholesale buyers use the materiality of the avocado to exercise power against local brokers, which causes losses and waste production. An example of how wholesalers use the materiality of the avocado to wield power against local brokers is presented in Appendix 6.2 (Box 6.5)[90]. From Appendix 6.2, a long-term trading relationship between the wholesalers and local brokers does not guarantee that the local broker can sell their avocados even when the wholesaler has placed the order. The trading relationship is based on the ability of the local broker to buy avocados that meets the wholesaler requirements. As demonstrated in Appendix 6.2, wholesalers use the materiality of the avocado to justify their refusal to purchase fruits they have ordered from brokers they have trading relationships with:

> *"[...] It was a difficult situation for us; the buyer ordered the avocados, he refused to buy from us because we were late to the market. But this happens all the time, even if you come to market on time, it is the same story" [PTK_LB_0063, see Appendix 6.3].*

Similar situations were observed in other markets; many interviewees (local brokers) expressed the same sentiments about power inequalities from 'wealthy buyers' (external traders) from Dar es Salaam and other cities:

> *"The buyers do not care if they buy your fruits or not. The relationship between you and the wholesaler does not matter; they always look at the avocados [quality standard]. Even if they decide to buy, you must accept any offered price. You have brought the avocados to the market; what are you going to do with the avocados?" [Female, local broker; Sanya Juu market PTK_LB_0064].*

The wholesalers use the materiality of the avocados to extract value - in price negotiations and rejection of fruits. Such unequal power relations make local brokers vulnerable and disposed to exploitation. Once they have purchased the avocados from the farm, they must sell; failure to sell means loss of capital and income.

6.3.3.1 Power relations between packers and local brokers

While power inequalities between the local brokers and the "wealthy" wholesalers can lead to losses and waste generation, the relationship between packers and local brokers also impacts losses and waste generation in the market. Usually, the packers do second stage sorting and grading when packaging for wholesalers (first stage grading is done by local brokers when they sort the avocados into a pile). However, the practices of the packers involve 'stealing' avocados from local brokers

[90] The case study presented in Appendix 6.3 showcase the researcher following the avocados and brokers to the local wholesale markets to understand how power relations among traders causes losses and waste in the supply chain.

while packaging with or without their knowledge. The practice is normalized among the packers and some brokers in the different markets across Kilimanjaro. While some local brokers accept the practice and view it as "a means for the packers to earn a living", [PTK_LB_0044], others frown upon the practice. Yet, the packers use the practice to exercise power against local brokers and farmers that resist their practice. An extract from the field journal (selling observation events) illustrates this:

> *At Sanya Juu market, I worked with the packers for John [wholesale buyer]. As we were grading packing the avocados, I noticed the packers secretly took some of the avocados. When the broker saw the packers were stealing the avocados, she angrily shouted at them! And took her avocados back (more than a quarter of sack bag). I could see the faces of the packers had changed; an argument ensued, and packers changed their tactics. They started rejecting avocados with the slightest visible bruises or marks (irrespective of the size) and medium-size avocados with no bruises. Avocados which they had previously graded as 'good', are now graded as 'bad. The broker had more fruits rejected full sack bag of avocados (approximately 260kg) was rejected compared to other brokers who allowed the packers to take some of their avocados. I had witnessed a similar incidence in Mwika, Mamsera and Kilema markets. The behaviour of the packers' surprised me; they hold so much power, and in their exercise of power, when resisted, a present potential avenue for losses and waste generation. [Field Journal, 18th July 2018].*

Therefore, the packers can work in favour of local brokers or against them - depending on the social relations. Where a relationship based on "mutual benefit" exists, the broker usually has fewer rejections: 'Allow me to take some of your avocados, and I will make sure you have fewer rejections'. In instances where the social relations between the broker and packer is well established, the packer(s) can agree with a broker on "sharing profit or payment system". In that case, packers apply minimum quality criteria to ensure the broker has minimal rejections in exchange for payment or tips.

The packers sanction any broker whose relations towards them is contrary to the norms with a barrage of rejected fruits. The relationship between the packers and the local brokers plays a critical role in whether packers apply 'stringent quality criteria' (as defined by them or 'quality standard' set out in Table 6.1). Because the quality standards are not codified, they are subjected to individual wholesalers and packers' subjective definitions.

6.3.4 Value and waste production in Dar es Salaam wholesale/retail markets

The avocado begins its 'new life' in the regional wholesale/retail markets[91], where it is valued based on size, firmness/ripeness, colour and appearance, provenance, eating quality, and seasonality and availability (Appendix 6.3, Box 6.6). "All of which impact on the value (price)" of the avocado (Coles and Hallett, 2013; p.161). Bigger size and firm avocados command a higher value than those that have softened or have lost their firmness, shrivelled, or unevenly ripened (Table 6.1). The value determination in-cooperates the work done by skilled labourers such as farmers, fruit pickers, local brokers, packers, truck drivers, porters, each occupying a specific locale in the avocado's 'life' journey from the Kilimanjaro to Dar es Salaam. Therefore, the avocado gains more value as it is moved from the production area to nonproduction urban centres; and repeatedly sold in markets and retailed in small quantities (see Table 6.2)

However, the value only holds so long as the avocado maintains its firmness[92]. Determining firmness is an embodied and sensory practice; traders and buyers access firmness by gently squeezing the fruit (Hofman *et al*., 2013). As the avocado is harvested and moved from one market to another, its value increases with firmness (being intact). At the same time, the embodied biophysical properties that hold the firmness together begins to disintegrate, influenced by over-maturity, the material environment (mainly temperature, road infrastructure), handling practices, packaging material, truck, and conditions at the markets. The value of the avocado decreases as firmness reduces and deteriorate with ripeness[93]. As the firmness decreases beyond full ripening, the avocado skin becomes more blackened, the flesh over-softens and is unattractive – reducing its quality and being devalued by retailers and consumers.

Over-maturity increases the rate at which firmness declines after harvest, shortening shelf-life (FAO, 2013; HLPE, 2014). While a well-matured avocado is valued at the farm and the rural-urban wholesale markets in the production areas, it is a significant cause of losses and waste generation at regional markets.

[91] The field observation presented in Appendix 6.2 (Box 6.4) depicts a similar picture in all major avocado markets in Dar es Salaam - Mabibo, Temeke Sterio Vetenari, Tandale and Buguruni; and indeed, in secondary markets like Kisutu, Mwananyamala, Mwenge, Mkumbusho and Sinza.

[92] The firmness of the avocado is a widely accepted reliable means for assessing fruit maturity and stage of ripeness (Magwaza and Tesfay, 2015; Hofman *et al.,* 2013)

[93] The rate of fruit firmness is high at harvest, initially "declines at a moderate rate, but the rate of decline increases and falls to zero at full ripening" (Magwaza and Tesfay, 2015, p. 1999; see also Ledger and Baker, 1995). As firmness decreases, so does skin colour changes from green to black for black-skinned varieties (Ledger and Baker, 1995). At the retail level the skin colour of the avocado is a significant determinant of fruit quality (Holman *et al.,* 2013).

Table 6. 2 Prices of Avocado at the farm gate and wholesale markets (2018)

Year (2018)	2018 Avocado Prices in Kilimanjaro and Dar es Salaam (per 150kg and 100kg sack bag)				
	Farmgate price (Siha District) Per sack bag (150kg)	Farmgate (Rombo Dist. Per sack bag) (150kg)	Rural-urban Wholesale Market (Sanya Juu - Siha Dist.) Per sack bag (100 kg)	Rural-urban Wholesale Market (Mwika/Mamsera - Rombo Dist.) Per sack bag (100 kg)	Wholesale market in Dar es Salaam Per sack bag (100 kg)
Jan	15000	15000	50,000	50,000	70,000
Feb	12000	13000	45,000	45,000	70,000
Mar	10000	10000	35,000	40,000	60,000
Apr	10000	10000	25,000	30,000	50,000
May	10000	10000	30,000	30,000	50,000
Jun	10000	10000	35,000	30,000	60,000
Jul	10000	12000	40,000	35,000	70,000
Aug	12000	12000	45,000	40,000	70,000
Sep	12000	13000	45,000	45,000	70,000
Oct	15000	15000	50,000	50,000	70,000
Nov	15000	15000	55,000	60,000	70,000
Dec	20000	22000	60,000	60,000	75,000

Source: Interviews and observations

The norm is that the fruit should be fully ripened within 4 -7 days from harvest to the final consumer. As explained by female *dalali* (agent) while discussing the challenges she faces during market observation:

> *"Waste is a big challenge; I will say that for every 100 bags of avocado delivered to me, about 4 - 10 bags of it be wasted during the rainy season. Because the fruits are over-matured, most of them ripened together, and if there are no buyers, you end up getting a lot of waste. Sometimes the avocados do not ripe within the expected time because the fruits are immature. Like the avocados I have put here, I will sell these to the juice maker, and if I am not able to sell to juice makers, I will send it to the dump" [Agent, Sterio Temeke market, Dar es Salaam; PTD_TA_0093].*

While reduced fruit firmness leads to loss of value, abnormal ripening (due to immature fruit) results in diminished value[94]. Immature fruits are a significant cause of losses and waste in regional markets during the lean season. Some traders reported losses as high as 40% of a given consignment (see Appendix 6.3), and Mwakalinga (2014) has reported similar levels of losses and waste. The avocado embodies specific biophysical characteristics that make one avocado valued as foodstuff; and another as waste stuff when it crosses the 'contingent cultural acceptability' of firmness/ripeness (Coles and Hallet, 2013; Evans, 2012). Once valued as waste stuff, it begins its

[94] Typically, immature avocado shrivels during storage, and the uneven ripening, as a result, affect eating quality – causes watery taste, stringy and rubbery texture (Magwaza and Tesfay, 2015; Gamble et al., 2010; Pak et al., 2003).

new journey in the market where other value(s) may be derived (Appendix 6.3)[95]. However, the materiality of the avocado 'firmness and ripeness' can become an object through which power is exercised and inequalities experienced within the supply chain. In the next section, I discuss how the market institution – 'a credit system' and the materiality of the avocado juxtaposed with power relations lead to waste production in the domestic supply chain (section 6.3.4). First, I provide a summary of the main causes of losses and waste in Dar es Salaam and ways of dealing with losses and wasted is presented.

6.3.4.1 Dealing with loss and waste at Dar es Salaam wholesale markets

Most of the losses and waste in the domestic avocado supply chain occur at the Dar es Salaam the last stage of the supply chain. Loss and waste are high during the peak avocado season [March – May] because the peak season coincides with the rainy season, affecting sales. The rainy season in Tanzania makes transportation difficult, and the markets get flooded, destroying all the avocados – the leading causes of waste. Also, because the avocados are harvested when they are over-mature, most of the avocados ripened together during transportation resulting in losses at the destination markets. During off-season period, loss and waste are mainly caused by immature fruits, although losses are lower than during peak season. In the Dar es Salaam market, most losses and waste are dumped at an organic waste point located in the market; only a small amount is recovered – sold to juice makers.

6.3.5 'Credit system' and power relations among wholesalers and agents

The credit system was "introduced by traders who started the long-distance trade of transporting avocados from Kilimanjaro to Dar es Salaam" [PTK_WS_0070]. The credit system is a critical market institution that ensures a continuous supply of avocados between production and non-production regions. The trading capital is owned by the wholesaler, who purchase the avocados, covers the costs of loading, transportation, and market taxes (in the production area). The agents "take delivery of the avocados and pay the market taxes in the destination market" [PTK_WS_068], and the wholesaler is paid after the consignments have been sold (see chapter 4). With the advent of mobile phones, most transactions are carried out over the phone, and payments are made through mobile money transfers (some 600 km) between wholesale buyers and agents (Juma *et al.,* 2019; Mwakalinga 2014; de Putter *et al.,* 2007; Holtzman *et al.,* 1988).

[95] It may be revalued and sold at a reduced price to consumers, juice makers, and pig feed or categorized as 'no value' and subject to disposal at the dump

"Trust is of central importance"[96] in informal market institutions (Lyon and Porter, 2009; p.905; Amoako 2019; Eskola, 2005). One agent trader described trust as: "the capital and currency by which one can continue to trade and stay in business" [Agent, Ilala Boma market, Dar es Salaam; PTD_TA_0092]. Yet, "to have an agent who is 'trustworthy', is difficult, because there are only a few of them" [Wholesale buyer, Mwika market, Rombo; PTK_WS_0068]. Other wholesale buyers expressed similar sentiments because of the exploitative nature of the credit systems (see Appendix 6.4 for sample cases). The agents (*Madalali*) survival in business is based on profit margins - a '*commission system'* as explained by a leading agent (with 10-years' experience) at Temeke Sterio market:

> *I buy the avocados on credit from the wholesaler in Kilimanjaro and sell them myself [….]. In a month, I take delivery of about 100 bags. This is how the credit system work; because I do not pay the wholesaler, I estimate that if I get a profit of say 15,000 TZS [6.47 USD] per bag after all cost deductions, that is enough for me. After selling, I will negotiate with the wholesaler, I have not made any losses, and you have so much profit, so we must share the profit. In this way, I reduce the gain for the wholesaler […]. And because I take the avocados on credit, if there are any losses, it is for the wholesaler [Agent, Male, Temeke Sterio market, Dar es Salaam; PTD_TA_0092].*

The credit system coupled with the materiality of the avocado and power relations among the actors and the long distance between them provide an avenue for exploitation and losses and waste production. Due to the materiality of the avocado – its perishability, the agents prefer the credit system; it reduces their risks and uncertainties and passes on the risks to the wholesalers. "In this kind of business, things can change very quickly" [PTD_TA_0092]; losses and waste can occur due to over-ripened and immature avocados or bad weather (heavy rains/high temperatures), the agents use such situations to exploit wholesalers. Over the years, the practice of pushing all the risks to the wholesalers have changed. Now, risks and uncertainties are linked to the causes of losses. In a situation where the wholesaler has supplied bad avocados (e.g., immature fruits), the wholesaler pays or bear the economic cost of any losses and waste: "If the avocado does not get ripe, you [wholesaler] won't get your money from the agent" (Wholesaler, Mamsera market; PTK_WS_Voice 002). Conversely, if the wholesaler supplies good avocados but the agent fails to sell for whatever reasons, the agent bears the cost of the losses.

Notwithstanding, the spatial temporality between the agents and the wholesalers means that the materiality of the avocado can still be used to exploit traders upstream of the supply chain:

[96] Trust may be defined as an expectation of others' behaviour with confidence based on personal relationships or based on the awareness that there are institutions that can enforce or ensure expected behaviour (Lyon and Porter, 2009; Humphrey and Schmitz, 1996, p.5; Zucker, 1986)

"Only a few agents are trustworthy, most are not trustworthy […]. Even if a small amount of the avocado in a bag does not ripen, the agent would say the whole bag of avocado has not ripened." Wholesaler buyer, PTK_WS_0068]

"The agents whom we trust to sell the avocados do not care; even if they can sell the avocados, they will come up with the same old stories" [Wholesaler buyer PTK_WS_0066].

Examples of such cases where unscrupulous agents take advantage to exploit wholesalers are presented in Appendix 6.4. Where an agent is considered 'trustworthy' by a wholesaler and long-term personalised relations exist between them, an "agreement or arrangement for cost-sharing" is instituted to share the burden of losses, reducing the risks for each other irrespective of the nature of the causes of losses. But such an arrangement only exists where the agent view "trust and good relationship with the wholesaler as their only trading capital or currency" [Male, Agent, Ilala Boma market, Dar es Salaam; PTD_TA_0089].

Besides, a fundamental challenge of the credit system is that the sanctions are difficult to enforce since transactions are not formally documented and cannot be verified. In many cases, issues of debt and default payments result in disagreement between the parties. Where default payments are reported to trust-based informal institutions like the market management teams (in Dar es Salaam markets), wholesalers do not receive favourable support leading to mistrust in trust-based institutions. (Amoako *et al.,* 2021; Amoako, 2019; Lyon and Porter, 2009; 2006; Lyon, 2000). This is exemplified by the experience of one wholesaler of dealing with market management:

"The challenge is when I send avocados to the agents, some of the agents did not pay. They changed their mobile number, and I could not contact them. When I reported the issue to the management of the market in Dar es Salaam, they could not help to solve the problem. I think the management at the market does not think or care about the trader who brings the avocado from Kilimanjaro to Dar es Salaam. They just care about the traders in the Dar es Salaam market. Even when the management has contacted the trader who owns you, they will call a meeting to write the agreement on paper for the agents to pay you instalments; nothing happens, they will not pay, and the management does not care much about that. A way to overcome these challenges is when the wholesalers form an association. We have talked about it, but nothing has happened" [PTK_WS_0068].

While trust-based institutions like the market management body regulate the market space by settling disputes, controlling the agents and traders' activities, and collecting taxes, they are perceived unreliable by long-distant wholesale traders.

6.4 Discussion

This chapter examined the institutional and material context for selling/buying practices and how this leads to losses and waste production in Tanzania's domestic avocado supply chain using the supply chain between Kilimanjaro and Dar es Salaam as a case study. The results show institutional arrangements between growers and traders and among traders, structured buying and selling, harvesting, and packaging practices and how losses and waste occur. The materiality of the avocado – its perishability, firmness, and quality (particularly 'size') was used as a risk-avoiding strategy by traders leading to losses and waste generation as each actor seeks to reduce their risks and extract value. The perishability of the avocado was used as an object through which power was exercised and inequalities experienced. At the same time, the institutionalised "credit systems" provided a further avenue for exploitation and losses and waste production, particularly among wholesale and agents traders. Analysis and discussion of the empirical evidence presented in sections 6.2 - 6.4 lead to three critical findings discussed below: how power shifts down the supply chain, how the avocado itself, credit agreements, trust, and risks determine the power shifts and the exercise of power linked to waste production.

The empirical evidence presented in the analysis shows that power shifts down the supply chain – via brokers, wholesalers (and their packers) and agent traders. Fundamentally, the materiality of the avocado, risks avoidance and value extraction play essential roles in determining how power shifts depending on the position of the actors. A focus on risks reinforces how power and inequality work in food systems (Beck, 1992). Risks in themselves can be viewed as a critical source of power - 'by shielding one-self from risks and increasing another exposure to them is a key source and exercise of power' (Gille, 2013, p31; see also Power, 2007; Beck, 1992). I draw broadly on Gille's (2013) conceptualisation of food waste, where risk is viewed as a vital connector between waste chains and value chains, to contend that risks provide an essential avenue for exercising power leading to food losses and waste generation.

First, as the empirical findings show, local brokers at the farmgate shield themselves from the risks of possible economic loss (loss of profit or trading capital, economic days) via fruits rejections; any rejections mean they must spend several days to sell the avocados in small quantities at the local markets where prices are lower due to low demand (Juma *et al.,* 2019). Due to limited trading capital and high transportation costs (Mwakalinga, 2014; Shumeta, 2010; Eskola, 2005; van Ufford and Zaal, 2004), sometimes, brokers make just marginal gains or do not earn any profit. Therefore, the risks of losing entire trading capital are very high. Juma *et al*. (2019), in their study of avocado

traders in the SH, found that local traders (brokers) have limited purchasing capacity. While Eskola (2005) noted that marketing margins for brokers along national agricultural produce supply chains in Tanzania range from 4% to 20%. Similar margins have reported been among avocado brokers in Ethiopia (Shumeta, 2010).

The brokers as primary middlemen between the farmers and wholesalers (Mwakalinga, 2014; Eskola, 2005; de Putter, Koesveld and Visser, 2007) hold power in the price negotiations. They use their position as buyers to shield themselves from potential loss – they decide which avocados to buy and how it is priced, graded, and packed. Juma *et al*. (2019, p.11) reported that in the SH, middlemen (brokers) "set low prices to earn more profit by selling the produce to wholesalers at higher prices" (ibid). The same findings have been reported in domestic avocado supply chains in Kenya (Omolo *et al*., 2011; 2006), Ethiopia (Megerssa, 2013; Shumeta, 2010) and the Philippines (Sotto, 2002), where brokers used their bargaining power to set lower prices. For instance, Megerssa (2013) noted that among the smallholders' avocados growers in Southwestern Ethiopia, prices were exclusively determined by local collectors (brokers) at the farm, which had resulted in farm gate prices falling from 8 birr/kg to 1.75 birr/kg within 5 years. The farmers' low bargaining power is because of limited access to price information (in the wholesale markets) and the high cost of searching for information. Similar issues have been reported in other SSA rural-urban food systems (Lyon and Porter 2009; Porter, Lyon, and Potts, 2007).

Farmers in their weak position must rely on personalised trust-based trading relations with a local broker, links to other traders, neighbours, relatives or visit markets to access price information (Omolo *et al*., 2011; Shumeta, 2010). Shumeta (2010) reported that a significant number of avocado farmers in Ethiopia relied on the benevolence of their buyers to set their selling price. Using personalised trust-based links to access market information has been identified as necessary in reducing uncertainties (Lyon and porter, 2009). However, traders are better positioned to obtain price information than farmers (Lyon and porter, 2009; Porter et al., 2007).

The findings indicate that at the farm gate, respective of the buying arrangements between the local broker and the farmer, brokers use the materiality of the avocado – its perishability and quality to exercise power and set lower prices. Shumeta (2010 p.205), for instance, observed that smallholder avocado farmers in Ethiopia "received lower prices due to the perishable nature of the product." Megerssa (2013) reported similar findings; he found that around 73% of farmers he studied in Southwestern Ethiopia were compelled to sell avocados at whatever price offered by the collectors. Collectors use the "short shelf-life of the avocado to pressure producers to sell at a low price" (ibid,

p.2293). Besides, evidence from this study shows that the quality of the avocados - particularly fruit size, taste (water and oil content), and skin colour (green skin varieties) were essential attributes that brokers used to exercise power and control over farmers in the trade relations, often resulting in food losses and waste.

Further, the trading arrangements that allowed the broker to 'secure the avocado tree' or the fruits in either long-term or short-term relations were found to be vital sources for the exercise of power and control. Similarities can be drawn with the study by Akyoo and Lazaro (2007) on Tanzania's spices supply chain, and Lyon and Porter (2009) analysis of vegetable trade on Nigeria's Jos Plateau, where traders provided credit to farmers based on trust and the farmers are obliged to sell to the traders when the crop is ready. The effect of these trading arrangements is that it makes farmers vulnerable and dispositioned with limited options to sell to other buyers and are forced to accept whatever price is offered (Lyon and Porter, 2009; Eskola, 2005). In contrast, other studies have reported cases where producers sell on credit to the buyers and traders (Lyon and Porter, 2010; Lyon, 2000; de Putter, Koesveld and Visser, 2007; Lynch, 1994). Although the exercise of power by brokers leads to losses and waste generation, they provide a critical marketing channel to the farmers – because of their ability to buy relatively large quantities compared to selling to rural retailers (Juma *et al*., 2019; Mwakalinga, 2014).

Secondly, as the avocados are being exchanged, the power held by the local brokers' shifts to the wholesaler buyer at the markets. As the empirical evidence shows, the wholesale buyers' ability to purchase large quantities of avocados provides brokers with the most reliable and cost-effective marketing option (Juma *et al*., 2019; Mwakalinga, 2014; Shumeta, 2010). The wholesalers work as cartels – their ability to coordinate activities and communicate among themselves enables them to control and set lower prices at the wholesale markets to increase their margins and reduce their risk of loss. Shumeta (2010) and Omolo *et al*. (2011), in their study of domestic avocado production and marketing systems in Ethiopia and Kenya, both observed that wholesalers use their position in the supply chain to offer lower prices. For instance, Shumeta (2010) found that wholesalers in the Ethiopian trade gained 35.41% of the gross profit from the transaction compared to about 25% margin earned by brokers. The power of wholesaler to lower prices have been noted in other fruits and vegetables and grain marketing in Tanzania (de Putter, Koesveld and Visser, 2007; Eskola, 2005; Ashimogo, 1995; Lynch, 1994; Shechambo, 1993) and in studies focusing on West Africa (Porter et al., 2003; Lyon, 2000; 1999; Porter, 2001).

Wholesalers use the materiality of the avocado - its perishability and their defined stringent quality (individualised criteria) to exercise power through sanctions – peer pressure, shaming, and personal reputational damage even in trusted-based social relations (Lyon and Porter, 2010; 2009; Lyon 2000). Sanctions significantly resulted in food losses and waste production, causing an economic impact on brokers – loss of income, potential buyers, future income, and exclusion from trade activities (Lyon and Porter, 2009; Porter and Lyon, 2006). In extreme cases, sanctions in such informal market institutions have been reported to include "to physical threats and actual bodily harm" (Porter and Lyon, 2006). The relatively short shelf-life of the avocados, low demand, and prices in the production regions - especially during peak seasons (Juma *et al., 2019*; Megerssa, 2013; Shumeta, 2010; Omolo *et al.,* 2011) exacerbate the vulnerabilities of brokers and provide an avenue for buyers to extract value (lower prices). The exercise of power, either through lower prices or total rejection of pre-arranged orders from a local broker, causes food losses and waste. Further, the informal verbal arrangement, where the broker takes orders and purchase fruits with their capital, leads to an unequal balance of power. The empirical evidence shows that because of the perishability of the avocado, personalised trust in the trading arrangement is not reciprocated when the product does not meet the wholesaler defined quality criteria leading to losses and waste production. However, the nature of social relations between brokers and packers at the market is critical to the level of rejections that brokers get. The power exercised by packers in grading decisions resulted in higher rejections where negative relationships exist, and the brokers do not accept normalised practices.

Thirdly, as the empirical findings illustrate, much of the credit trading occurs between wholesalers and agents *(Madalali)* in Dar es Salaam. As the avocados exchange hands between them, the balance of power shifts to the agent traders. The shift of power is supported by the credit systems and trust in the trading relations (Amoako *et al.,* 2021; Amoako and Lyon, 2014; Lyon and Porter, 2009; Porter *et al.,* 2007; de Putter *et al.,* 2007; Eskola, 2005; Ufford and Zaal, 2004; Lynch, 1994). This study shows that while agents considered trust as "the trading currency or capital", they use the materiality of the avocado and the credit systems to exploit and exercise power against the wholesalers who owns the trading the capital. Therefore, personalised relationships are increasingly essential to reduce risks and uncertainties in such informal market institutions where transactions are complex and not covered by the formal contract (Amoako *et al.,* 2021; Lyon and Porter, 2010; 2009; Porter *et al.,* 2007; O'Neill, 2002; Moore, 1994).

As part of the credit system arrangements, norms about the causes of loss and waste determines who bears the cost of the associated loss. The established norms weaken the wholesalers' position,

makes them vulnerable, and allow agents to perpetuate inequalities against them. For instance, where an agent bears the cost of losses, the wholesaler is expected to continue supplying avocados to the agent to enable the agent to pay back. Thus, 'enslaving' the wholesaler (the credit provider) to the agent, especially where the loss involves a considerable sum of trading capital (see Appendix 6.4, samples cases of trust in the credit system leads to exploitation). Lyon and Porter (2009), in their study of vegetable traders in Nigeria's Jos Plateau, noted that "the credit supplier did not have the upper hand" or hold power in the credit relationships and an "over-pressured farmer or petty trader (credit receiver) can call on local moral judgments to support his/her decision to renege on responsibilities to repay (ibid, p.910). Thus, "trust-based relationships can result in conspiracy and exploitation" (Baier, 1994; cf. Lyon and Porter, 2009, p.907).

As observed in several studies, while the credit systems are critical for the movement of food and trade in SSA, they can be exploitative if individuals become tied into debt relations (Bhaduri, 1986; Clough, 1981, 1985; Watts, 1987). This study revealed that conspiracy and exploitation by the agents in social relations have a significant impact on loss and waste generation (Appendix 6.4). Agents conspire and exploit through the materiality of the avocado, especially where there is a spatial barrier between them (as in this study). While power relations and activities of urban traders and rural traders shape the marketing system and movement of food/goods through the urban food provisioning system (Guyer, 1997 & 2019; Mather and Greenberg, 2003; Bernstein, 1996; Cough, 1985). This study has shown that the materiality of the 'product' in the trading relations enables power to be marshalled through the credit system arrangements. The exercise of power leads to losses and waste as the product is traded and exchanged; thus, the exercise of power did not reside with one actor but shifted along the supply chain.

Lastly, the findings discussed have critical theoretical implications and contributions. This chapter generally contributes to the growing body of literature on informal market institutions, specifically, the role of trust - in social relations and credit system arrangements that underpin the functioning of food supply chains in SSA. Yet, the extant literature on trust has primarily focused on analysing the influence of trust and trustworthiness in the personalised-based trade credit relationship without greater attention to power relations and its impact on food losses and waste production. The findings bring to the fore how trust in personalised trade relations and credits system arrangements in an informal market institution shape different selling relations and their implications for losses and waste generation in the domestic or national food supply chain in Tanzania. It demonstrates how power works and shifts along the supply chain to produce losses and waste.

6.5 Chapter summary

This chapter examined institutional and material context for selling-buying practices and how social relations between farmers and traders and between traders leads to losses and waste production in Tanzania's domestic avocado supply chain using the supply chain between Kilimanjaro and Dar es Salaam as a case study. The chapter explores how risk, value and power relations operate in the trade relations to produce losses and waste. The finding has shown that the institutional arrangements and the social relations between brokers and farmers structure the buying/selling and harvesting practices, which has implications for the ways losses are generated during harvesting. The next chapter (chapter 7) focuses on the institutional arrangements, social relations, and waste production in the export avocado production system.

Chapter 7

Institutional arrangements, social relations, and waste production in the export avocado supply chain.

7.1 Introduction

This chapter builds on the institutions, values and agronomic practices, and supply chain and marketing channels discussed in chapters 4 and 5 to provides empirical evidence of how institutional arrangements structure buying-selling relations in Tanzania's export avocado production. There is a lack of empirical studies using a social relational approach to understand how institutions, materiality, and power relations among exporters/buyers and growers cause farm losses and waste production in SSA. When development and political economy approaches are adopted to analyse power relations and the impact of contract farming on farmers in the global South, it often fails to illuminate the nuances and subtleties in the social relations between exporters and growers. For example, how value creation by farmers and value extraction by exporters/buyers produces waste. This chapter addresses this knowledge gap and takes a social relations approach to investigate how buying/selling relations (institutional arrangements – contract/agreements) and materiality operate to produce losses and waste in the two sites (NH & SH) studied in this research.

The chapter draws on in-depth interviews, informal conversations, and 'go-along ethnographic observations in Tanzania's NH and SH production regions. Findings show that the institutional arrangements between farmers, farmer groups, and buying companies shape how farmers sell their avocados through one or a combination of the four-mode(s) of buying/selling relations. The modes of selling relations were found to provide an avenue for value extraction and creation by exporters and farmers alike as they seek to reduce their risks. I argue that the social relations of buying/selling between farmers, farmer groups and exporters and brokers provide an avenue for value extraction and exploitation by exporters, which have intended and untended consequences for losses and waste production. However, there were differences in how the social relations of selling/buying operates to produce losses and waste in the two sites.

Furthermore, the interactions between the materiality of the avocado (volume of production and location of growers) and price determination were found to be a significant source of inequalities and price disparities among growers, particularly in the NH. The institutionalised arrangement such as 'rejects sharing system' where all farmers in the out-grower scheme shares rejects from out grading create capacity for waste generation compared to the SH where farmers do not have share rejects. The unevenness in sharing the burden of waste production in NH, result in farmers adopting risk reduction strategies that generate further waste. Taking a social relation approach helped to analyse food losses and waste through the lens of power relations, value extraction, inequalities, and vulnerabilities among growers in Tanzania context. Thus, pushes against the technological, infrastructural, and managerial inadequacy and practical know-how bias, which has hitherto dominated food losses and waste discourses about the global South. This chapter is structured into seven sections, the introduction section (7.1), followed by a discussion of the main findings in sections 7.2 to 7.5. After which, the results are discussed in the context of other literature (section 7.6), and the chapter concludes with a summary (section 7.7).

7.2 Institutional arrangements and losses and waste production.

In global production systems, particularly high-value fresh fruits and vegetables the global South has become a vital production hub to meet all-year-round demand for fresh fruits and vegetables in the global North (Clapp and Fuchs, 2009; Clapp, 2012; Fold and Pritchard, 2005; Friedland, 1994; Barrett *et al*., 1999). However, as discussed in chapter 5, such export-oriented production systems in the global South are structured, controlled, and institutionalised through quality and safety standards and certification schemes (Henson and Reardon, 2005; Busch, 2000; Barrett *et al*., 1999). Exporters need to sign contracts with farmers[97] to fulfil a significant production and marketing requirement (GlobalG.A.P. certification as the minimum requirement), which requires a new institutional arrangement with farmers. This section critically examines how institutional arrangement shapes buying-selling relations between exporters and farmers. The results showed that farmers sell their avocados through one or more of the four modes of selling-buying relations (Figure 7.1) based on the marketing channels presented in chapter 4 (see, Figure 4.18).

(1) Direct selling relations between the farmer and exporter through contracted out-grower scheme where the exporter manages the out-grower and GlobalG.A.P. certification scheme.

[97] Contract farming defines the arrangement between a buying company and a selling farmer in which the terms of sales are specified and agreed upon in advance (Grosh, 1994)

(2) Direct selling relations between the farmer group (association or cooperative) and exporter or broker where the farmer group acts as the marketing agent for the group members.

(3) Direct selling relations between farmers and the farmer group – where the cooperative acts as the buyer.

(4) Spot buying relations (side selling) – the farmer sells directly to the exporter/packer or broker in this mode of selling. It usually involves informal arrangements, sometimes with repeated market transactions and is used mainly by independent growers. However, farmers in modes 1, 2, or 3 selling relations may sell to other buyers outside their contract or agreements (with the farmer group).

The choice of mode of selling relations is shaped by the institutional arrangements between farmers, farmer groups and exporters. A summary of the advantages and disadvantages of each selling-buying relationship is presented in Appendix 7.1 (Table 7.1). How each of the four modes of selling relations operates in the two production sites is examined in more detail in the following subsections.

7.2.1 Contracted out-grower selling relationship (Mode 1)

There are two types of selling relations in the contracted out-grower schemes[98]: 1) The farmer belongs to an out-grower association; the buying company signs a contract with the association which in turn signs a contract with individual farmers (predominantly in the NH). 2) The buying company signs contract directly with the individual out-grower – mainly in the SH (Figure 7.1).

[98] Out-grower schemes are models use by agri-food companies to integrate smallholders and medium scale producers into the production systems –usually export production and Agri-processing companies. Out-grower schemes, also known as contract farming, are broadly defined as binding arrangements through which a firm ensures its supply of agricultural products by individual or groups of farmers. Thus, ad hoc trade agreements are being replaced by co-ordinated commercial relations between producers, processors, and traders leading to a vertical integration of the agricultural value chain. The scheme comes in different models with different arrangements based on each partner's input and management structure – where the scheme is managed by the exporter or agri-food processing company; or the scheme is self-organised by farmers who sell their produce to the exporter or processing company, and sometimes scheme is own by government – in case the processing factory is owned by government. The scheme ensure control over sourced supply while at the same time granting access to local markets. Key ingredients for success are a long-term business interest and the development of mutual trust. See for example - OECD Development Centre (2008), Business for Development: Promoting Commercial Agriculture in Africa, OECD. Development Centre, Paris. Available at https://www.oecd.org/countries/ghana/businessfordevelopment2008promotingcommercialagricultureinafrica.htm

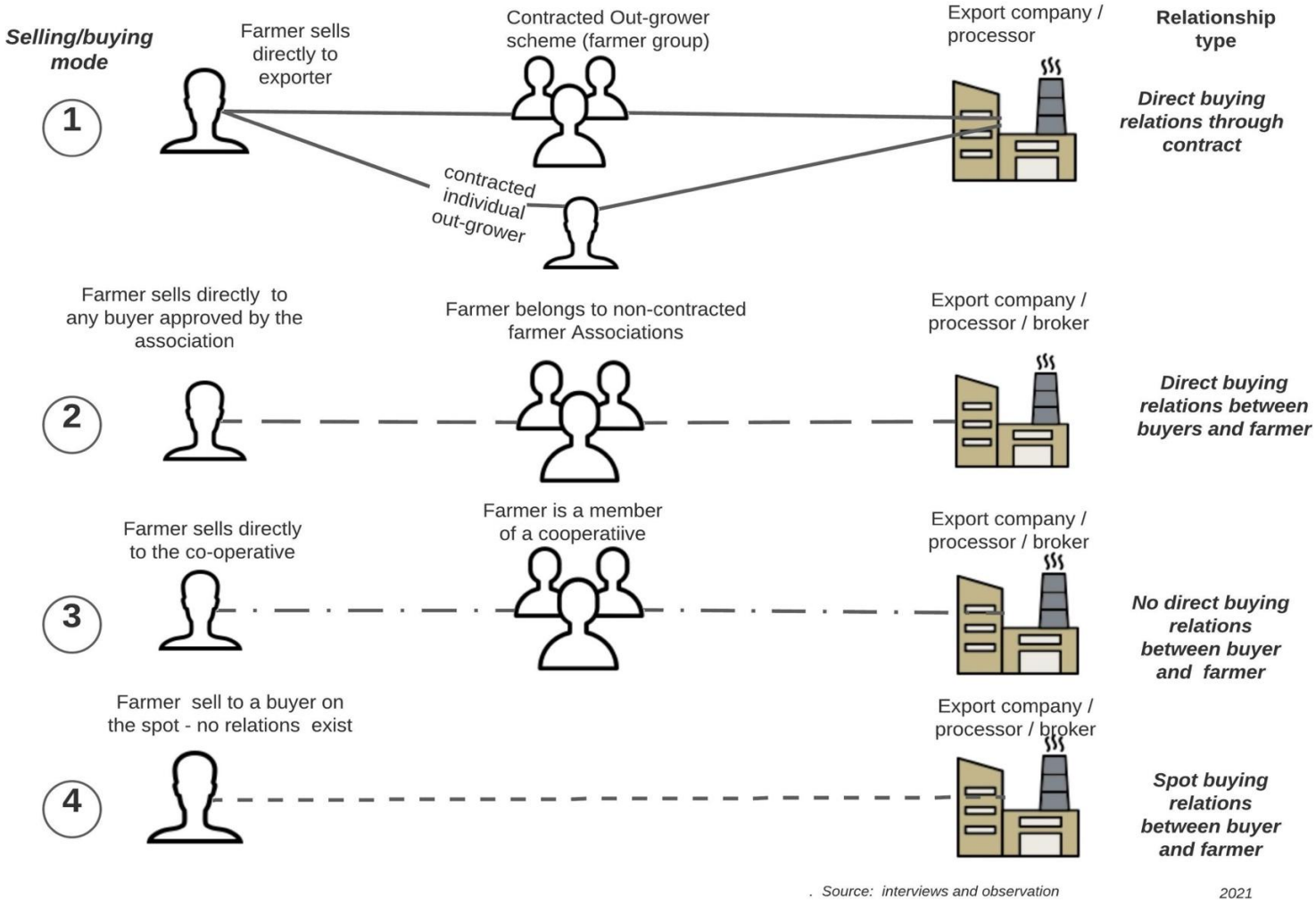


Figure 7.1: Selling and buying relationship – based on marketing channels (Figure 4.16)

In either type of out-grower scheme, there are direct selling-buying relations between the farmer and the exporter/buyer. In this relation, the farmers must sell to the contractual company as the sole buyer. However, there are subtleties and nuances in the contracted out-growers selling relations in the two production sites, which have implications for losses and waste production.

7.2.1.1 The contractual selling relation in NH

Farmers are not engaged in the contract process; the exporter sets contract terms, and the group or the farmer just signs it. Surprisingly, most of the farmers interviewed did not have copies of the contract (except lead farmers) even though they sign a contract at the start of each harvesting season - as expressed in the quote below by a field officer:

> *"Also, the farmers do not have a copy of the contract; they just sign the contract every year [...]. The company say that the contract is not complete, every year they try to add something to the contract, so when you ask the company, why can't we give copies to farmers, the answer is that if we give farmers a copy, how can we come back and take that copy and change it?" [Field officer; PTK_FO_0166].*

The lack of access to contract (either individual contract or group contract) by farmers, give rise to control lack of transparency, and inequalities in a mutual relationship. As the only exporter (at the time of this research), the company enjoys monopsony power and controls the out-grower association. There is a high degree of mistrust among farmers about the company's operations. However, weakness in leadership and lack of capacity among the group means it cannot operate independently of the company; and is subjected to the control strings of the company. While farmers acknowledge the benefits of having a contract: ready market access, security, and a guarantee to sell directly to a company, they have a contractual relationship. They also expressed concerns about being 'locked-in' in the contractual relationship with severe sanctions if they fail to follow the rules and guidelines set out in the production and marketing manual. The quote below by one of the research participants (a lead farmer) exemplifies farmers sentiments:

> *"As a group, we must not sell [our fruits] to anyone else apart from the company. Other buyers come from Kenya, but we are told not to sell to another buyer. If the company notice that you have sold your avocados to someone else…, they will not buy from you again, and you will be removed from the contract [association] [..]. One thing that most farmers fear is [that] if you breach the contract with the company, you cannot get a buyer from Kenyan…just to come and buy your fruits as a [individual] farmer" [Male, smallholder, lead farmer; PTK_EF_0077].*

The contract sanctions and discipline "scares" farmers because of their effects in generating not only food losses and waste but, most importantly, financial loss. Farmers' do not have alternative markets to sell their products if removed from the contract. Farmer's vulnerabilities in the selling relations and implications for losses and waste production are discussed in section 7.3.

7.2.1.2 Contractual selling relations in the SH.

Unlike the NH, in the SH, the out-growers are contracted individually by the exporter companies – until 2017, there was only one export company in the SH and enjoyed monopsony power (see Figures 4.2 & 4.14)[99]. Since 2017, contractual relations have changed from one that restricted farmers to sell only to the exporter; to a new contract relation - that tacitly oblige the farmer to sell to the exporter through the provision of inputs loan or services:

> *"[…] Now the old type of contract is no more in existence; the new contract is that they [companies] are providing loans [farm inputs] to the farmers, and the farmer must agree to sell their fruits to the company so that the company can deduct the loan from the farmers' harvest. So, selling my avocados to a company that provided me with the loan [is] a must" […].*
>
> *"However, the farmer is also free to sell to another buyer if the farmer pays the loan or buy the inputs on cash, so there are two options" [Male, medium-scale farmers; PTSH_EFMS_0176; PTSH_EFMS_0183].*

Being in contract restrict farmers' right in the selling-buying relations and their ability to create value for the product through higher price, as well as when to make harvesting decision:

> *"For me, I think it is not good having a contract, because it ties me to the company providing inputs; and [I am] forced to sell my harvest to them, even when another buyer is offering a higher price" [Male, smallholder; PTSH_EF_voice 021].*

Farmers view the exporters/packers as the primary beneficiaries of the contractual relationship as they can secure and are "assured of getting fruits from the farmer" [PTSH_EFMS_0221]. Therefore, farmers seek to create value (higher price) for their produce by 'side selling' to other exporters (especially Kenyan brokers) even if they have contractual relations. Section 7.2.4 details the impacts of side selling.

7.2.2 Selling relation between non-contracted farmer groups and buyers (Mode 2).

In the SH, many non-contracted self-organising farmer groups have emerged recently. An example of such association is Mbeya Avocado Farmers Association (MBEAFA), which operates at the regional level with several smaller farmer groups[100]. The association has its own rules and conditions for membership and determines how members sell their avocados - farmers can sell to

[99] The internal politics within the export producer company (Rungwe Avocado Company Limited) split up the company, and Kuza Africa Limited was formed in 2016. However, the split up affected farmers ability to sell their harvest in the 2016 crop season leading to losses and waste as the local domestic market could take all the harvest.
[100] Such associations provide a common voice for farmers, represents farmers' interest at the stakeholder level, and links farmers to exporters and buyers approved by the association

any company approved by the association (Appendix 7.1). The institutional agreement creates a selling-buying relationship where the export companies buy directly from the farmers without contractual relations. This mode of selling relation gives farmers the freedom to sell to a buyer of their choice, thereby reducing risks usually associated with contractual relations. Therefore, concrete transactions are not agreed upon in advance, so the farmer remains flexible in the marketing decision (Schipmann and Qaim, 2011), unlike the contracted out-grower scheme. Because of this freedom, farmers are not keen on signing a contract with companies approved by the association:

> "*I do not have a contract with any buyer because when you have a contract, you lose the freedom of choosing a buyer with a higher price. The big issue for me is, there is no freedom of decision if you have a contract. Although I don't have a contract with any company, their field officers come and advise me on good practices, creating an environment for me to sell to them in case their price is reasonable" [Male, smallholder, PTSH_EF_0184].*

This new mode of selling relation help create value for the farmers - better prices, access to reliable and secured buyers, and flexibility of when to harvest, which has hitherto not been possible due to contract locked-in, and monopsony power enjoyed by the only export processor in the SH. Farmers can sell to different buyers depending on the quality and size of fruits they want. However, the selective harvesting process used by the buyers presents challenges, which make farmers vulnerable and create losses and waste (section 7.2.4 and 7.3).

7.2.3 Direct selling relationship between farmer group and the farmer (Mode 3)

An example of direct selling relationship between the farmer group and the farmer is the Agricultural Marketing Cooperative Societies (AMCOS). AMCOS acts as the marketing agent and a buyer in this selling relation, examples are Rungwe Avocado Growers Association (UWAMARU - AMCOS) and Njombe Avocado Farmers Network (NAFN)[101]. The buyer first establishes contact with the association's leadership, indicates the quantity they want to buy, and the price negotiated with the buyer. Once the price has been agreed, the leadership then determines which farmers the

[101] Umoja wa Wakulima wa Maparachichi Rungwe (UWAMARU) association was formed in 2016 due to the internal conflict in Rungwe Avocado Company in 2016. The association was formed by two small groups of farmers in Kiwamilo and Lutengano villages who team up with the investor (Rungwe Avocado Company limited) to start the out-grower scheme in 2009. The association was formally registered as a cooperative society under AMCOS and currently has 176 members (24 are women, 38 youth and 114 are elder men). NAFN started with 12 farmers and now have over 2,500 farmers. Both associations have the same mode of operation and aim to increase the income of farmers through access to good market prices, assist farmers to have power and voice in marketing their products and to have direct access to the market without using middlemen as well providing training and advice to farmers.

buyer can harvest. As a condition for membership, farmers sign an agreement to sell their products through the association as explained by the UWAMARU chairperson:

> *"Our mood of operation as cooperative is that when a buyer comes, we ask how many tonnes the buyer want to buy. For example, if the buyer wants to buy 20 tonnes, we negotiate the price and, the buyer then must pay the total amount into the association bank account. Only when payment has been made can we take the buyer to the farmers, and the buyer is allowed to harvest only the agreed quantity. If the farmers are supposed to be paid 1,500 TZS per 1kg, the cooperative paid the farmer 1450 TZS per 1kg and, the cooperative keeps 50 TZS from each 1kg sold by the members for the management of the association and undertaking other development activities" [Chairman, PTSH_UWAMARU AMCOS_0232].*

The direct selling relationship provides farmers with a voice and control over how they sell their produce, it reduces power imbalance in price negotiation, and creates value – a higher price and timely payment for farmers (see Appendix 7.1). However, internal power dynamics among association members and leadership, and buyer's behaviour can sometimes lead to losses and waste production at the farm.

Some farmers reported favouritism in the selection of farmers by leaders: "If a farmer is not on good terms with the leadership, he or she may not be selected in time" [female, smallholder; PTSH_0235], which can result in losses and waste due to over-maturity of fruits. Large-scale producers have more power and influence, and maybe allocated buyers first. Also, buyers prefer buying from large producers because it reduces transaction costs compared to harvesting from several small-scale farmers. Because of their influence and power, large-scale producers can look for buyers, leaving smallholders vulnerable to the risk of losses and waste. Small-scale producers' vulnerabilities are heightened if they are in remote areas (and have fewer avocado trees). Most buyers [Kenyan brokers] prefer to buy from farmers in areas that are easily accessible, leading to losses and waste for farmers in remote locations. Again, the large producers in NAFN have a cluster of individual smallholders and therefore have control over how they sell their fruits, as explained in the quote below:

> *"The problem is that most of the smallholders got free seedlings from innovator farmers [the large-scale farmer], each innovator farmer has a group of smallholders, so he has got a voice for them - he tells the farmers, wait until I give you a company which is coming to buy your fruits. There are only a few farmers who can decide on their own what they want to do" [Male, manager of the export company; PTSH_TMGR_0220].*

Moreover, a lack of monitoring of the activities of buyers (i.e., Kenyan brokers) at the farm results in high levels of losses and waste. In some cases, buyers only harvest a small percentage of the total harvest or reject the whole crop, leading to losses and waste:

> *"Last year [2018], the association (NAFN) sent a company to our village, the company supplied us with creates to harvest our fruits, I harvested 62 creates [approximately 1.24 tonnes], but when the*

buyer came back to weight the fruits, they rejected all fruits, not only my fruits but other farmers in the village as well" [smallholder farmer; PTSH_EF_Voice 031].

Farmers are also faced with uncertainty and risks of losses and waste when production is high and harvesting season coincides with avocado harvesting season in Kenyan. For example, in 2018, due high level of production, Kenyan brokers did not buy from Tanzania (Njombe region), leading to losses and waste.

7.2.4 'Side-Selling': spot buying relationship (Mode 4)

Side-selling relations arise when farmers that are part of a contracted out-grower scheme or belong to an association or cooperative 'sell' their fruits to a different buyer. Farmers side-sell to create value - higher price and prompt payment. Narratives from the farmers revealed that although side-selling generate value for them, the practice leads to many rejects, causing losses and waste production, as exemplified in the quotes below:

"This year [in April 2019], I first sold some fruits to KUZA Africa limited, who bought the fruits for a low price; but when the Kenyans came, they offered a better price, so I sold the rest of the fruit to them. However, the problem with the Kenyan buyers is that they left me a lot of fruits on the trees, which I sold to the trader(s)(Wasaketera) from the local market in Kiwira *for a low price" [Male, smallholder; PTSH_EF_0215]*

"I sold my fruits to the Kenyans [brokers], but they only picked the good fruits; I was left with a lot of rejects, which I sold to a local trader. But this was a loss to me because the local trader bought the rejects at a low price. The trader did not even measure the fruits; she just looked at the heap of the fruits and said I would pay you this amount" [Female, smallholder, PTSH_EF_0177].

Kenyan buyers extract value from farmers by harvesting only premium fruits. The practice presents a critical challenge to farmers regarding losses and waste generation. Sometimes, losses can be as high as 70% of the total production, as explained by a senior manager of an export buying company:

"The problem we face here is the Kenyan brokers, they just buy from the farmers, and they are very selective - they select the best fruits and leave almost 70% of the fruits to the farmers to look for their own local market" [PTSH_TMGR_0220].

In the NH, however, farmers who side sell to Kenyan brokers are of the view that they have fewer losses compared to selling to the export company they have direct selling relations with– as revealed in the quote below by a smallholder farmer:

"The brokers normally pay higher price 1,200 TZS [0.52 USD] per kg some even pay 1,500 TSZ [0.64 USD] per kg. The good thing is that they are not leaving the rejects; they pick them all, about 80%-90% of what is harvested. Even if there are any rejects, it is just a few, unlike Africado limited, which takes 60%-70% of what is sent to the packhouse. Once they weigh your avocados, you get

your money. But, in the case of Africado, you to wait five months; that is a problem" [Male, smallholder; PTK_EF_0147].

Notwithstanding, side-selling is critical for losses and waste production due to selective harvesting and contract sanctions (see section 7.3). A situation that stakeholders view as posing a significant threat to the sustainability of the avocado industry, as expressed by a senior manager of SAGCOT:

> *"These Kenyan briefcase traders [brokers], they come to the farmers and just adding, 100 TZS, 150 TZS, or 200 TZS to the price being offered by the export companies. For example, instead of 1400 TZS per kg, the Kenyan traders will be buying the fruits at 1500 TZS or 1600 TZS per kg. For these farmers, adding just 50 TZS to the price adds up for the farmers. So, that is the challenge for the industry. As you might have been told, the farmers have a contract with RAC, but farmers sell to these briefcase traders" [Male, SAGCOT; PTSH_SAGCOT_0218].*

Side-selling is not the only essential driver for losses and waste production at the farm but also causes significant losses downstream in the import countries due to immature fruits, which threatens the sustainability of the industry, especially in terms of quality and reputational risk for established processors and exporters:

> *"[...] The problem with the Kenyan brokers is that they harvest the fruits too early to get higher prices in the international market. The practice destroys the "name" [Tanzania avocado brand], which is well sought after in the international market. I mean, the last market report, which came out last week [April 2019; Week 2019 report], did mention that they have started to receive fruits from Tanzania, and most of them are immature, which creates a bad image for the brand" [Director, Africado ltd, PTK_MD_0151].*

There is tension in how value creation is viewed: to the brokers and small packers and farmers, value creation is the bottom-line – higher price. For large exporters (see section 4.4; Figure 4.13 and Table 4.6) – value creation is not only about higher price, but their reputation and market share, the services provided to the farmer, the quality of the product, a secured and reliable market that comes with the certification process (permanent contract with farmers), traceability, and not just the final price paid to the farmer (Miller, 2008; Gille, 2013).

In summary, while in the NH, the selling relation is predominately through contracted out-grower, which the exporter tightly controls; in the SH, contracted relations operate more loosely (in terms of sanctions) due to recent competition. Farmers face different vulnerabilities and risks for losses and waste generation. In all four modes of selling relations, farmers' value creation and value extraction by exporters and brokers provide the necessary conveyor belt for losses and waste production. In the next section, I detail farmers' vulnerabilities and how these vulnerabilities coupled with sanctions, notably in contracted relations, lead to further production of losses and waste.

7.3 Social relations, vulnerabilities and losses and waste

This section picks up some of the vulnerabilities in the modes of selling relations summarised in Appendix 7.1 to explore further how losses and waste are generated at the farm level.

7.3.1 Sanctions and discipline

In contracted relations, particularly in the NH, where the exporter enjoys monopsony power, farmers who breach the contract are sanctioned and disciplined. For instance, in 2016 and 2017, twenty-eight farmers were sanctioned and removed from the out-grower association because they 'side sold' their fruits to Kenya brokers, as explained in the quote below by the out-grower manager:

> *"Before harvest, we visit the farmers to estimate the harvest volume; maybe we are targeting to do about 10 containers. But before you start harvesting, you see that some of the farmers have already sold to brokers. We cannot work with such farmers'; we must stick to our guts because the company has policies. So, we must stick to those policies. If a farmer sells to a broker the following year, we will not buy their fruits. We usually give them a break; we remove them from our system; if the farmer comes back and apologies, we will accept the farmer but will not buy his/her fruits in the following year. That is their punishment" [Male, Manager; PTK_OGM_0114].*

The farmers faced significant losses and waste since they could not sell their produce to the exporter in the subsequent years. During the fieldwork and the entire period of this research (2018 – 2021) several cases of losses and waste were reported among farmers because of contract sanctions. An interesting example is a large-scale farmer (owns 42 acres orchard) who lost about 4 tonnes of fruits because of contract sanctions (Appendix 7.2)[102].

The exercise of power and control over the selling relations by the company through sanctions and discipline coupled with unreliable alternative buyers create risks and vulnerabilities for farmers. The monopsony power of the export company makes farmers more dependant and vulnerable to the contract (Cai *et al*., 2008). Therefore, deem it "safe" to remain in contract to avoid losses as expressed succinctly by 65 years old retired teacher, who owns two acres of the avocado orchard:

> *"When Africado see something fishy has taken place on your farm, next time they will not deal with you. But those guys [brokers] from Kenya, if they will be coming every year, that would be good; but if they come this year, they do not show up next year. Where are you going to sell your crop? That is why we find it safe for the time being to sell to the company because we do not have any alternative. Otherwise, we would sell to them, but if you do it, you are in big trouble" [Male, smallholder; PTK_EF_0102].*

[102] In the Northern Highlands, the export variety is not widely known to consumers and not accepted in the domestic market due to its size of the variety –it mainly consumed in the villages where the avocados are produced.

The sense of vulnerability creates asymmetrical power relations and lower prices for farmers (section 7.4) and increases quality standards in years of oversupply (Adams *et al*., 2019; Bijman, 2008; Haucuja, 2006; Clapp, 1994). Thus, in a situation where farmers are 'lock-in' a monopolised production system, stability and long-term market access through unfavourable contractual relation is viewed as somewhat "valuable" by vulnerable smallholders[103] over a short-term unsustainable 'value' created by side selling (Eaton and Shepherd, 2001).

7.3.2. High dependence on exporters and buyers harvesting decisions

Farmers in all four modes of selling relations have very little or no control over harvesting decisions. Although farmers in non-contracted groups and spot buying relations have some freedom to sell to a buyer of their choice, harvesting decisions depend on exporters and buyers, increasing risks and creating losses and waste production if fruit picking is delayed. Findings show that exporters and buyers' decisions to harvest depend on evaluating interactions of several factors. The most important factors include the market price or the best market window in the EU market, business profitability/risks as explained by a manager of the leading exporter:

> *"We do not want to harvest when everybody [other producing countries] else is harvesting; we know we are just going to be sinking money. We have our market window - around April to mid-June, and from August onwards, which we are focusing on. That is our opportunity window; if we miss it, we will not make money[...]. If we want to get the fruits [to the market] after July, we must harvest in June, when the trees are also flowering [and fruits would be overmature]. So, that is the dynamics of things, finding compromises is challenging" [Male, Technical manager; PTSH_TMGR_0207]*

To get the fruits to the market at the 'right window' means exporters must harvest either when the fruits are immature or over-mature, resulting in losses and waste. This conundrum sometimes requires evaluating risks and weighing different consequences for food losses and waste production at the farm, processing facility, and import market. Case studies of how the interaction between exporters harvesting decisions, market forces and materiality of the avocado lead losses and waste are presented in Appendix 7.3 (Boxes 7.1; 7.2; 7.3). Thus, farmers are subjected to and dependent on exporters' risk avoidance decisions, making farmers vulnerable and reliant on the company's harvesting schedule (Johnson *et al*., 2019; Ocheng *et al*., 2017; Barrett *et al*., 1999; Glover, 1987). Growers' vulnerabilities are heightened in situations where the exporter is also a producer; sometimes, low-season fruits are not harvested even when prices are high in the global market (see Appendix 7.3; Table 7.1b).

[103] Unlike the SH, about 90% of smallholders in NH – particularly Kilimanjaro region own less than ten avocado trees due to access to land and competition for other food crops.

7.3.4 Resistance against vulnerabilities and exporters' power and control

It has been argued that the farmer groups - associations /cooperatives are effective ways for farmers to fight back against the concentration of power and capture in agricultural production systems (Howard, 2016; Schneiberg, King, and Smith, 2008). How these associations/cooperatives are formed is critical in enabling the group to resist the power and control of processors and buyers. While in the SH, farmer groups showed some signs of pushing back exporters control. In the NH, the out-grower association is "vertically integrated" into the operation of the export company (Friedland *et al*., 2013; 1987; Barrette et al., 1999; Fitsimmons, 1986). Although, it is supposed to be independent, the leadership structure is weak; it cannot operate independently, and there is a lack of coordination among the different smaller groups across three regions (Kilimanjaro, Arusha and Manyara). There is dissatisfaction among growers, but the association cannot stand up against the exporter's monopsony power and control. However, the story of one farmer's determination to fight against the monopolisation and imbalance of power in the selling relations demonstrates how individuals can fight against firms' power and control in the agricultural production system, albeit with some losses and waste (this case study is presented in Appendix 7.2). Nonetheless, such effort requires individuals with social and financial capital and are ready to take risks. Most of the smallholders (80-90%) own less than ten productive trees and do not have the social and financial capital to do that.

This section has explored how sanctions, discipline, and exporters' decisions of when to harvest creates vulnerabilities and dependencies for farmers with increased risks for losses and waste production and financial loss for growers. Farmers' (contractual and non-contractual relations) are not compensated for any losses caused by those decisions. In SH, growers are less vulnerable and face fewer risks and uncertainties due to competition and alternative marketing channels, although significant dependencies still exist. In contrast, farmers in the NH are more vulnerable and face significant risks of losses, waste, and inequalities due to the monopsony power of the exporter (section 7.2.1). In the next section, I explore how interactions between the materiality of the avocado, price determination mechanism, cost deductions, late payment, power relations and value extraction create losses and waste and inequalities among growers.

7.4 Materiality, price determination, power, and value extraction

Tanzania's avocado prices are influenced by the avocado's materiality (quality, size, and harvesting seasons in different geographical sites globally) and demand fluctuations in the EU market. Avocado prices in the EU market are highly variable and depend on seasons (Table 7.1a and 7.1b) and supplies from significant producing countries which export to the EU market (Figure 7.2 &7.3).

Table 7.1a: Main harvesting season of major Hass avocado exporters to the EU

Country	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mexico												
Peru												
South Africa												
Chile												
Kenyan												
Israel												
Brazil												
Tanzania												

Table 7.1b: Structure of Tanzanian avocado supply, seasonality, and export calendar (Hass varieties)

Zone	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
S. Highlands				Hass - Carmen variety & Hass (lowland areas)								mid-Dec.
N. Highlands												

Key

	Low season
	High season

Although the harvesting seasons in Tanzania offer some comparative advantage over other countries, it coincides with supplies from major producers like Peru, Chile, South Africa, and Kenya (Table 7.1a), which have comparatively lower shipping costs and shorter shipping periods than Tanzania.

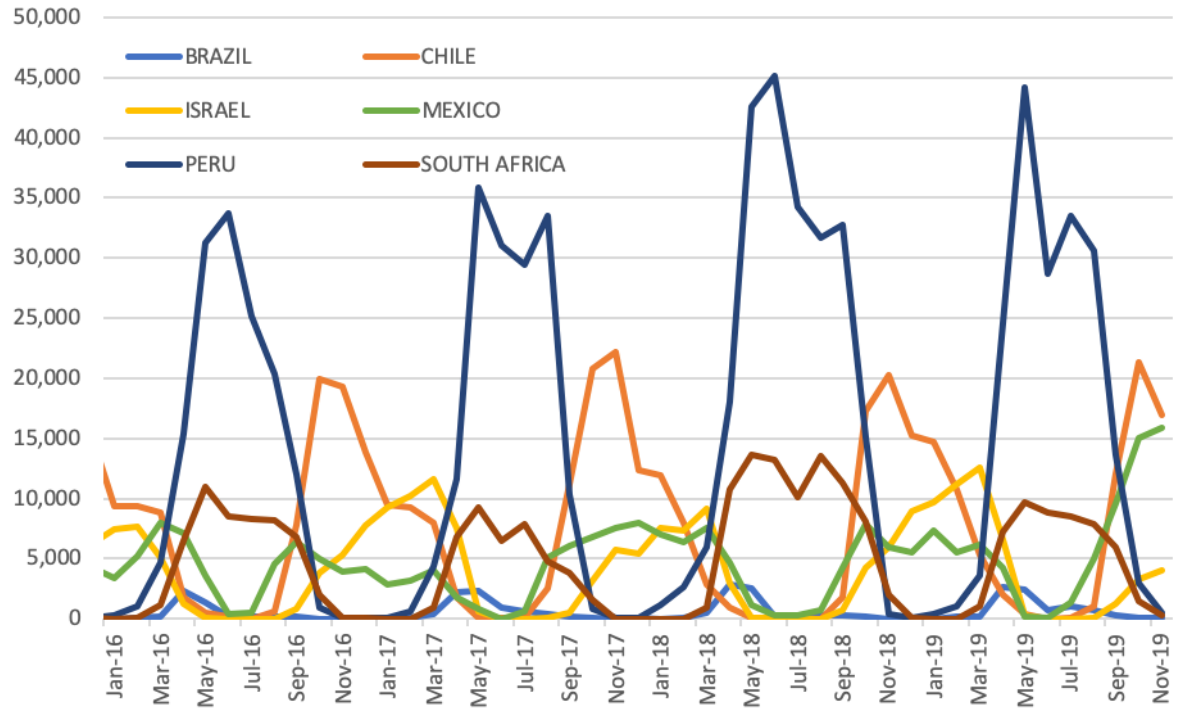


Figure 7. 2: Monthly Hass Avocado Imports (MT) by origin in EU market over four years. *Source: Eurostat; Compiled by Stable, 2020. Available at https://stableprice.com/soaring-avocado-consumption-increasing-price-volatility/)*

As Figure 7.2 depicts, Hass avocado prices in the EU market are highest in April and lowest in June/July, which coincide with the primary harvesting season in most production areas in Tanzania. Peak prices in the EU market are centred around avocado supplies from Peru (the highest avocado supplier to EU), which start in April until October. High production in Peru means lower prices in the EU avocado market and vice versa. For example, a bumper harvest in Peru in 2018 (with a 45% increase in yield) resulted in a sharp price drop from 14.34 EUR/4kg box in April 2018 to 6.49 EUR/4kg box in July (see Figure 7.3). Tanzanian depends on the EU market for more than 80% of its export (section 4.2.4, Table 4.6 & Figure 4.15); therefore, price variabilities have significant implications for losses and waste production (Appendix 7.2) and price inequalities.

Moreover, the price variability is also influenced by the materiality of the Hass avocado alternate bi-production cycle – a higher yield in a year is followed by lower yield in the following season as explained by the Managing Director of a leading export producer company:

> *"This year (2019), we are expecting low production because South Africa had higher production last year [2018], so it will be on off-year [this year], and I think Peru is on off-year this year because last year they had a bumper harvest. It is not like there will be no supply, but there will be low production. Here in Tanzania, the production cycle alternate when you have a big yield; the following year the yield goes down a bit but is not significant like South Africa and other places" PTK_MD_0151].*

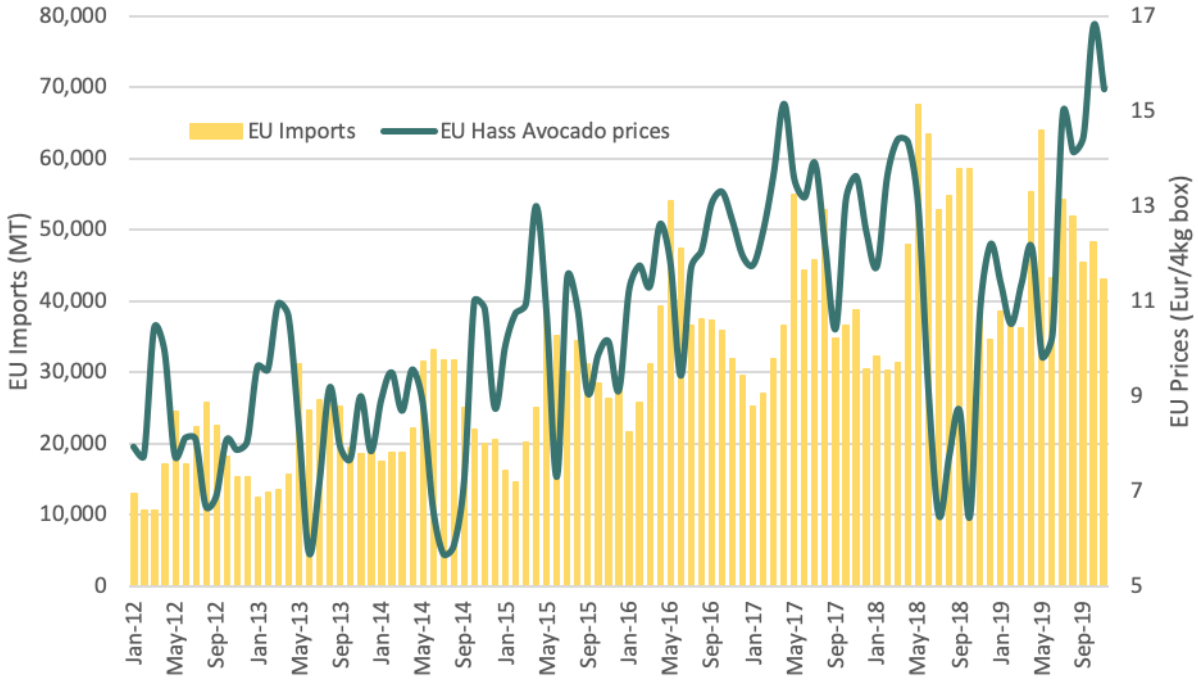


Figure ***7.3: Monthly Hass Avocado Imports (MT) and Price Trends (Hass variety EUR/4KG box).*** Source: CIRAD, EUROSTAT: Compiled by Stable, 2020. Available at https://stableprice.com/soaring-avocado-consumption-increasing-price-volatility/

Despite price volatilities in the European market, exporters' control over price and market information provides an avenue for value extraction. Differences in pricing regimes in the NH and the SH (influenced by the social relations of production) lead to different ways of waste production.

7.4.1 Milking growers: Control over price, market information and value extraction

In the NH, price determination is tightly controlled by the exporter who enjoys a monopoly in a contracted out-grower relationship (see Table 7.2). The farmers have no bargaining power, and they are not engaged in price determination and negotiations. The quote below from a smallholder who owns 2.5 acres of avocado orchard (320 trees) articulate and exemplifies such a power imbalance between the exporter and the farmers:

> *"You see, so you can never know the price of avocados [...]; the market in Europe determines the price of the product here. So, you sell your avocados to Africado ltd, and you still do not know the price. When they finish processing and selling all the avocados in Europe, they will tell you that the price for this period is this Shillings. So, this is what you get. That is one of the contract terms; it is a challenge to the farmers' because you are not sure what you are getting. One of the weaknesses of the contract is that you cannot know the price of the fruits" [Male, medium-scale farmer; PTK_EF_0169].*

The exporter has total control over the pricing system and sets the contract terms designed to extract value and pass risks to the farmers. The exporter operates a risk and profit-sharing model and acts as the marketing agent. Most farmers expressed this sentiment, as shown in the remarks below:

> *"We agreed with the company [that] the company should sell our fruits in the market and then they come and tell us the price. We do not have any prove whether the price is lower or higher. We just accept the price because we do not know much about the prices in Europe [...]. The contract we have with the company is that if the price goes up, they can pay us a good price; if the price goes down, they pay us a low price. Sometime in [a] certain year, they will say the price is going down, we just accept, if the price falls, we just accept" [Male, smallholder, PTK_EF_0075].*

> *"[…] The company sells the avocados at the international market,* ***deducts all the costs, and then we share the profits; between us the farmers and the company****" [Male, Smallholder, Lead farmer; PTK_ELF_0073].*

Smallholders are paid 50% of the profit as the final price after costs deductions (11 different costs), and large-scale commercial producers are paid 70% of the profit as the final price. Large commercial producers as elite farmers (5.3.4) have access to market and cost information associated with exporting and marketing their products. However, smallholders do not have access to cost deductions, which create mistrust among farmers who view the behaviour of the exporter as opportunistic. As a result, some farmers side sell to Kenyan brokers to create value but can lead to losses and waste generation due to how the brokers operate (section 7.2.4). The issue of transparency is contested – from the exporter perspective, their activities are transparent – cost items are set in contracts, and the company does not make a profit from out-growers (see Appendix 7.5). Nevertheless, in practice, smallholders' production and marketing system provide premium product and cooperate image branding as well as profit sharing to the exporter (Appendix 7.5).

Similarly, RAC, the only exporter in a contracted selling relation (7.2.1), initially controlled price in the SH. Between 2011 and 2017, the exporter extracted maximum value by paying farmers lower prices to discourage them from abandoning tea production (see Table 7.2) [104]. Lower prices resulted in some farmers side-selling and not caring for the trees. Now, because of competition and changing social relations of production, price determination is a bit open, and the local government is involved in setting prices:

> *"As a District, we have a meeting with those buying the avocados before the start of the season. We request reports from the companies about the numbers of farmers they are harvesting from and*

[104] The exporter feared farmers might switch completely to export avocado production (which has more value) and abandon tea growing. The farmers who adopted avocado production are the same farmers who produce tea for the WALKULIMA Tea Company which owns Rungwe Avocado Company. The effects of price control, value extraction leads to food losses and waste (see 5.7.8) - lower price means farmers cannot adequately take care of the avocado trees leading to poor quality fruits which do not meet export standards.

their proposed prices. We discuss how the previous season fared and set an indicative price for the new season, which is communicated to farmers at the start of the harvesting season. All the buyers must go with that indicative price. However, the farmers are not involved when meeting with the buyers because we have just started. The advantage of establishing a floor pricing regime is that it provides "good value for farmers" [District Agricultural Officer; PTSH_DAO_0193].

While the process is fragile and ad-hoc, competition among buyers pushes prices up above the minimum price (Table 7.2). In other parts of the SH (Njombe region), exporters announce their price at the beginning of the season. Notwithstanding the effort by government officials to establish a minimum price in the SH, exporters and processors still have the bargaining power due to information asymmetry (Wambi *et al*., 2014; Poku *et al*., 2018; Mazwi, 2020). Some stakeholders' express concerns about government involvement in setting minimum price when government officials have limited or no knowledge and understanding of the global avocado market (SAGCOT, 2019).

7.4.2 Materiality, price disparity and value extraction.

In the SH, once exporters and buyers announce their buying price or the farmer associations and cooperatives negotiate the price, the same price is applied to all exportable fruits. Farmers are paid the agreed price irrespective of their production volume and the percentage of the large fruits from their harvest. In contrast, in the NH, farmers' harvests are subjected to price disparity based on the volume of harvest (from each farmer) and percentage of large fruits in a consignment (total harvest from a group of farmers in producing area or village) delivered to the packhouse. This provides an avenue for inequities in the way farmers fruits are valued, especially among smallholders. Consignment with 75% to 90% of large fruits is priced differently than consignment having less than 70% larger fruits. This is tacitly linked to the altitude (lowlands, midlands, and highlands) of the different production areas where farmers are located. For instance, in highlands areas, because of the climatic and edaphic conditions, the avocado fruits are larger sizes and have a good appearance than fruits from lowlands growing areas (section 5.2.3). However, fruit sizes and quality appearance vary depending on the farmer agronomics and management activities, even in the highlands. Equally, farmers who employ good agronomic practices have larger fruits sizes in the midlands and lowlands.

Table 7.2: Export Avocado prices in the Northern and Southern Highlands

Northern Highlands price Per Kg (Africado ltd)				Southern Highlands price per Kg (Exporters & Cooperatives)						
Year	***Rombo (smallholders)***	***Siha (smallholders)***	***Large commercial farmers***	***UWAMARU AMCOS Rungwe***	***Rungwe Avocado Company – (RAC)***	***KUZA Africa ltd***	***Lima Kwanza Ltd***	***Four Seasons Ltd***	***Njombe Avocado Farmers Network***	***Tanzanice Ltd***	***Rungwe District Minimum Price***
2009											
2010	400	550	935								
2011	600	700	1190		250						
2012	680	824	1401		250						
2013	800	996	1693		270						
2014	1000	1029	1749		300						
2015	1133	1258	2139		607						
2016	800	1025	1743	600	750						
2017	1135	1200	1500-2000	1000	700	1000	700			1200	
2018	685	750	1200-3000	1200	1200	1200	1200	1200	1200	1500	1000
2019	1200	1320	?	1500	1450	1400	?	1500	1500	1500	1300
2020	750	900	?	1500	1250	1200	?	1600	1600	1500	?

Source: Interviews and payment records from farmers.

The exporter can extract value from the smallholders (who produce a premium product – best avocado-eating quality and provenance due to non-conventional sustainable production practices (section 5.2.3) by aggregating fruits together and pricing fruits based on the material location of the farmers

Moreover, price disparity is not only based on the locational materiality of farmers' but also on the volume of production, as explained by the field officer during harvesting observation:

> *"Smallholders who have high production [around 3 tonnes] and have potential to increase their production to achieve five tonnes or more a year [....]. We pay them a bit more to motivate them. For instance, in 2018, farmers were paid between 660 - 740 TZS per kg based on their locations and volume" [Field officer, PTK_FO_0149]*

Thus, in the same village, the price paid to farmers varies depending on the volume of production tacitly linked to quality, making the system unfair to the thousands of smallholders (who owe less than ten avocado productive trees) and produces the same quality of fruits. Such practices create price inequalities among smallholders and favour commercial producers who apply advanced production technologies that increase yields and improve quality (size, appearance, shape).

The price disparity among smallholders is also facilitated by the egalitarian approach to the out-grower system. Farmers across the different production areas must wait until all fruits are exported and sold, and prices averaged out for the growing areas[105]. However, the averaging out of prices to achieve somewhat price equity for farmers is unfair:

> *"You cannot pay a farmer in Arusha 1,200 TZS per kg or something higher and pay a farmer in Rombo 600 or 400 TZS per kg. So, farmers must wait until we finish selling all the fruit and find the average price before paying the farmers to reduce the complaints [from farmers]; why Arusha farmers are paid more than Rombo farmers? [..]. We just put the farmer in limbo; they do not know anything. The price issue is not transparent because if you take the money from Arusha people [farmer] to top up Rombo farmers, that is not fair! [Field officer, PTK_FO_0166].*

While the location-based approach for determining price disparity for farmers benefits all the farmers, individual quality production is not valued and rewarded. The price inequalities create mistrust among farmers and result in practices such as side selling (section 7.2.4) and mixing their harvest with immature fruits and non-exportable variety (section 7.5), thereby creating losses and waste production.

[105] Fruits maturity varies across the NH – for example, production areas in Arusha, Siha, Hai have early fruits maturity (April/May) and therefore their avocados would be sold at higher price (Figure 7.3) compared to highland production areas like Rombo and Marangu where fruits mature in June/July when prices are lower in EU market (Figure 7.3).

7.4.3 Late payments and losses and waste production

Late payment is another challenge faced by the smallholders and is particularly prevalent in the NH (Appendix 7.2), where farmers sometimes wait between 3-5 months after delivery of fruits to the packhouse before they are paid as expressed by a medium-scale farmer:

> *"[…] The payment does not come in time; as you know, I harvested around May [2018] was paid in October [2018]. So, I don't know what type of schedule they [company] use regarding payment. I do not know. If they already have harvested the fruits, why can't the company have money to pay people? They wait until they sell to the European market. Is it fair? I mean for a local [farmer] here, waiting that long to be paid. He/she has waited for almost a year for the crop, and then you pick the crop, and he needs to wait until you take the crop to Europe before being paid. It is very discouraging; I don't know" [Female, medium-scale farmer; PTK_EFMS_0153].*

Late payment affects production and agronomic practices (in inputs purchase) required for the next crop season. As discussed in (section 5.2.3), agronomic practices such as fertiliser or manure application and irrigation are critical during the flowering and fruit set, which coincide with the waiting period. One of the participants commented: "shortened payment period would benefit the farmer reduce uncertainties and disappointment over price expectations" [Male, smallholder, PTK_EF_0074]. Lack of transparency in the pricing system, lower prices coupled with delayed payment demotivate farmers and affect agronomic practices that impact quality leading to waste production. Besides, it affects the work of field staff (extension officer) as expressed by one of them as we discussed payment issues:

> *"We were even scared to go to the field because if you go to the field, the farmer does not want to hear anything; all that the farmer wants to talk about is, I want my money, I want my money. So, you cannot talk about your extension work or advice. Yeah, you can't; delaying the payment is a disaster" [Field officer; PTK_FO_0166].*

However, delayed payment is used by the exporter as a risk-sharing and risk avoidance strategy – farmers are paid at the end of the season, which allows the exporter to pass on risks and shares profit with farmers.

This section has critically examined how the interactions between the materiality of the avocado, price determination, power dynamics, cost deductions, late payments, and value extraction create inequalities among growers and, in some cases, lead to losses and waste production. The following section explores how an institutionalised rejects sharing system among out-growers in the NH produces losses and waste in the production system.

7.5 Institutionalised 'rejects sharing system' and losses and waste

As discussed in chapters 4 and 5, GlobalG.A.P. certification for smallholders treats produce from all the farmers in an out-grower scheme as from a 'single farm' for ease of traceability[106]. This has led to an 'institutionalised rejects sharing system' in the NH where the exporter manages the smallholder out-grower scheme. The harvested fruits from all farmers in the out-grower association are aggregated and processed at the packhouse. At the farm level, the harvest from the individual farmer is weighed and recorded, but the farmer is only paid the final weight of exportable fruits at the packhouse (see Table 7.3). The rejected fruits from packhouse grading are then shared proportionally among the group members based on their farmgate volume[107]. As summarised in the quote below by farmer B (Table 7.3) while discussing the reject sharing system:

> *"Last year [2017] I sold 290kg, and I was paid 250kg, so about 40kgs was a reject. Sometimes you can be careful during the harvesting, but other farmers may not be careful and bring many rejects. Maybe you have a tiny [amount] of reject, but the company does not care about that; usually, all the rejects are added together and shared among the farmers according to the number of kilos the farmer sells to the company. If you have sold a lot of kilos, it means you will have a lot of rejects". [Male, smallholder – Farmer B; PTK_EF_0077].*

The institutional arrangement of sharing rejects among smallholders causes losses and waste through opportunistic behaviour and practices, as farmers seek to reduce their risk of rejections.

Table 7.3: Sample of smallholders' farmgate kg and packhouse rejects – kg.

Sample of farmer(s)	*Year of harvest*	*Farmgate weight (kg)*	*Packhouse weight (Kg)*	*Total rejects at packhouse (Kg)*	*% Of Rejection at the packhouse*
A	2017	120	100	20	16.7%
B	2017	290	250	40	13.79%
C	2016	295	258	37	12.5%
	2017	500	416	84	16.8%
	2018	1456	1182	274	18.8%
D	2017	250	216	34	13.6%
E	2016	991	791	200	20.2%
	2018	1085	878	206	19%
F	2018	2,200	1,400	800	36.36%

Source: Interviews, weighing and payments records.

[106] All farmers in the out-grower group are required to adhere to prescribed production requirements, guidelines, or rules (in this case company managed out-grower scheme).
[107] In contrast in the SH selective harvesting process is used and harvesting is mostly done by exporters and grading is done at the farm - any non-exportable fruits (rejects) are left to the individual farmers.

Farmers expressed concerns that the way the reject system is operated by the exporter leads to inequalities and exploitation. If a farmer has high production, he/she is allocated a higher percentage of rejects respective of the quality of fruits from their farm as in the case of farmer C, E and F. For instance, during the harvesting observation event (August 2018), farmer F harvested the best quality fruits in the village because of his farm location and agronomic practices. However, he was allocated the highest rejects, irrespective of the quality of his fruits. The farmer felt unduly disadvantaged, as expressed in the quote below:

> *"If your production is high compared to other farmers who have fewer production, they [company] take the rejects from the farmers that have fewer production and add to those with higher production to encourage farmers with fewer fruits [from] runway or stop growing the avocados. So, the farmers who are getting lost are farmers like me with high production. In 2018, I harvested 2,200kg and was paid 1,400 kg, which means my reject was 800kg that is a lot. In terms of money, I lost 550, 400 TZS [approx. 237 USD] due to rejects. [Male, smallholder, farmer F; PTK_EF_0158].*

Like farmer F, most of the smallholders interviewed expressed a lack of fairness in the rejects sharing system. Because of the financial loss, some farmers reduce their risks through fraudulent practices – mixing immature fruits or other varieties (Fuerte[108]) with the Hass variety and thereby increasing their farmgate weight to compensate for any rejections from the packhouse (see Figure 7.4). These practices were prevalent among farmers in highlands areas compared to farmers located in the midlands and lowland areas - as indicated in a comment by a field officer:

> *"Last year [2018], a lot of the rejects was due to immature fruits [off-season fruits] mainly fruits from Tarakea. Other farmers [in Ushiri] harvested Fuerte variety which we do not export. The farmers know well what they are doing - they try to get more Kilos from the farm weight. All these farmers are in the highlands [Field officer, PTK_FO_0129].*

Farmers in highlands areas generally produce good quality fruits with fewer rejects than farmers located in midlands and lowlands elevations – where in some cases, all the harvested fruits will be graded as rejects (Appendix 7.3, Box 3). Thus, farmers in highlands feel disadvantaged by the system as they bear the cost of rejections from other farmers. The general perception among farmers is that irrespective of the quality of fruits delivered to the packhouse, they will be allocated a share of rejects, leading to bad practices and waste production.

Moreover, lack of transparency in the reject systems exacerbates the problem as farmers feel they have been cheated through the system. Lack of farmers' presence or representative during grading means they cannot verify the veracity of the actual rejects, as indicated in an excerpt from a field journal:

[108] In SH Fuerte is widely grown by farmers until recently (2017) was not exported leading high losses and waste as the variety is not popular in the domestic market. In the NH only the Hass varieties are exported and the Fuerte variety is less popular in the NH compared to SH were Fuerte is popular.

A well-educated farmer in Siha district, complaint of unfairness and lack of transparency in how the rejects systems work. In 2018, he harvested 1.5 tonnes - farmgate weight (after initial sorting) of avocados. After 48 hours, he visited the packhouse to check the rejects from the grading of fruits. According to him, he was shown a reject, which would be around 150 kg, to his estimation. However, when he received his payment (after three months), he was paid an equivalent of 750 kg, which means 50% (750kg) was rejected. "When I do the maths, things do not add up; how can I be showed a reject of about 150kg and be paid half of what I have sent to the packhouse"? (Field Journal, 14/4/2019).

According to a key informant:

"The reject system is very confidential – the 'real or actual reject' is what remains in the packhouse within the 48 hours after grading. But, after 3 or 5 months of grading, when the accountant comes to do the calculations, the rejects increase. If the calculation is done within 48 hours of grading, there is no way the rejects will increase. So, the company just try to balance its figures" [PTK_FO_0166].

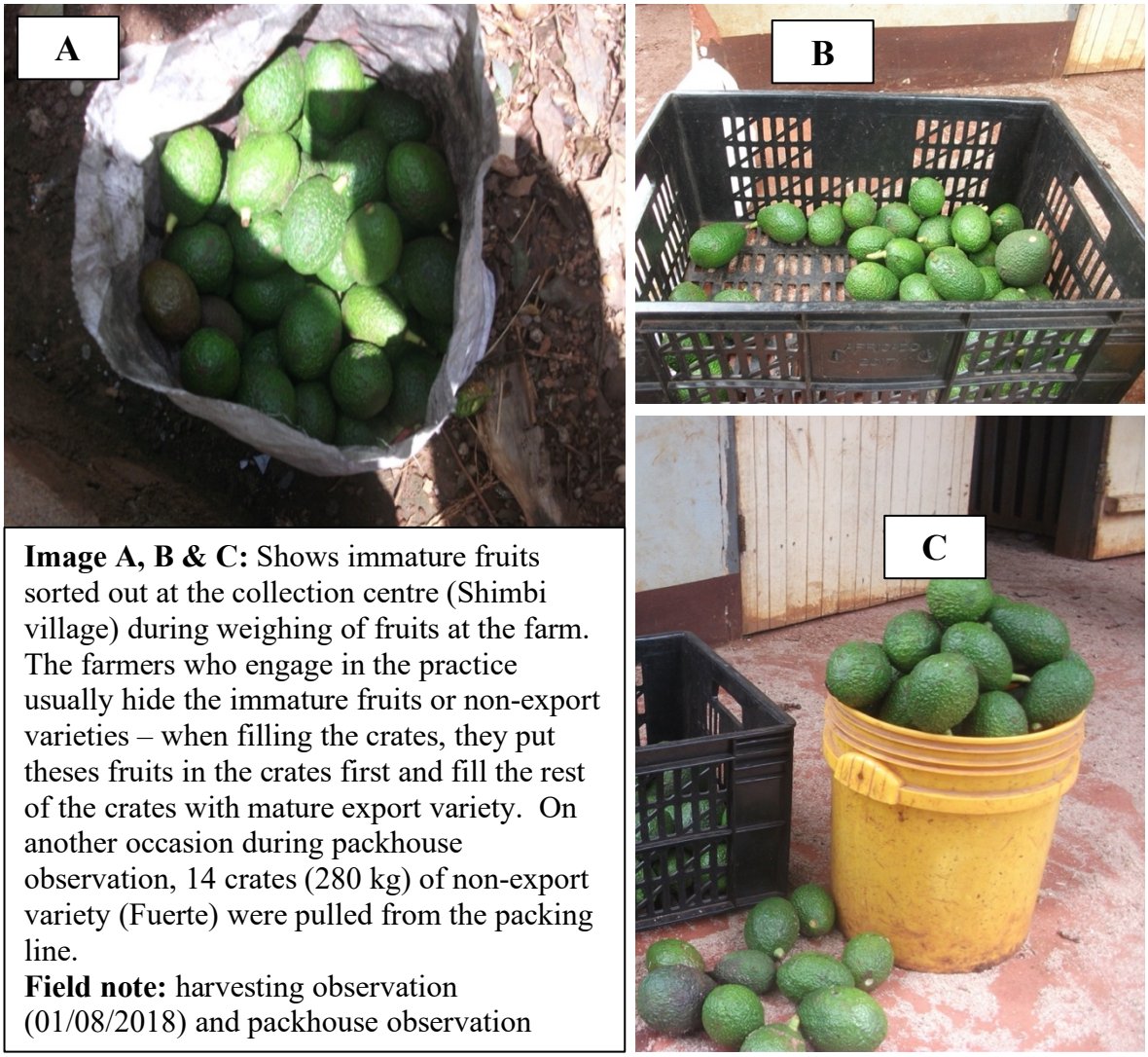


Image A, B & C: Shows immature fruits sorted out at the collection centre (Shimbi village) during weighing of fruits at the farm. The farmers who engage in the practice usually hide the immature fruits or non-export varieties – when filling the crates, they put theses fruits in the crates first and fill the rest of the crates with mature export variety. On another occasion during packhouse observation, 14 crates (280 kg) of non-export variety (Fuerte) were pulled from the packing line.
Field note: harvesting observation (01/08/2018) and packhouse observation

Figure 7.4: Images of immature fruits harvested to increase farm-gate weight (3rd August 2018)

While key informants acknowledged that the reject system is not equitable, they feel it is the best solution since most smallholders have low production. While there are plans to improve the system, e.g., farmers who produce "five tonnes and above will have their fruits processed separately, so, the farmer knows the exact rejects from their farm" [PTK_FO_0129]. Very few farmers can achieve that level of production. Therefore, a significant proportion of smallholders will continue to suffer from inequitable systems that generate losses and waste.

7.6 Discussion

This chapter investigated how institutional arrangements and the social relations between farmers, farmer groups, and exporters shaped selling relations and assessed its consequences for losses and waste production in two avocado production sites in Tanzania. It was found that selling relations present different risks and vulnerabilities to farmers and operate differently in the two sites (NH and SH) in how it leads to waste production. Value extraction or creation by buyers and farmers in the selling relations was an essential vehicle for losses and waste production in both sites through risk reduction strategies by exporters and farmers. The interactions between the materiality of the avocado (volume of production and material location of growers) and price determination were found to result in price disparities which create inequalities among growers. Moreover, an institutionalised 'rejects sharing system among growers, particularly in the NH, leads to inequalities in how farmers share or bear the cost of waste production. Thereby creating an avenue for risk reduction strategies by farmers, which further create waste. The empirical evidence presented in sections 7.2 - 7.5 leads to four main findings discussed below.

Firstly, the nature of social relations of production between farmers, farmer groups and export companies revealed a complex context of how value creation and value extraction (by both farmers and buyers) lead to losses and waste and inequalities in the export avocado production system. This finding builds on and provides further empirical evidence of the concept of food waste regimes by Gille (2013). In this study, value creation and extraction are inherently linked to risk reduction, whether it is farmers forming cooperatives and associations to create value for the product; or buyers tightly controlling out-grower schemes or price information to extract value.

In the NH, where selling takes place predominantly through contracted out-grower scheme, production and marketing risks are passed on to the farmer and value is extracted through tight control over price information and sharing of profits. Several agrarian political scholars have

argued that contract farming is a risk avoidance strategy that agribusiness uses to transfer production risks to farmers (Watts, 1994; Little and Watts, 1994; Clapp, 1994; Mazwi, 2020). For example, farmers in NH are exposed to price risks; they sell their products without knowing the exact price. While the exporter reduces risks, protects itself from any loss (including market reputation), and extracts value by applying stringent quality standards, which causes high rejections and losses for farmers (Colbert, 2015; Parfitt *et al.,* 2010; Stuart, 2009; Bloom, 2011). The contracted out-growers bear all costs associated with processing and marketing their fruits and shares profits with the exporter. Similar findings have been reported among contracted smallholder avocado farmers in Kenya (Mwambi *et al.,* 2016; Oostendorp, 2018; Amare *et al*., 2019) and sugarcane out-growers in Uganda and Malawi (Adams *et al*., 2019; and Martinello, 2021). A situation which Martiniello (2021) has conceptualised as "scarification"- "maximisation of value extraction from farmers and its appropriation by agribusiness and finance capital" (p.355)[109]. Mwambi *et al*. (2016) found that among contracted avocado growers in the Kandara district in Kenya, there were no prior agreements on prices and quantities of the harvest to be delivered to the buying company, which exposed smallholders to price and production risks – losses and waste generation particularly periods of high production. At the same time, Amare *et al*. (2019) and Oostendorp (2018) reported a high rate of side selling among contracted out-growers because of the costs of harvesting and transporting avocados to the packhouse.

Furthermore, the findings show that unequal power relations and information asymmetry between exporters and farmers limited farmers bargaining power and resulted in value extraction through lower prices (Martiniello, 2021; Karing'u *et al*., 2020; Ruml and Qaim, 2020; Ochieng et al., 2017; Bijman, 2008; Haucuja, 2006; Glover, 1987). Lack of transparency, negotiability, and unequal power relations coupled with lack of capacity among the out-grower association further limit farmers bargaining power (Mazwi, 2020; Ruml and Qaim, 2020; Oya, 2012; Little and Watts, 1994; Clapp, 1994). Monopsony power, mainly in the NH, reduces opportunities for price discovery by farmers as spots market activities are reduced or non-existence (Murphy, Burch, and Clapp, 2012). Notwithstanding, alternative marketing channels in the SH means that farmers receive higher prices than farmers in the NH (Mwambi *et al.,* 2016). Although, buyers extract value through selective harvesting practices (stricter quality criteria), resulting in high rejections at the farm. Moreover, the

[109] Martinello (2021) in his study of contracted sugarcane farmers in Uganda, found the out-growers only received 40% of the total price after cost deductions of inputs, loans, and service charges. Similarly, Adams et al. (2019) study of contracted out-grower scheme of sugarcane growers in Malawi reported a contract condition where there is "a strict division of proceeds, allowing the miller [company] to retain 40% of the total proceeds derived from the cane supplied by the out-growers without justification of the cost of milling – its take or leave condition. The farmer receives a net income of around 23% of the total proceeds after deductions of management and services cost from the remaining 60% by the outgrower association" (p.1447).

findings from this study showed that extraction of value is not only limited to profit sharing, cost reductions and lower prices; but is linked to the volume of production and Spatio-temporal materiality of the farmers' location.

Farmers fight back against inequalities and create value for their produce through spot buying relations or side selling (side selling gives farmers in the NH additional benefits in cost savings - harvesting and transport costs). Similar cases have been reported among contracted avocado out-growers in Kenya (Karing'u *et al*., 2020; Amare *et al*., 2019; Johnny *et al*., 2019; Oostendorp, 2018; Mwambi *et al*., 2016). However, side selling and its associated discipline and sanctions (for contractual relations) lead to losses and waste production, as reported in other contracted out-grower schemes (Ruml and Qaim, 2020; Poku et al., 2018; see also Key and Runsten, 1999). Ruml and Qaim (2020) argue that such sanctions can be problematic when it involves a specialised contracting crop (not easily tradeable locally) and the company enjoys a monopoly; thus, making farmers dependent and vulnerable to the contract (Cai *et al*., 2008; Eaton and Shepherd, 2001). Similar to the findings in the NH site in this study, Oostendorp (2018) reported that avocado farmers in Kenya who side sell to brokers could sell all their fruits – 'brokers collect all the harvested fruits' (ibid, p.2; see also Mwambi *et al*., 2016)[110]. Nonetheless, side-selling (in the SH) and export market quality requirements lead to high levels of rejections among avocado growers (Karing'u et al., 2020; Amare et al., 2019; Johnny et al., 2019; Oostendorp, 2018); and in other fresh vegetables and fruits production (Feedback Global, 2014; Stuart, 2009; Bloom, 2011; Freidberg, 2004; Clapp, 1994; Little and White, 1994).

Secondly, the exporter's decision of when to harvest creates vulnerabilities and dependence for farmers with increased risks for losses and waste production. Any decision to harvest early or delay harvesting leads to losses and waste at the farm level - including processing, and farmers are not compensated for any losses due to exporters' decisions (HLPE, 2014; Sivakumar, Jiand and Yahia, 2011; Bloom, 2011; Stuart, 2009; Kader, 2008; Kitinoja and Kader, 2003; Clapp 1994). This research indicates that when evaluating harvesting decisions, exporters and packers weigh several interacting factors to reduce their risks; most significant factors being the market window and market reputational risks (Gille, 2013) Conversely, a recent study by Johnson *et al*. (2019) and Johnson (2020) found that buyer availability and price offer influence the level of losses at the farm, and the market price was the most critical factor that influenced growers harvesting decisions.

[110] This difference is because in Kenya the domestic market for the export avocado varieties have developed compared to Tanzania. Therefore, brokers can sell non exportable quality in the domestic market whilst in Tanzania, the brokers focus on the export market leading to higher losses for farmers.

Besides, the high transactional cost was an equally important factor that influenced exporters and buyers harvesting decision – where the perceived economic risks associated with harvesting is higher than the economic value; they do not harvest from farmers leading to significant farm waste. High labour and packing costs have been cited as an important reason for field losses and waste generation in fruit and vegetable production (Johnson et al., 2019; Johnson 2020; Berkenkhamp and Nennich, 2015; HLPE, 2014; Stuart, 2009; Bloom 2011).

Thirdly, while implementing quality standards and certification schemes reduces economic, biological, technological, legal, and reputational risks for exporters and actors downstream of the supply chain, the same generate farm waste and inequalities among growers. Gille (2013) argued that there is a relationship between farm waste and risks in the ways losses and waste production occurs in a globalised and market-oriented production system. In this study, an institutionalised rejects sharing system creates waste and inequalities as farmers attempt to reduce their risks through bad practices (Gille, 2013). Lack of transparency in the reject system causes mistrust and perception of opportunistic behaviour on the part of part of the exporter – e.g., unexpected reduction in quantities delivered to the packhouse. Such incidences have been reported in other studies in Western Africa and Asia (Ruml and Qiam, 2020; Ochieng *et al*., 2017; Bijman, 2008; Haucuja, 2006).

Lastly, the findings from the study enhance our academic knowledge and highlight how institutional arrangements and social relations between farmers, farmer groups and exporters shape different modes of selling relations and their implications for farm losses and waste production in the export production system in the context of Tanzania. Although identifying the causes and drivers of food losses and waste in a stagewise supply chain may provide structural and analytical clarity (FAO, 2013). It conflates causes and drivers of losses and wastes to the stage where they occur (Gille, 2013; Alexander *et al*., 2013), but causes and drivers at different supply chain stages are interrelated (HLPE, 2013). Thus, the tendency to follow such categorisation obscures the root causes of farm losses and waste embedded in unequal power relations, inequalities, and risk avoidance strategies that characterise a market-oriented production system that offers little or no protection for smallholders. The empirical evidence from this chapter reveals a relationship between farm waste and risks and highlights how waste production can help us understand inequalities and vulnerabilities often faced by smallholders in a globalised food production system (Gille, 2013). In the global South, food losses and waste are often attributed to inadequate technological, managerial, infrastructural, and practical know-how (Affognon *et al.,* 2015; Rosegrant *et al.,* 2015; Abdoulaye *et al.,* 2015; Parfitt *et al*., 2010; FAO, 2011; Gustavsson *et al*.,

2011). While these factors contribute to losses and waste, a social relation approach reveals the underlying systemic issues and provides a better understanding of losses and waste generation, often hidden behind the walls of inadequate technology and infrastructure.

7.7 Chapter summary

This chapter analysed how social relations of selling/buying operates to produce farm losses and waste in two production sites (NH and SH). In doing so, the chapter used qualitative data from semi-structured interviews and 'go-along ethnographic observations to identify the different modes of selling relations; highlight farmers vulnerabilities in those relations; and how the interaction between materiality, pricing mechanism and value extraction; rejects sharing systems, and resistance against control and monopsony power leads to waste production. Interviews from farmers, exporters, buyers, farmer groups, field staff and government officials and data from observations were presented to examine the realities of social relations of selling and waste production and inequalities faced by farmers in the two production sites. The discussion section elaborated on the interactions between the different modes of selling relations, materiality, and value extraction work to produce waste. The subsequent chapter synthesises the empirical findings from the four chapters (4,5,6 &7) to outline the academic contributions and provide a holistic discussion concerning the overall thesis aim, implications, and priorities for future research.

Chapter 8

Concluding discussion

8.1 Introduction

This thesis examined food losses and waste within Tanzania's two distinct avocado production systems and supply chains by investigating how institutions, materiality, and practices intersect to generate losses and waste. In doing so, I explored how theoretical ideas and experiences from the global South help to address the following research objectives:

1. To examine the historical, socio-economic, and political context within which Tanzania's two distinct avocado production systems and supply chains have evolved and developed.
2. To critically examine how the interrelationship between institutions and materiality shapes the agronomic practices in the two different avocado production systems and its implications for pre-harvest loss and waste generation.
3. To investigate the institutional arrangements and the social relations in which buying and selling practices occur and how risk and power dynamics generate losses and waste in the domestic avocado supply chain.
4. To investigate how institutional arrangements and social relations among farmers, farmer groups, and exporters/buyers shape selling/buying relations, and the implications of these relations for exploitation, loss, and waste generation in the export avocado supply chain

Each of the four empirical chapters helped address the study objectives and the main research question: How do institutions, materiality, and practices intersect to produce losses and how losses and waste production manifest power relations and inequalities within the two distinct avocado production systems? Chapter 4 provided the broadest overview, illustrating how the development of Tanzania's avocado production systems and supply chains has been shaped by the socio-cultural, economic, and political context and global changes in consumption – towards sustainable and plant-based diets (social movements such as vegetarianism and veganism project avocado as a superfood). The chapter also highlighted supply chain challenges faced by farmers, traders, and exporters in the two production systems. Chapter 5 addressed objective 2; it examined the role of institutions and materiality in shaping agronomic practices for the two avocado production systems. The chapter focused on farmers' motivations and values derived from the avocado. It argued that the socio-cultural perception of the avocado as 'food', values from the avocado tree, and the economic value of avocado fruit influenced how agronomic practices are performed. Ultimately

impacting pre-harvest and harvest losses and waste. The chapter also highlighted the institutional arrangement between exporters and farmers and how exporters' exercise of power and control affects the farming practices, especially among smallholders. Chapters 6 and 7 examined institutional arrangements in the context of buying and selling practices to address objectives 3 and 4. Chapter 6 focused on the domestic supply chain and investigated how institutional arrangements and social relations between farmers and traders and among traders generate losses and waste in buying and selling practices. It argued that risk, power dynamics, and materiality of the avocado played an essential role in how losses and waste are generated. Chapter 7 argued that the institutional arrangements between farmers, farmer groups, and exporters/buyers shape different modes of buying and selling relations. The chapter argued that risk avoidance strategies by exporters/buyers and farmers, imbalance of power, and institutionalised reject system affect how losses and waste are generated in different production sites in Tanzania.

This concluding chapter first discusses the key findings of the thesis (Section 8.2). The results are addressed thematically, bringing together materials from the empirical chapters, and linking them to established debates. First, I argue for a '**social relations approach**' to researching losses and waste in primary production and the early stages of food supply chains. I return to the argument introduced in chapters 1 and 2 that the complexities within which losses and waste occur in primary production require an integrative approach. The approach gives primacy to the role of institutions, materiality, and practices in losses and waste production (8.2.1). As part of the argument, I discuss the role of **values and value** in influencing practices and its effects on losses and waste generation (pre-harvest, harvest, and post-harvest) (section 8.2.2). I elaborate on how the value construction (monetary/economic value attributed to avocado fruit) influences different practices during harvesting and grading. In the context of these arguments, I turn to the discussion of **institutional arrangements and waste generation** (section 8.2.3). Following the discussion of key findings, I discuss the contribution of this thesis (Section 8.3). The chapter then concludes with a brief synopsis of the central findings (8.4), framed in terms of SDG 12.3 and the global food security and sustainability agenda.

8.2 Key findings

8.2.1 Revisiting the conceptual framework: Towards losses/waste as a social relation.

Unpacking the complexities of farm loss and waste requires an integrative approach that bridges several concepts and attunes to multiple spatial and temporal scales, interactions, and interrelationships. The conceptual framework of this study presented in chapter 2 (Figure 2.2) contributes to the increasing calls for adopting an integrative approach to unpack the complexities of farm loss and waste by combining key concepts, namely, institutions, materiality, and practices. By integrating institutions, materiality, and practices into one framework, I approached losses and waste from a social relations perspective (Gille, 2013; 2010). A call made by Gille (2013, p.29) through the food waste regimes concept which suggests 'waste constitutes a social relationship and as such should be studied as something produced materially and conceptually as social relations.' As far as I know, this study is the first to apply the food waste regime concept and to take a more social relations approach to investigating losses and waste in production.

By adopting an integrative approach, this thesis moves the farm loss and waste debates from an isolated view of a particular unit of analysis (e.g., modelling, auditing, and quantification of loss and waste and drivers to understanding the complexities that underlie agricultural losses and waste (Mereno *et al.,* 2020; Johnson et al., 2019). Understanding on-farm food losses and waste involves exploring the avocado's materiality, the people, and the flows of actions that make up their everyday lives - the socio-cultural, economic, and social relations contexts (Mereno *et al.,* 2020; Spaargaren, 2011). While several studies focusing on consumer food waste in the global North (e.g., Evans 2014, 2012, 2011a, 2011b; Watson and Meah, 2013; Quested *et al.,* 2013b) points out that household food-wasting practices arise from the complex contexts: socio-cultural, economic, food safety concerns and anxiety and social relations and that are deeply entangled with everyday routines.

Through the integrative approach, this thesis substantially contributes to an emerging area of sociological scholarship on on-farm food losses and waste studies (e.g., Soma *et al.,* 2021). Soma *et al*. (2021) assert that their study is the first to apply social practice theory to investigate on-farm losses. They analyse the interactions between material, meaning, and competencies and how the interaction between the elements leads to losses. However, Soma *et al's*. (2021, p.29) study focused on farmers' practices of 'tilling under' wholesome edible unharvested produce, which limits the

gaze on the social relationship between the actors (e.g., buyers and farmers) and how buying and selling relations and practices generate losses and waste on farms in the first place. This thesis extends this initial application of theories of practice to put institutions and social relations at the heart of the analysis. Especially this study extends the sociological gaze on farm-level losses and waste from a global South perspective, where such approaches are lacking in academic debates. It thus, makes significant contributions to wider critical food waste studies, more specifically to the food waste regimes concept (Gille, 2013), and generally to the waste regime concept as developed by Gille (2007) (see also Gregson and Forman, 2021). It pushes against the idea of identifying food losses in the global South with inadequate infrastructure towards myriad activities from which losses and waste emerges – socio-economic, cultural, political, and material dynamics through which losses is produce.

Again, the conceptual framework and the theoretical framing allowed conceptualisation of loss and waste at the farmgate, collection centres, markets, and out-grades/packhouse levels as the outcome of the cross-scalar interactions between multiple conditions and processes – global, national, and local levels (Gille, 2013; 2010). In the case of the export avocado supply chain, the framework ensured that the analysis placed relatively more significant emphasis on the influence of macro-level institutions regarding growing, harvesting, and processing on the micro-level practices and the effects of power relations experienced by growers (particularly smallholders).

Notably, the cultural framing of the avocado as 'food' and motivations for its adoption influenced different practices for domestic and export avocado production. By adopting an integrative approach, for instance, in the case of the domestic avocado, I was able to analyse how the cultural framing of the avocado as 'butter for dogs' and the motivation for its adoption shaped the agronomic practices and the consequences for pre-harvest and harvest losses and waste generation (objective 2). The framework allowed this study to contribute to the scanty scholarship (e.g., Soma *et al.,* 2021; Johnson *et al.,* 2019) on agricultural losses that takes a qualitative and practiced theoretical approach. The study brings to light how agronomic practices are formed and shaped by farmers' motivations, the values derived from the crop, and the broader socio-cultural norms, economic, and ecological values (Lynch, 1999; 1994; Sachs, 1992).

In the case of the export of avocado, the interrelationship between institutions (food safety and quality rules, regulation, and phytosanitary standards), the economic value, and materiality shaped the agronomic practices (objective 2). The integrative framework helped analyse how institutional arrangements between avocado producers and exporters resulted in new forms of social relations

of production and how the power-play experienced by farmers creates losses and waste during production (objectives 3 & 4). Such understanding extends the debates and scholarship on farm-level losses, which primarily focus on how harvesting and handling practices, inadequate infrastructure, technology, and aesthetic standards (for example, FAO, 2019b; Delgado *et al.,* 2017; Sheahan and Barrett, 2017; FAO, 2011; Parfitt *et al.,* 2010). This research, for example, provides a better understanding of pre-harvest losses by attending to why certain practices are enacted; and how control of over how farmers enact agronomic practices by export (through the institutional arrangement) create losses.

Moreover, the framework provided the right lens to explore how risk-avoiding strategies adopted by different actors in selling/buying relations result in loss and waste generation. In the domestic production system, the study also examined the role of the market institution (a credit arrangement), illuminating how it provide an avenue for opportunistic behaviours and practices which result in generating loss and waste (objective 3). The integrative approach, for instance, helped to understand how the material state of the avocado provides an avenue for exploitative power relations and perpetuates waste generation and inequalities in the domestic avocado supply chain.

In the case of the export supply chain, the study uncovered that the differences in institutional arrangements between farmers, farmer groups, and exporters/buyers shape the selling/buying relations in the export avocado production system in the two sites studied (objective 4). This finding led to the establishment of four modes of selling/buying relations and risks avoidance strategies used by farmers and exporters in those buying /selling relations and implications for loss and waste production. Thus, contributes to how power relations in contractual and other institutional arrangements result in losses and waste production. The integrative framework helped analyse how interrelations between the materiality of the avocados and price determination create losses, waste, and inequalities among growers. For instance, the study showed that institutionalisation of a 'rejects sharing system' among growers (as part of the requirement for GlobalG.A.P. group structure) results in exploitation (by exporters) and risk reduction strategies by farmers, leading to further inequalities and losses and waste generation in the production system.

The integrative approach helps to theorise and conceptualise losses and waste in production and early stages of supply chains (and indeed in food systems) as issues of power and inequalities, which have not received much attention in food waste studies (Gille, 2013). This study brings to the fore, how attention to social relations in institutional arrangements and practices demonstrate the essential role power in losses and waste generation. By drawing on Schatzki's (2010) notion of

practice and material arrangements to attend to macro processes or structures, and social relations, which are challenging to account for when focusing on practices as performances (Watson, 2014; Shove *et al.,* 2012). This study attended to the issue of power dynamics and how they manifested in the social practices of growing the avocados, harvesting, and selling to generate losses and waste (Barnes, 2001). Taken a social relations approach enabled exploring sanctions and vulnerabilities faced by farmers (in the export supply chain) and traders – local brokers and wholesalers (domestic supply chain) through interaction between institutions and practices and how the 'avocado' itself is constitutive of those practices.

8.2.2 Value, values, practices, and loss and waste

The empirical chapters highlight that value - in terms of economic value and values – socio-cultural norms and non-economic values derived from the avocado significantly shape practices and generation of pre-harvest, harvest, and post-harvest loss and waste within the two avocado production systems.

First, the study found that economic value, socio-cultural norms/values, and non-economic values were the most important motivational drivers in enacting agronomic practices. The literature on consumer food waste studies has established that consumers' food-wasting practices are shaped by the socio-cultural norms and values which reside within them as well as the socio-material and structural contexts of their everyday routines (Hebrok and Boks, 2017; Quested *et al.,* 2013b; Evans 2014; 2011). Hebrok and Boks (2017) assert that the perceived value (economic value) that consumers attributed to food, the values engendered in the management of food, and the socio-cultural materiality of everyday routines are essential in analysing the drivers behind households' food waste.

Similarly, I argue that in researching losses and waste within agricultural production, it is essential to consider the economic value that farmers attribute to the crop, the socio-cultural values and norms held by the farmers, and the non-economic values derived from the crop itself. As evidenced in this study, because of the perceived low economic value (market price) of the domestic avocado and the socio-cultural norms and values of the avocado tree as part of agroforestry practices, farmers do not undertake any agronomic practices that reduce pre-harvest losses and losses at harvest and improve yield and quality of fruits. Therefore, the production system is less resource, labour, and capital intensive – does not require irrigation and use of inputs (fertilisers and pesticides) (Biazin *et al.,* 2018; Kitalyi *et al.,* 2013; Fernandes *et al.,* 1984). Thus, farmers'

decisions to undertake agronomic practices are shaped and influenced by the values and perceived value of the crop and the broader socio-cultural, economic, and material contexts (Lynch, 1999; Sachs, 1992; Gasson, 1973).

On the other hand, the agronomic and crop management practices of the export avocado production are shaped by the economic value (market price). The economic value is defined by safety and quality regulations and standards, certification schemes, and consumer expectations outside the production sites (Fuchs *et al*., 2009; Smythe, 2009; Busch, 2000). The production system takes a bottom-line approach and therefore it is capital, labour, and resources intensive. It requires an irrigation system (use a lot of water), inputs (fertilisers and micro-nutrients, and pesticides and chemicals), particularly for medium/large-scale monoculture production. Even smallholders (micro/small-scale) production, which is mainly intercropped, requires a significant amount of labour time to irrigate and apply inputs, compared with the domestic avocado. Therefore, failure to invest in the specific knowledge, practical know-how, technology, and information needed to produce products that meet the specified value defined by the standards leads to pre-harvest losses and losses at harvest (Colbert, 2015; Busch, 2000). As the findings from this study suggest, the bottom-line value approach and the associated quality standard contradict the practices (domestic avocado production practices) acquired by farmers, thus, leading to losses. Therefore, farmers require new ways of thinking and valuing the export of avocado to perform the agronomic practices that improve quality and reduce losses during production.

Hence, I argue that there are two value relationalities in the domestic and export avocado production systems. The tension between the two value/values systems shapes agronomic practices in both production systems. On the one hand, the non-economic values of the avocado tree do not require any agronomic practices (domestic supply chain). On the other hand, producing good quality fruits and commercial production requires adopting better agronomic practices in both production systems (Juma *et al*., 2019; Mwakalinga, 2014). Such nuance considerations are lacking in the literature on pre-harvest losses. This thesis contributes to and extends the current debates on understanding pre-harvest losses which tend to be a single perspective – either biological/climatic and environmental factors that reduce marketable yield or poor crop performance due to pests and diseases or poor orchard management practices (Lufu *et al*., 2020; Ramírez-Gil *et al*., 2019; Hussein *et al*., 2018; Arah *et al*., 2015; Kader, 2002; Sams, 1999; Kays, 1998).

I argue that pre-harvest losses must be understood from the social, cultural norms and value(s) and the material context within which farming practices are shaped and performed. Pre-harvest losses

should not only be viewed within the prism of economic value; but through other values derived from the crop (Miller, 2008; Sachs, 1992). It is essential to attend to the interactions and interdependences of institutions, materiality, and practices in understanding pre-harvest losses. Taking such an approach brings into sharp relief the human element of the supply chain and the value(s) underlying the production system – highlighting the fact that pre-harvest losses are connected to broader institutional market structures and systemic issues (WWF-UK, 2021). In the case of the domestic avocado production system, the structural inequalities in the supply chain – e.g., traders paying lower prices to farmers de-value the crop. Therefore, farmers have no incentive to view the domestic avocado as economically valuable. Such inequalities must be addressed to achieve a shift in the production system that reduces farm-level losses. In the export-oriented avocado production, an imbalance of power through control over the production process leads to inequalities, pre-harvest losses, and losses at harvest in the global South.

Secondly, the literature on post-harvest losses indicates that poor handling practices during harvest and post-harvest are the primary driver of losses in fruits supply chains in Tanzania (van der Maden *et al.,* 2021; Ekka and Mjawa, 2020; URT-NPHMS, 2019; Ezekiel and Mtunguia, 2014) and in the global South (Sheahan and Barrett, 2017; Affognon *et al.,* 2015; FAO, 2011; Parfitt et al., 2010). I argue that the debate on poor handling practices needs to consider how perceived monetary value attributed to the product, actors-held norms/values, and interest influences and shape handling practices that create losses during harvest and early stages of the supply chain.

As evidenced in the case of the domestic avocado supply chain, the cultural perception and framing of the avocado as "butter for dogs", low economic value, and framing of the unripe avocado fruit as 'hard as stone' resulted in poor handling practices during harvesting, sorting, grading, and transportation (loading and unloading). On the contrary, brokers' practices to extract more value from farmers during harvest visa-as-vie wholesalers' interest to extract more value from local brokers (i.e., packing more fruits into sack bags at the farm and the market) inadvertently lead to bad packaging practices. Resulting in bruises and mechanical damage to fruits which causes losses and waste further down the supply chain (markets in Dar es Salaam and other cities). The actors (traders, helpers, and packers') perception of the material state (hardness/firmness - 'hard as stone') of the avocado reproduce the bad practices. However, as the firmness of the avocado decreases with ripeness in the wholesale/retail destination markets (e.g., Dar es Salaam), traders handle the avocado with care (albeit with poor market infrastructure, e.g., using dry banana leaves to cushion fruits). Here, the perception of the avocado as fragile and delicate and potential of financial loss to the trader engender different practices (Eaton *et al.,* 2008).

Thus, highlighting the diversity of norms, values, and interests of different actors along the supply chain and how those shape handling practices. This reveals the multiple ontologies of the avocado as it is moved along the domestic supply chain (Mol, 1999). Mol (1999) asserts that an ontological position calls into being a particular version of an object whereby the reality of that object is shaped by practices of knowing (cf. Blake, 2019). The different perceptions of the material state of the avocado are not different representations of the same thing. Instead, they are an alternative representation of distinct realities (Mol, 1999).

In contrast, the export avocado is highly valuable - a higher market price (price per kg) compared to domestic avocado (price per sack bag). The ontological position afforded to the export avocado (viewed as special – green gold, for unique market and consumers, etc.) creates new realities, not only for the practices of growing but also the practices of handling it. I argue that the role of norms/values, value, and materiality of the product raises important issues of 'why and how practices are performed. Such nuanced analysis is needed to expand our understanding of handling practices and losses and waste in primary production and distribution, especially in the global South context.

As discussed in chapters 6 and 7, the monetary or economic value attributed to the avocado must be viewed in the context of 'quality criteria and standards used by traders and exporters to evaluate and define 'good and bad avocado'. For example, in the domestic avocados supply chain, bigger size avocados have higher market value, sell faster at the wholesale/retail markets, and provide value for money for the urban consumers compared to smaller or medium-sized fruits. However, determining what counts as a small or big 'size' avocado is not a 'static feature' as there is no standard measurement. Fruits that do not meet the expected market value are rejected at the farm and wholesale markets. In the case of the export avocado, the higher market value attributed to it also means the application of stringent safety and quality standards and aesthetic standards (colour, shape, size, appearance, maturity, etc.) during harvest, out-grade, and processing resulting in much greater rejections (Soma *et al.,* 2021; Johnson and Dunning, 2020; Johnson *et al.,* 2019; Stuart, 2009; Parfitt *et al.,* 2010). How the value of a product is constructed significantly impacts losses and waste generation (Mavrakis, 2014; Hebrok and Boks, 2017).

This finding contributes to the growing body of scholarship that challenges how economic value attributed to food products results in losses, waste, and surplus generation in profit-oriented commercial supply chains (post-farm) (e.g., Midgley, 2014; Alexander and Smaje, 2008; Blake,

2018; David 2018; Blake, 2019; Swaffield *et al.,* 2018, Messner *et al.,* 2020). At the household level, monetary value, novelty(exotic) value, resource value, and the values of social relations have been identified to play an essential role in determining food disposal decisions by consumers (Mavrakis, 2014; Hebrok and Boks, 2017; Evans, 2014). Blake (2018; 2019, see also Midgley, 2014) suggests that food loss (surplus food) arises in profit commercial supply chains when the food is deemed to have lost its commercial or market value – due to over-production and over-ordering, damage to packaging, or product mislabelling. But the same food ceases to be characterised as food loss or waste once it enters the non-profit surplus distribution network where it is refigured as a carrier of values – 'social good'. Suggesting how qualities attributed to the product are constructed, produced, and re-produced by the interaction between actors (Blake, 2019). Thus, understanding the process of how different values (cultural, social, environmental, economic) that are usually considered in market behaviour, transactions, and calculations is important (Miller, 2002; Midgley, 2014)

I argue that there is the need to critically account for the role value, values, socio-cultural norms, and institutions that shape multiple ontologies of the avocados (food crops in general) and the practices that are connected to their farming, harvesting, handling in researching farm-level food loss and waste in global South context. It is "necessary to acknowledge the importance of different kinds of value[s] in different contexts" (Alexander and Smaje, 2008, p.1297), and by extension, the materiality of the product under investigation, the socio-cultural construction, and framing of the food product. Following Gille (2013) and broadly (e.g., Blake, 2019; Midgley, 2014), this thesis challenges the received wisdom that frames losses and waste in primary production and distribution in the global South as entirely due to lack of technology and infrastructure.

8.2.3 Institutional arrangements, risk, power relations, and losses and waste

The thesis has identified prominent dimensions of the institutional arrangements and the social relations between farmers, farmer groups, exporters, and traders that impact how losses and waste are generated in the domestic and export avocado supply chains. These are evident in two key areas explored in this section. First, I summarise how institutional arrangements shape buying and selling practices, illuminating how losses and waste are generated. Second, I discuss the risks avoidance strategies, how the materiality of the avocado is used by how traders and exporters to exercise power and inequalities, and the effects on loss and waste generation. I discuss how the institutionalisation of 'rejects system' and 'credit systems' in export, and domestic supply chains contribute to losses and waste generation.

8.2.3.1 Institutional arrangements, losses, and waste

Institutional arrangements (formal and oral contracts) play an essential role in agricultural product marketing and trading and establish the buying and selling relations between growers and traders and among traders further down the food supply chains. The literature on losses and waste in primary production has established that contractual arrangement is a significant cause or driver for losses and waste generation. For example, product take-back clauses, delivery quantity/volume commitments, product specifications, and quality standards, fear of losing contractual relationships (result in overplanting), and a slight price difference between quality premiums have been identified as critical structural and systemic issues that exacerbate losses and waste production (Skorbiansky and Ellison, 2021; Colbert, 2015; Bloom, 2011; Parfitt *et al.,* 2010; Stuart, 2009). However, the literature fails to account for the diversity of the institutional arrangements in the global South context. An investigation of the institutional arrangement between export avocado growers and exporter/processors (chapter 7, objective 4) identified four modes of selling relations shaped based on different institutional arrangements: contracted out-grower selling relationship; selling relationship between non-contracted farmer groups and exporters; direct selling relationship between the farmer and farmer group; and side-selling- spot buying relationship.

These modes of selling relations presented different constraints and opportunities that exacerbated losses and waste generation for the growers. While contractual out-grower selling relations provide stable and secure market access to the farmers, they are obliged to sell only to the exporter/processor they have a contractual relationship, limiting their ability to negotiate a better price, faced with severe sanctions and stringent product quality, and high dependence on the exporters harvesting schedules, all of which resulted in various degree of loses and waste for the growers. In contrast, non-contracted farmer groups have freedom of choice of buyers, reduce transactional costs that are caused by information asymmetry, lower risks to members by opportunistic behaviour of the marketing firm - exporters/buyers (in the case of UWAMARU – AMSCO) (Eaton *et al.,* 2008; Thorp *et al.,* 2005; Borgen, 2001). I argue that internal power/control among growers and association leadership and buyers' opportunistic behaviours lead to losses and waste generation, particularly among smallholders. Large growers have more influence and power and maybe located buyers first, and buyers and exporters also prefer to buy large growers to reduce transactional costs. Thus, leaving smallholders vulnerable to the risk of losses and waste – especially in remote locations.

However, as the finding illustrates, farmers attempt to create more value (higher prices and prompt payment) by side-selling to brokers/other exporters. This practice of side-selling or spot selling results in higher rejections for farmers and have severe implications for contract sanctions which causes further losses and waste. The findings provide a more nuanced understanding of losses and waste generation in contractual arrangements and highlight different vulnerabilities and risks for losses and waste generation (Skorbiansky and Ellison, 2020; Bloom, 2011; Stuart, 2009).

In contrast to the institutional arrangement discussed above, which pertains to the export-oriented avocado production, the marketing of the domestic avocado is essentially spot markets – which is "the default option for marketing fruits and vegetables for most farmers" (Eaton *et al.,* 2008, p.28; Eskola, 2005; Fafchamps, 2004). As discussed in chapters 4, 5, and 6, the production system is subsistence; smallholder farmers sell their surplus mainly to local brokers (rural collectors), who sell it to wholesalers and agents. Chapter 4 expanded on the role of the traders and actors in the domestic supply chain and how the avocado is moved from the rural production areas in the Kilimanjaro region to the urban cities, particularly Dar es salaam. Chapter 6 then provided the empirical evidence on the type of institutional arrangement and the trading relations between farmers and the traders. In an ideal spot market condition, "no personal relationships are developed", and transaction costs are very low for both parties" (Eaton *et al.,* 2008, p.20-21). As highlighted in chapter 4, because of the many intermediaries involved in the supply chain and the complexities surrounding transactions, the spot markets are characterised by high transactional costs (Fafchamps, 2004; Kydd and Dorward, 2004; Jaffee and Gordon, 1992).

Therefore, personalised relationships are formed with traders and farmers entering into informal agreements (oral contracts) (Eaton et al., 2008). As evidenced in chapter 6, at the farmgate, three types of informal institutional agreements were identified between local brokers and traders (long-term trading relations, short-term trading relations, and spot buying arrangements) that structure the buying/selling relations and price negotiation process. Both long-term and short-term agreements are based on the personal relationship between the farmer, and the local broker (De Putter *et al.,* 2007; Lyon and Porter, 2009; Lynch, 1994). However, parties may not always comply – a farmer may sell to a local broker offering better prices, or the broker may purchase from a farmer at a lower price. Such practices result in losses to farmers in a supply chain where produce can quickly deteriorate. The uncertainty is reduced through a personalised relationship that establishes trust (Amoako *et al.,* 2021; Lyon and Porter, 2010; Lyon and Porter, 2009; Lyon, 2006; Eaton *et al.,* 2008). Trust is essential in the case of this study where the institutional environment does not offer enforcement mechanisms. Personalised trust was a critical factor in the long-term

trading relations between local brokers and wholesale buyers and between wholesale buyers and agents. Information asymmetry enhances the opportunistic behaviour of traders.

Access to market information about customer (wholesale buyers) preferences and prices may not be readily available for farmers, and obtaining them may be costly (Eaton *et al.,* 2008; Porter *et al.,* 2007), resulting in farmers being paid lower prices and limit farmers' bargaining power. In the same way information asymmetry enables opportunistic behaviour of wholesaler buyers and agents, especially as the supply chain involves greater distance between production areas in Kilimanjaro and main consumer markets in Dar es Salaam. However, the use of mobile phones lowers the information asymmetry (Eaton *et al.,* 2008) as local brokers can rely on friends, relatives, and other networks (Lyon and Porter, 2009; Amoako *et al.,* 2021) in Dar es Salaam to access price information. Notwithstanding, the wholesale buyers have the bargaining power. Price changes in the rural-urban production markets can be at short notice, creating inequalities and vulnerabilities, and risks for local brokers, potentially impacting losses, and waste generation.

The study found that the mode of measurement or pricing the domestic avocado (at harvest) determines responsibility for the 'burden of losses' (who bears the losses at harvest), which influence harvesting practices. Losses were high where the farmer bears the burden of losses. This finding contributes to and extends academic understanding of how harvesting practices are enacted and losses generated, where the 'burden of loss' plays an active role or affects the volume of loss produced at harvest. Often, in the global South, on-farm losses are attributed to a lack of use of the appropriate technique or poor practices (Parfitt *et al.,* 2010, FAO, 2011) without understanding the why (Minor and Thornsbury, 2021).

8.2.3.2 Risk avoidance strategies, materiality, and power

Risks play an essential role in understanding losses and waste in food supply chains. Gille (2013) has argued that risk avoidance strategies serve as a connector between value chains and waste chains. In the domestic avocado supply chain, the trade is considered highly risky and volatile due to high post-harvest losses, particularly during transportation and off-loading, with wholesalers bearing the more significant risk (Eaton *et al.,* 2008). Therefore, local brokers and wholesalers adopt risk avoidance strategies to mitigate their financial loss, but these strategies also create losses and waste production on farms and in the market.

As elaborated in chapter 6, traders – local brokers and wholesalers set lower prices to mitigate against any potential post-harvest losses. The traders use their position of power in the supply

chain and the materiality of the avocado – its perishability to exercise power which creates more losses and waste. Risk avoidance strategies like changing the agreed price once the fruits have been harvested result in agreements and multiple handling and recounting of avocados which cause losses and waste in the supply chain due to mechanical injuries to fruits. Thus, power relations between the local brokers and farmers and the exercise of power to either extract value or reduce risk can result in losses and waste generation. Sometimes losses and waste on farms arise because local brokers fear losing trading capital, loss of potential economic days if wholesalers reject the product, and risk of being subjected to shaming and reputational damage and loss of potential buyers. Since the wholesalers bear a more significant burden of post-harvest losses, their practices to reduce their risks generate losses and waste in the market. Practices such as refusal to buy consignment they have ordered from local brokers if they think the consignment will create maximum value for them, resulting in losses and waste, especially during peak seasons. It is difficult for local brokers to find buyers or sell in the local market. The wholesalers use the materiality of the avocado and power imbalances to exploit local brokers, which has implications for waste generation.

Another important finding of this thesis is how established norms and systems that ensure the sales and distribution of avocados in the two-production system play a significant role in the ways loss and waste are generated but through power and inequalities that are exercised and experienced by the actors (elaborated in chapters 6 and 7). Elsewhere, several studies have shown that while the credit systems are critical for the movement of food and trade in SSA (e.g., Lyon and Porter, 2009; Porter et al., 2007; De Putter *et al.,* 2007; Lyon and Porter, 2010, Van Ufford and Zaal (2004; Amoako and Lyon, 2014; Amoako *et al.,* 2021) they can be exploitative if individuals become tied into debt relations (Bhaduri, 1986; Clough, 1981,1985; Watts, 1987). Therefore, personalised trust-based relationships are essential to reduce risks and uncertainties in informal market institutions where transactions are complex and not covered by the formal contract (Porter *et al.,* 2007; O'Neill, 2002; Moore, 1994). The findings extend these debates by focusing on how trust and trustworthiness in the personalised-based trade credit and power relations impact food losses and waste production.

In chapter 6, I argued that the institutional 'credit system' arrangement that underpins the domestic avocado supply chain allowed the movement of the avocado from the production sites to the national markets in Dar es Salaam. However, the same system enables losses and waste to be generated through the opportunistic behaviours of the agent traders in Dar es Salaam. While agents considered trust as "the trading currency or capital" in the institutional arrangement, evidence

showed that they used the materiality of the avocado (perishability) and the credit systems to exploit and exercise power against the wholesalers who own the trading the capital (Appendix 6.4). The study found that as part of the credit system arrangement, norms about the nature of causes of losses and risks and uncertainties linked to the causes of losses and waste determined who bears the cost of the loss. Again the 'burden of loss' norms weaken the wholesalers' position, make them vulnerable, and allow agents to perpetuate inequalities (Lyon and Porter, 2009). I argue that informal market institutional arrangements and the power relations that operate within them are significant sites in understanding losses and waste generation (distribution stage) in food supply chains in the global South context. An area that has not received much attention in the discourse on losses and waste in SSA.

Chapter 7 examined the institutional arrangement in the export-oriented avocado production system and the implications for losses and waste generation. While implementing quality standards and certification schemes reduces economic, biological, technological, legal, and reputational risks for exporters and actors downstream of the supply chain, the same generates farm waste and inequalities among growers (Gille, 2013; Colbert, 2015; Stuart, 2009). Gille (2013) argued that there is a relationship between farm waste and risks in the ways losses and waste production occurs in a globalised and market-oriented production system. The findings indicate that exporters and packers weigh several interacting drivers to reduce risks when evaluating harvesting decisions, including reputational ones (Johnson *et al.,* 2019; Johnson, 2020). Most significant is the market price or best market window and market reputation. An institutionalised rejects sharing system creates waste and inequalities as farmers attempt to reduce their risks through bad practices (Gille, 2013). Farmers' desire to reduce their risks of reject allocation resulted in practices such as harvesting immature fruits and avocado varieties that are not exported, thereby causing losses. Lack of transparency in the reject system caused mistrust and perception of opportunistic behaviour, as reported elsewhere (Ruml and Qiam, 2020; Ochieng *et al*., 2017; Bijman, 2008; Haucuja, 2006).

8.3. Contributions of the thesis

This section provides an overview of the contributions of the thesis in three key different areas: food geographies – food losses debate, food waste regime concept, and policy and practice.

8.3.1 For food loss and waste binary debate

Within food loss and waste scholarship, the definition of "food loss" and "food waste" are varied and differ across international organisations concerned with global agriculture, including the FAO. The World Resource Institute (WRI) defines "food loss" as "the unintended result of agricultural processes or technical limitations in storage, infrastructure, packaging, and /or marketing," whereas "food waste" occurs in the storage, processing, and distribution stages of the supply chain (Lipinski *et al*., 2013). The most straightforward definition divides the supply chain at one point - often the distinction between food loss and food waste based on the stage of the food chain at which the loss or waste occurs (FAO, 2011; Parfitt *et al*., 2010; Gustavsson *et al*., 2013). Where "food loss" is argued to happen at the pre-consumer stage of the food chain (growers, distributors, manufacturers, processors etc.) and "food waste" occurs at the retail or consumer stage of the food supply chain (Parfitt *et al*., 2010; FAO, 2011).

However, there is a lack of consistency in the use of the terms and the exact scope of what is food loss and what is food waste (Schneider, 2013; HLPE, 2014). Other scholars base the distinction between food loss and food waste on the nature or origin of the causes of loss or waste. If the reason is "behavioural" or "voluntary", it is considered waste; if it is "not behavioural" or "non-voluntary" is considered loss (HLPE, 2014). For example, flood damage to crops may be considered food loss, while the decision not to have a harvest, regardless of the underlying reasons, would be considered food waste. This distinction and narrative have become increasingly embedded into frameworks and initiatives by national governments and supernational organisations like the EU and UN that seeks to provide strategic directions to reducing food waste. For example, the UN SDG 12.3 reporting is separated into FAO's food Loss Index, the UN Environment's Food Waste Index (FAO, 2019) and the EU's framework like the Platform on Food Loss and Waste repeat the loss/waste distinction (EU, 2018; Bowman, 2020). Disturbingly, UN SDG 12.3 set the target - "by 2030, to halve per capita global food waste at the retail and consumer levels and reduce food loss along production and supply chain" (UN, 2016). This provides a target for halving food waste but vaguely target for loss reduction, although a group of global leaders (Champions 12.3) set up to drive progress towards SDG 12.3 have recommended for the 'halve per capita' to be applied to the

losses too – from farm to harvest (Hanson, 2017). The binary approach to food loss and waste 'reduces all food waste to the problem of inefficiency and technological inadequacy' (Gille, 2013, p.39). Such duality also implies that supply chain 'losses' are not caused by socio-economic arrangements, such as power imbalance in the supply chain - trade relations or social relations of production, which does not demand just technical, technological, or infrastructural remedies but institutional and systemic changes (Gille, 2013; Bowman 2020). The duality approach often confuses the definition and scope of investigation on food losses and waste, contributing to unreliability and lack of understanding of "why" loss and waste occur. Within agricultural production, food loss and waste can happen either due to decisions and direct or indirect actions/inactions by actors both at the distribution and retail stages of the supply chain or at the production stages (Gille, 2013; Alexander *et al*., 2013; Minor and Thornsbury, 2020; WWF-UK, 2021).

This thesis challenges that binary approach and calls for an integrative approach to the study of food loss and waste across the entire food supply chain – where a focus on food loss and waste in any part of the supply chain will consider the production-consumption relationship as one spectrum instead that dichotomous approach and will help better understand losses and waste production. The integrative framework presented in chapter 2 makes a significant theoretical contribution to the debate around providing a holistic approach to understanding losses and waste production. Integrating institutions, practices, and materiality into one framework helps us to account for or bring to the fore all possible causes of loss and waste, whether human, non-human or the interaction between the two. Particularly the debate on food loss and waste in primary production, as some causes of loss and waste in production are inextricably linked to the consumption and practices of actors. Primarily, this thesis has demonstrated the analytical utility of institutions, materiality, and practice approach in understanding losses and waste in food supply chains. The integrative approach that gives attention to practices shifts the debate from focusing on the individual actor, where systemic issues are reduced to individualised behavioural choices of the sovereign actor (e.g., farmer, trader, processor) to the understanding of the collective and distributed responsibility throughout the production-consumption system (Welch *et al*., 2021).

The findings have contributed to the debates on food waste and general waste that calls for focus on the n relational materialist perspectives, where the 'matter' that is wasted is an active actant in the circumstances in which it becomes waste (Bemmel and Parizeau, 2020; Hawkins, 2009; 2011; 2015; 2017; Gregson *et al*., 2007; 2010a, 2010b). At the consumer level, the relational materiality of food and how it becomes waste have been picked up in several foods wastes studies (e.g.,

Bemmel and Parizeau, 2020; David Evans, 2014; Meah and Watson, 2011; Cappellini and Parson, 2013; among others). This thesis extends these debates to refocusing food loss and waste at the centre of analysis in the agricultural production system to explore its dynamic and shifting role in the process of the social organisation of production and distribution (Friedland *et al.,* 1981, 2013) and the relations surrounding their production and values to illuminate inequalities in the production systems (Evans *et al.,* 2013; Coles and Hallett, 2013; Gille, 2013).

The findings also extend the emergent but limited debates around the role of value, values, practices, and on-farm losses (Soma *et al.,* 2021; Johnson *et al.,* 2019) and post-farm losses – surplus food from processors, manufacturers and supermarkets, and retailers and their redistribution (Midgley, 2014; Blake, 2019; 2018; Swaffield *et al.,* 2018, Messner *et al.,* 2020). As discussed in chapter 2, several kinds of literature illustrate that food loss and waste production occur at the intersection of social, cultural, economic, environmental, and historical forces. However, as the debates on food losses and waste, particularly post-farm, argue, losses and waste production are not unilaterally determined. Instead, food losses and waste arise due to the interaction and interrelation between institutions, materiality, and practices, where value and values play an essential role. The findings from this thesis provide empirical support for such theorisation at the on-farm level. Chapters 4 and 5 traced the relations and mutual influences within production-distribution networks, highlighting the importance of values and value in shaping agronomic practices and the ways losses are generated during production and supply arrangements for domestic and domestic and export avocados. This thesis has contributed to understanding the social, spatial, and economic relations that get the avocado – in the first instance – into the vital material state (Goodman, 2016, 2002; Bennett, 2007).

Taking a relational materiality approach, chapter 5 foregrounded the role of nature – both the environment and other non-human things as an active agent (Gille, 2014; 2016), participating in the "collective action" of the production process in ways that are not predictable or controllable (Murdoch, 1997). This brings a new understanding of the role of a material relational approach to food production in Tanzania's domestic and export avocado production systems, but essentially the losses and waste generation in primary production. Chapters 5, 6 and 7 highlighted the power relation between growers, traders and exporters, control over the production process and inputs (export production) and extraction of value. Contributing to the debates on the concentration of power in food systems (Howard, 2016) and corporate power in agri-food governance (Clapp and Fuchs, 2009) and extending this to account for the losses in the production process. Chapters 6 and

7 illustrated how economic values shaped harvesting, handling practices, and grading/sorting in generating losses and waste.

8.3.2 For the food waste regimes concept – theorising loss and waste as manifestation of power relations in food systems

In the last decade, there have been calls to take sociological approaches to understand food waste (Evans *et al*., 2013). In their sociological review monograph, Evans *et al*. (2013) catalogued the intellectual debates that have projected the profile of food waste to call for sociological engagement with the issue. Drawing on broader development in the field, they suggested that food waste is constitutive of the social ordering process at varying scales (cf. Welch *et al*., 2021).

This thesis generally contributes to the sociological gaze on understanding food losses and waste in agriculture production in the global South, drawing attention to the socio-economic and cultural contexts in which food losses and waste occur. More specifically, it contributes to Gille's (2013, p.29) calls in the *sociological review* that "waste constitutes a social relationship, and therefore must be studied as something produced materially and conceptually by profoundly social relations". In taking the social relations approach to studying food waste, Gille put forward the concept of food waste regimes. She argued that food waste production should be viewed as "the dynamic interrelatedness of value chains and waste chains with risk avoidance strategies comprising the most important transmission belt between the two" (Gille, 2013, p.28).

Theoretically, this thesis builds on and provides further empirical evidence of the food waste regimes concept. It illuminates the role of risk as an essential connector among geographical scales in food loss and waste production and the social arrangements used to reduce or avoid risks. In this study, value creation and extraction are inherently linked to risk reduction strategies. Risk avoidance strategies play an essential role in generating losses and waste in both domestic and export production systems, particularly at harvest and immediate stages of the supply chain. While economical, biological, legal, and political or reputational risks were critical factors for farm losses and waste (including processing) in the export of avocado production, in domestic avocado production, economic risks were the main factor causing losses and waste on farms and within early stages distribution chain (see chapters 6 and 7). Gille asserts that "economic risks are a key aspect of the production of waste…efforts to shield oneself from economic uncertainties generate [loss and] waste in different stages of production …" (Gille, 2013, p. 32). The ability to transfer

one's risk to another actor in the food supply chain is an exercise of power; as Gille notes, the risk is inherently power-laden (ibid).

Several studies, especially in the global North, have shown that farmers overproduce to shield themselves from the vagaries of the weather and contract conditions resulting in a surplus, loss, and waste production on farms, particularly within the produce sector (Messner *et al.,* 2021; Gillman *et al.,* 2019; Johnson *et al.,* 2019; Bowman, 2018; Alexander *et al.,* 2017; Stuart, 2009). For example, Messner *et al.* (2021) noted that in Australia, the pressure for growers to overproduce also emanates from competition in a highly concentrated and oversupplied marketplace and the need for growers to secure contracts and safeguard the contractual relationships by ensuring they are ready to fill orders all year round (see also Bowman, 2018; Stuarts, 2009).

Thus, the risk of losing contracts opportunity and potentially weakened meaningful supply relationships with prominent retailers and supermarkets causes overproduction leading to losses. Retailers and supermarkets shield themselves from financial uncertainty through demands for consistent volumes and stringent quality standards during over-production and order cancellations (Bowman, 2020; 2018; Colbert, 2017; Clapp, 1994). Such power imbalances manifest in the form of surplus food on farms (losses, and sometimes waste) as growers must plant enough quantities to allow for changes in yield and quality and then leave crops unharvested or cull unwanted produces (Gillman *et al.,* 2019; Johnson *et al.,* 2019; Bowman, 2020; 2018; Gille, 2013, p.35). The evidence from this thesis presented in chapters 6 and 7 shows that in both the export and domestic avocado supply chains, the exercise of power and power imbalances between the farmers, traders, processors, and exporters leads to loss and waste generation on farms and in early stages of the supply chain. Unfair trading practices such as paying lower prices, delayed harvesting, higher quality standards defined by the exporters, contract sanctions and arbitrary quality criteria used by brokers and wholesalers (domestic avocados) resulted in significant losses and waste in both supply chains. Thus, farmers are always in a vulnerable position, and the product's perishability heightens farmers' vulnerabilities.

This evidence contributes to findings by Feedback investigations into farmers in the global South exporting Europe found similar unequal power relations, including last-minute order cancellation, and flexing cosmetic standards (Colbert, 2017). Additionally, what this thesis contributes to the debate, is that such unequal power relations do not only exist within export supply chains involving farmers in the global South. Nevertheless, such power inequalities exist within domestic, informal, and non-export food supply chains in the global South, which often remains unreported in the food

loss and waste debate. As the results show (chapter 6, see also Appendix 6.4), power inequalities and unfair trading practices were prevalent within the domestic supply chain as most transactions are spot transactions. Even when a repeated and long-term trading relationship has been established, there is no fair process to redress bad practices, and the seller is always in a vulnerable position. Therefore, actors, particularly wholesalers, wade control and power with impunity as they seek to reduce their risks and pass on costs to traders upstream, leading to loss and waste generation. Gille (2013) argues that costs and risks are externalised onto farmers by their buyers. In the export supply chain, buyers shift their risks to producers through contractual arrangements – contracts act as a risk avoidance strategy (Little and Watts, 1994; Friedland *et al.,* 2013 (1987); Barrette *et al.,* 1999)). While exporters and buyers can organise their uncertainties into risk institutions (insurance), poor producers cannot do the same (Power, 2007).

I argue that conceptualising loss and waste as a manifestation of power inequalities and "as a function of social relations" in food systems help us to understand better the phenomena in the global South and North context (Gille, 2012, p. 38; Gillman et al., 2019). This helps us move away the debate away from seeing on-farm losses and waste through the hazard model of vulnerability – where losses are seen as a result of a hazard rather than the social constructionist perspective that considers the structural context that makes one vulnerable to the threats (Gille, 2013).

8.3.4 Implications for policy and practice

The findings from this thesis have highlighted important areas that policymakers, development practitioners, and agencies need to consider when considering improving losses in agricultural production and smallholder livelihoods. I discuss these in terms of understanding farmers' values and socio-cultural context when introducing new crops, understanding farm losses at the farm level, engagement with farmers, overcoming the binary approach to losses and waste, the importance of understanding institutions, practices and materiality at the policy level and ensuring social justice in the production system – e.g., the promotion of fair trade.

First, policymakers, development practitioners, and donor agencies should consider the socio-cultural norms and values that farmers hold when introducing new crops or new varieties of existing crops. The values that farmers attribute to the crop or views held about the crop, and the values derived from the crop, be they economic or non-economic, have significant importance in how practices are enacted. As evidenced in chapters 4, 5, and 6 of this study, farmers' values about the avocado impacted how agronomic, harvesting and handling practices are enacted. For example,

farmers' view of domestic avocados as *"butter for dogs"* and of "*low economic value"* impact their know-how, knowledge, and practices, negatively impacting the practice required to produce commercial avocados. Therefore, transitioning into growing a new crop or a new variety of existing crops (in this case, commercial avocado varieties) requires new ways of knowing, valuing, practical understanding, and know-how to enact agronomic practices that improve the quality, yield, and reduce losses in production (pre-harvest losses) including harvesting and processing. This calls for engagement with farmers to understand their values and socio-context within which specific crop production occurs. Policymakers, governments, and donor organisations must understand how the introduction of new crop fit into the needs of farmers' livelihoods and the structure of their farming systems (Sachs, 1992, Lynch, 1999, 1994, Piscasso *et al.,* 2020). Engaging farmers early before introducing new crops engender buy-in, identifying knowledge gaps and testing management alternatives, which are critical for introducing new crops (Gbetibouo, 2009; Bandewar *et al.,* 2017; Piscasso *et al.,* 2020).

Secondly, there is the need for a new understanding of losses at the farm level (pre-harvest/harvest losses) – losses at the farm should be understood as from the social, cultural norms and values and the material context within which farming practices are shaped and enacted. Current policy directions and practice (e.g., in the case of Tanzania - NPHMS (2019-2029) are focused on post-harvest losses to the neglect of on-farm losses and fails to recognise the strategic role and importance of agronomic practices and their impacts on pre-harvest losses and losses at harvest (see chapter 5). Notably, at both policy and practice levels, there should be a consideration of actors held norms, values, and values attributed to the food crop at different stages of the supply chain and the interactions and interdependences of institutions, materiality, and practices in the generation of losses and waste at the farm level, but also at the across all stages of the food supply chain. For example, understanding the interrelationship between qualities attributed to avocados and the framing and re-framing of those qualities and economic values and non-economic values ascribed by the actors (farmers, fruits pickers, packers, traders, processors etc.) to the avocados along the supply the chain will help to address losses and waste in the avocado production system. This applies to all food products if efforts to reduce losses and waste throughout the supply chains are to achieve a meaningful result. Also, policymakers and practitioners need to appreciate the influence of social relations within the specific supply chain and the values underlying the production system. This research has shown that farm-level losses are connected to broader institutional, market structures and systemic issues. This calls for the need to overcome the losses/waste binary within agricultural systems and supply chains, where losses are viewed as occurring at the farm level and waste at the consumer stages of supply chains.

Thirdly, producer groups (associations and co-operatives) are considered necessary institutional arrangements by the government, development and donor agencies, and local NGOs to strengthen smallholder farmers' market access and integrate smallholders into high-value export-oriented crop production. These institutional arrangements arguably increase rural income, enhancing smallholder competitiveness and reducing poverty (Eaton *et al*., 2008; Stockbridge *et al*., 2003). However, there is a need for policymakers and development practitioners to focus on the institutional environment within which the institutional arrangements are established. Strengthening the leadership and capacity of farmer group members to ensure that the groups can operate independently. It is important to consider power dynamics and the social relations within the institutional arrangements and how they positively or negatively impact practices and their effects on losses and waste generation. The effects of social relations are often neglected in policy and practice discourses, particularly on farm food losses and waste. Social relations within production systems and the early stages of the supply chains should be at the forefront of policy and practice efforts in reducing losses and waste. Besides, governments and NGOs must work towards achieving fairness in the production system in terms of pricing for both domestic and export avocado production systems. This study showed that lower prices, unfair treatments, and late payments affect agronomic and handling practices, impacting losses and waste generation. Mainly, in the export avocado production system, government and development agencies should work with farmer groups and market organisations to adopt or establish a fair-trade system to ensure that farmers get a fair share of the price, especially for smallholders. As export avocado production is becoming more important relative to domestic avocado production (in terms of its economic value and ability to improve smallholders' livelihoods) in the coming decade or so, establishing policies and practices that promote fair trade principles would engender more significant benefits the local economies (Strong, 1997; Witkowski, 2005)

8.3.4 Limitations and direction for future research

This thesis has provided a theoretical framework and empirical evidence of how institutions, materiality and practices interact to produce losses and waste in primary production and at the early stages of food supply chains. Theoretically, it takes social relations to approach drawing on food waste regimes concept as the theoretical and analytical lens. Empirically, the thesis adopted the follow-the-thing and go-alongs ethnographic observation as methodological approaches for data collection. I reflect on the limitations of this research and critically interrogate how the methodological approaches were adapted and implemented and the direction for future research.

Undoubtedly, the go-alongs provided several significant strengths in the data collection in the following areas: (1) It provided a deeper understanding of the domestic and export avocado production practices that lead to loss and waste generation. These were the practices of risk avoidance strategies, reject sharing, and credit system and the broader webs of practice in which the avocado is harvested and sold. 2) the go-alongs operated (like an active interviewing strategy) as a 'jump off' point for further discussion about participants' growing, harvesting, selling, and trading practices. (3) they provided valuable insights into the material environment and physical organisation of growing, harvesting, selling/buying, and trading practices. (4) They illuminated the existence of different 'modes' of institutional arrangements that underpins the selling/buying and trading relations in the two-production system.

However, like any data collection method, go-alongs are limited by thematic, practical, and interpersonal aspects (Kusenbach, 2018). Kusenbach argued that thematically, for go longs to be an effective tool of data collection, those being researched "must display a certain degree of environmental engagement which routinely happens when people are on the move or when engaged in stationary activities like cooking or waiting for a bus […], and the research participants engagement with the environment must be accessible and leave room for reflection and conversation" (ibid, p.354). In the case of this research, while the research participants were highly engaged with their environment, whether during harvesting events or selling events (both involve movement and stationary activities), the critical limitation was somewhat the limited direct interactions between the researcher and researched.

While the go-alongs were intended to provide deeper insight into the lived experience of participants' practices, such participatory encounters require active interaction – as observing and asking questions, talking, and listening are the main feature of collecting data (Kusenbach, 2003; 2018; DeWalt and DeWalt, 2011). My limited fluency in the Kiswahili language (and no knowledge of the Chagga dialects) meant I could not fully engage in conversations which could have hampered gaining a deeper insight into the lived realities and unenacted practices. To overcome this challenge, I adapted the main feature of go-alongs - which is the interaction between the researcher and the researched) to include the use of an interpreter in the research setting. Using an interpreter and 'informal conversational style' in the go-alongs settings helped overcome some shortcomings. The use of interpreters in participatory observation is recommended (see Tonkin, 1984; DeWalt and DeWalt, 2011; Borchgrevink, 2003). Tonkin (1984) advised that depending on the nature of the topic, the researcher can use an interpreter, which should be supported with a

systematic recording of relevant material (I reflect on the methodological and epistemological challenges of using an interpreter in chapter 3, section 3.5.2.).

Moreover, the repeated nature and the length of the go-alongs (a typical day of harvesting or selling trip lasted from morning until evening) allowed me to engage participants in conversations after an event or situation of interest. For instance, during harvesting, I used the time between – walking from one farm to another (sometimes 1-2km) to discuss issues that needed further clarification. However, not all the participants' environments and conversations were accessible. For example, in some circumstances (during harvesting go-alongs), the local broker(s) went ahead of us (myself and the interpreter) to negotiate the price with the farmer before we joined in for the harvesting. Moreover, in other cases, even when we are present during price negotiations, sometimes undertones and switching from Kiswahili to the local Chagga dialect (the interpreter does not understand Chagga dialect) between local brokers and farmers prevented me from thoroughly assessing what transpired in the setting. Kusenbach (2018, p.355) argues that "there are social complexities that can reduce the utility of go-alongs." As already noted, go-alongs rely on social interaction and are embedded within the broader fieldwork relationships (Coffey, 1999). While there were positive relationships and connections between the research team and the participants, price negotiations were sometimes deemed sensitive by research participants who were less willing to share that information during observations. Other researchers have noted that some topics and situations socially limit the application of go-alongs (e.g., Kusenback, 2018; Ferguson, 2016; Carpiano, 2009). Notwithstanding, since in go-along conversations, "there is less pressure to fill silences" (Kusenbach, 2018), I used opportunities outside of engagement (that the method offers) during follow-up calls to brokers and later interviews with farmers to explore non-verbalised knowledge and practices (Riley, 2010; Trouille and Tavory, 2016).

Like the go-alongs method, the 'follow-the-thing' approach presents practical, ethical, conceptual, and personal challenges. The first challenge for any researcher employing the method is how to define the start and end points of the study and when to stop following. How do these decisions affect the stories you can/cannot tell as a researcher? (Hulme, 2017; Christophers, 2011a; 2011b; Gregson *et al.,* 2010). Traditionally, 'follow the thing' works backwards from the commodity through "assembling of pre-figured point of sale [of the] commodity" (Gregson *et al.,* 2010, p.825) and tracing it to the point of its origin (production). The earlier literature predominantly focuses on the linear understanding of the production-consumption chain, mainly from the South to the North. Gregson et al., in their study of furniture created out of ship-disused furniture in Bangladesh, identified problems in the current follow the thing literature: 1) that the producer is always located

in the global South and the consumer in the global North; 2) the Western way of consumption is considered the universal consumer culture; 3) stable objects are always followed; and 4) the transforming objects, such as the ships she studies, are obscured by final commodities (Gregson *et al*., 2010, p.848).

In this study, the approach was adapted so that the direction of 'following' started from the farm (place of production) and ended at the wholesale/retail markets (for the domestic avocado supply chain) and at the packhouse (for export avocado supply chain), which is a departure from the "backtracking" associated with the 'following the thing' tradition (Gregson *et al*., 2010). The decision to 'follow' avocados forward tracking instead of backtracking was necessitated by the focus of the research, which was to understand why loss and waste occur in primary production and early stages of the supply chain. Therefore, the 'following' the domestic avocado and export avocado was limited only to the country of production and did not include consumers. Limiting the study to the production and early distribution stages helped to define the start and the endpoint and that the data collection was practicable. I explored the avocado loss and waste production in Tanzania within the bounded case study of the avocado supply chain, focusing on the cultivating, harvesting and early stages of the distribution.

However, defining the boundaries of the connections and associations to be followed was quite challenging as many potential threads opened during the research process. For example, labour relations and gender issues in the avocado production systems. A key feature of following the thing tradition is "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, p.423; Cook, 2006). While this research provided some anecdotal evidence of labour relations and gender inequalities, these threads were not followed in detail.

Secondly, in following the avocado and how it became lost or wasted, there were issues of power relations, particularly with export avocado, where I could not fully follow the avocado to the packhouse as intended. The initial plan was to follow the avocados from the farm to the packhouse and spend two weeks shadowing packhouse workers to understand how institutional requirements regarding food safety and quality standards are negotiated, to understand how the workers interpret these standards and the decisions that are made when the practices of processing the avocado are initiated and enacted. Due to restricted access to the packhouse (I was allowed in the packhouse for a very limited time, two half days) because the production processes and data were deemed sensitive by the exporter. The challenge of some things not being followable, e.g., sensitive topics

and data, has been acknowledged in other studies (Hulme, 2017; Bates *et al.,* 2016; Christophers, 2011). This affected the detailed stories that could have emerged from the packhouse processes. As argued by Hulme (2017), this represents gaps, or "disjointed breaks pauses, start points, end points" (Bates *et al*. 2016). In the case of this study, some of the gaps revealed the exercise of power by the actors, stakeholders, and those networks connected to the commodity, or the thing being followed. To overcome this challenge, I held a group discussion with the packhouse workers outside of working times to understand what fully transpires in the processing. Also, several in-depth interviews with the packhouse manager helped triangulate the information gathered during the short time in the packhouse.

Although, this thesis calls for the need to take a social relations approach that integrates institutions, materiality, and practices to highlight how inequalities and power relations contribute to understanding loss and waste in agricultural production in the global South. Several areas require further research and investigation. First, the empirical evidence showed that the production of food loss and waste within primary production and early stages of the supply chain is a manifestation of power relations within the production systems. Future research could draw on gender theoretical perspectives to investigate power relations and gender participation in domestic and export avocado production systems and the implications for losses and waste generations and livelihoods. The thesis highlighted the gendered division in the production and avocado trade for domestic and export avocado production systems. In the domestic avocado supply chain, production and selling (rural-urban market and retail) are dominated by women, while men dominate the wholesale trade. In the export production system, men dominate both production and selling as it is seen as a cash crop. Applying a gender theoretical lens could ask, for example, how do gender and power relations influence food loss and waste production on farms and in the early stages of food supply chains? Are there specific gender practices (growing, harvesting, and selling) that engender loss and waste production? Few studies on household food waste provide some evidence that males waste more food than females (Secondi *et al.,* 2015; Visschers *et al.,* 2016), although Buzby and Guthrie (2002) found contrary evidence. A qualitative study drawing on gender theory and feminist approaches would provide a detailed explanation and understanding of how gender-related practices and power relations and implications for loss and waste in primary production. Again, gender-related studies could explore how avocado "commercialisation impacts gender relations, and processes that shape them" (Manda, 2022, p.1) using the different structured out-grower schemes and the institutional arrangements that are operational in the export production sites in the NH and SH. This kind of research could reveal gendered impacts across out-grower schemes and the institutional arrangements that shape them by asking, does integration into the out-grower

scheme responds to gender needs, does it alter pre-existing socio-cultural imbalances, does it engender transformational change among participants or replicate structural inequalities and the implication for loss and waste production.

Secondly, this thesis traced the socio-economic, cultural, and political context within which the Tanzania avocado industry has evolved and developed. The evidence showed that cultural norms and the socio-economic and political context for the development of the coffee industry played a significant role in the development of the two distinct avocado production systems. These findings could be extended further by drawing on a political economy approach to investigate, for example, how historical cooperative movements (particularly in the coffee production system) and government regulations on cooperatives have shaped institutional arrangements in the avocado production systems - particularly in the context of the export avocado supply chain. Again, the political economy approach could be used to investigate how Tanzania's post-independence socialist land reforms *"ujemaa"* and its implication for commercial avocado production, inequalities, and gender issues within the production system.

Lastly, Gille (2013) argued that the waste regimes concept consists of the production of waste, representation of waste and politics of waste and that these regimes differ from each other. This thesis primarily focused on the waste production aspect of the food waste regimes concept. Therefore, the thesis would benefit from further research investigating the representation of avocado losses and waste and its politics in Tanzania. For example, further research focusing on the representation of waste could ask which side of fundamental dichotomies waste is seen to lie – efficiency/inefficiency, gain/loss and could focus on losses, and waste recovery strategies and the key bodies of knowledge and expertise that are mobilised in dealing with losses and waste would be essential. Further, a detailed study that focuses on public discourses on food losses and waste, asking, for example, what are the tools of policy; who mobilise and deals with the issue; what institutional changes are required to improve to institutional environment in dealing with losses and waste?

8.4 Conclusion

This thesis has investigated food losses and waste in Tanzania's two distinct avocado production systems. The central finding is that food loss and waste in primary production and early stages of supply chains are due to the intersection and interaction between institutions, materiality, and

practices. Consequently, economic value and other values played a significant role in shaping practices and institutional arrangements. The risk avoidance strategies used by traders and exporters and power relations within the institutional arrangements determined how losses and waste are generated. This research has shown that losses and waste provide a unique conceptualisation of understanding inequalities and power relations in our food systems. The findings of this thesis have highlighted that food loss and waste within primary production systems in SSA and the global South, in general, cannot be attributed mainly to a lack of appropriate technology, capacity, and infrastructure. Often institutional arrangements, value, values, risks avoidance strategies, and the institutions that define the production and distribution processes are ignored.

These raise important questions about national and global efforts to achieve UN SDG 12.3. In order to achieve SDG 12.3, there must be a focus on the interactions and interrelationships between institutions, materiality, and practices at all stages of the food supply chains. Such an integrative approach will help to veil the systemic and structural issues that border on socio-cultural norms and values, economic value, and how food qualities are constructed, which must be addressed together with social relations and power inequalities in the food systems. Addressing these critical underlying issues with improvement in awareness, infrastructure, increasing market access for smallholders, and investment in technology will help reduce on-farm and post-harvest losses and waste

Appendices

Appendix 3.1 Research Permits

TANZANIA COMMISSION FOR SCIENCE AND TECHNOLOGY
(COSTECH)

Telephones: (255 - 022) 2775155 - 6, 2700745/6

Director General: (255 - 022) 2700750&2775315
Fax: (255 - 022) 2775313
Email: relearance@costech.or.tz

Ali Hassan Mwinyi Road
P.O. Box 4302

Dar es Salaam
Tanzania

RESEARCH PERMIT

No. 2018–393-NA-2018-39

23rd May 2018

1. Name : **Jonas Cromwell**
2. Nationality : **Ghanaian**
3. Title : **Food Waste and Recovery within Avocado Supply Chain in Tanzania**

SCIENCE AND TECHOLOGY
P.O. Box 4302
DAR-ES-SALAAM

4. Research shall be confined to the following region(s): **Dar es Salaam, Kilimanjaro, Mbeya**
5. Permit validity from: **23rd May 2018** to **22nd May 2019**
6. Contact/Collaborator: **Mr. Pius Shirima, Kilimanjaro Environmental Development Association, P.O. Box 13, Himo, Kilimanjaro**
7. Researcher is required to submit progress report on quarterly basis and submit all Publications made after research. Last but not least

M. Mushi
for: DIRECTOR GENERAL

UNITED REPUBLIC OF TANZANIA
PRESIDENT'S OFFICE
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT

MBEYA REGION
TELEGRAM: "REGCOM"
Telephone No: 025-2504045
Fax No.025-2504243
Email: *ras@mbeya.go.tz*

In reply please quote:

REGIONAL COMMISSIONER'S OFFICE,
P.O. Box 754,
MBEYA.

Ref. No. DA.191/228/01/

1ST April, 2019

District Administrative Secretary,
P.O. Box 148,
RUNGWE.

RE. RESEARCH PERMIT

Please refer to the above captioned subject.

May I introduce to you **Mr. Jonas Cromwell** from Tanzania Commission for Science and Technology (Costech).

At the moment he is conducting researches on **"Food Waste and Recovery within Avocado Supply Chain in Tanzania."** A case study of **Rungwe District Council from February, 2018 to May, 2021.**

Please assist him accordingly.

M. J. Sepocho
For: **REGIONAL ADMINISTRATIVE SECRETARY,**
MBEYA.

Copy: Mr. Pius Shirima,
Kilimanjaro Environmental Development Association
P.O. Box 13,
HIMO, Kilimanjaro

,, Director General,
Tanzania Commission for Science and Technology
P.O. Box 4302,
DAR ES SALAAM - TANZANIA.

JAMUHUIRI YA MUUNGANO WA TANZANIA
OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA

Anuani ya simu "ADMIN"
Simu ya mdomo 025 2552036
FAX NO: 0252552421

Ofisi ya Mkuu wa Wilaya Rungwe,
S.L.P 34,
TUKUYU.

14/05/2019

Unapojibu taja:-
Kumb Na.AB.353/574/01/ 158

MTENDAJI WA KATA
KATA YA KIWIRA, SUMA NA LUFINGO NA KYIMO.

Yah: **KIBALI CHA UTAFITI**

Tafadhali husika na mada tajwa hapo juu.

Nawatambulisha kwenu ndugu **MR. JONAS CROMWELL** kutoka Chuo Kikuu **SHEFFIELD** ambaye atafanya Utafiti Wilaya ya Rungwe.

Mada ya Utafiti " **Food Waste and Recovery within Avacado Supply chain in Tanzania"**

Tafadhali mpeni ushirikiano ili akamilishe Utafiti wake , ikiwa pamoja na Usalama wake . Kibali cha Utafiti kimeanza Mwezi Februari, 2019 hadi Mwezi May, 2021.

Nakutakia njema.

AMIMU J. MWANDELILE
Kny: KATIBU TAWALA WILAYA
RUNGWE.

Nakala:
Mkuu wa Wilaya
RUNGWE. Aione ndani ya jalada.

Kny KATIBU TAWALA WILAYA
RUNGWE

: **MR. JONAS CROMWELL**
MTAFITI

Appendix 3.2 Ethics Approval from University of Sheffield

Downloaded: 23/04/2018
Approved: 16/04/2018

Jonas Cromwell
Registration number: 170249364
Geography
Programme: GEOR71 Geography (PhD Geography S FT)

Dear Jonas

PROJECT TITLE: Food Waste and Recovery within Tanzanian's Avocado Supply Chains
APPLICATION: Reference Number 017367

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 16/04/2018 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 017367 (dated 15/02/2018).
- Participant information sheet 1039848 version 1 (15/02/2018).
- Participant consent form 1039850 version 1 (15/02/2018).
- Participant consent form 1039849 version 1 (15/02/2018).

The following optional amendments were suggested:

*From one reviewer: Despite your comments on researcher positionality, you are likely to be criticised by anthropologists for claiming an ethnographic perspective despite not being able to speak Kiswahili. Won't this limit your understanding of local power dynamics? It might be better to describe your method as 'ethnographic observation' (or similar). You mention working through an interpreter/translator (below). Doesn't this also raise issues of positionality and power? Be careful to spell key authors' names correctly: Zsuzsa Gille, Susanne Freidberg From another reviewer: Your use of institutions is not clear regarding if you are referring to institutions as organisations or as rules/norms. MKB has explained to the reviewer that it is the latter, but do be clear in your documentation. ***Please also revise the consent form in line with the following: Why do you switch from 'I' to 'we' half-way through the form? And who is Naomi Oates?? Shouldn't you refer to the use of interpreters/translators at some point in the PI form?*

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Yours sincerely

Clea Carroll
Ethics Administrator
Geography

Appendix 3.3 Participants information sheet and consent form (English)

AVOCADOS WASTE PROJECT: PARTICIPANT INFORMATION

The University Of Sheffield.

Department Of Geography.

SHEET

Project Title: **Food Waste and Recovery: A study of Tanzania's Avocado Supply Chains.**

Invitation to participate

You are being invited to take part in my PhD research project in order to share your rich knowledge and perspective with me. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take some time to read the following information carefully and discuss it with others if you wish. It is up to you to decide whether to take part or not. Please feel free to ask me questions if anything is not clear, or if you would like more information.

Background and the project aim

Globally, a third of all food produce for human consumption is lost or wasted in the food supply chain. In Africa most of the food loss or waste happens on farms and during storage and distribution. While progress have been made to understand post-harvest losses, they tend to focus on measuring the losses and causes are attributed to lack of infrastructure and inefficiencies in the food system. This project seeks to understand how institutions rules and norms either formal and informal help to generate loss/waste or surplus in avocado supply chains; and to examine strategies used by organisations, groups and individuals to reduce, redistribute or recycle avocado waste or surplus.

The research will be conducted over 2-3 year period in Kilimanjaro and Arusha region, Tanzania. The methods include: interviews and observations and focus groups discussions. This PhD, is funded by The Economic and the Social Research Council (ESRC) UK., and The Grantham Centre for Sustainable Futures at the University of Sheffield.

Why am I being asked to take part and what does it involve?

You have been chosen to participate in this as someone who is directly or indirectly involve in any aspect of the avocados supply chain from growing, processing, buying, transporting, and selling. I am interested in talking to and working alongside anyone involve in the avocado supply chain (directly and indirectly). If you decide to take part, please give your consent. Please note that you are free to withdraw from the study at any time and there are no negative consequences for you if you do so. You do not have to give a reason.

Whilst there are no immediate benefits to you for participating in the project, it is hoped that in developing a sound understanding of the various drives for losses/waste or surplus and examining the strategies for reducing, redistribution or recycling within the avocado supply chain, the work

will contribute to formulating better policies and policy intervention to reduce the negative impact of avocado waste in the long term.

You are being asked to take in this project through either:

1. Involvement in individual interview (s)
2. An in-depth engagement which involves allowing the researcher to shadow you at work (it could be on the farm, at the market, grading/packing house, during transporting avocados or at the office), and involvement in individual interviews or discussions

If you agree to an interview then it would last, usually, around 40 minutes to an hour. The interview questions will be open-ended which will allow you to give in-depth responses. The interview will be recorded so that I have an accurate record of the conversation. There may be an opportunity for a follow up interview if this is something that I felt was beneficial.

If you agreed for me to spend some time with you doing your work, this could be anything between a few hours and a day, and would depend upon the nature of your work. I would agree on a time that is suitable to you. While doing your work, I would be taking notes about what I was observing.

What will happen to the information gathered and will I be named in the research?

Please note that all the information that I collect about you during the course of the research will be kept strictly confidential. Your name, and other identifying information will not be used in reports or publications of the project.

I will do this by ensuring that:

- Any information collected as part of this research will be will be kept confidential.
- You will not be identify and and any direct quotes used will not be identified.
- In the event of publication interviewees will be given a pseudonym or identified by using a code such as A1 male (age) etc.
- As much as possible any personal identifiers will be removed from the transcripts.
- The personal data on the consent form would be or sstore securely after the data have been processed
- In the market places during observation and go-along pictures will be taken

The results of this research will be presented in reports, academic journal articles and my PhD thesis, but only anonymised information will be included and you will not be identified. Due to the nature of this research, it is likely that other researchers may find the data collected to be useful in answering future research questions. I will ensure that the interview data is not traceable back to you before allowing others to use it. Your name will not be cited without your explicit written permission.

After the research is completed only I (as the lead researcher) will have access to your personal details (such as your consent form) and these will be destroyed after the completion of my PhD.

What if I don't want to take part or I change my mind?

Participation in the study is totally voluntary; you are not required to participate if you do not wish to do so. You are free to withdraw from the study at any time before and during the interview or work-shadowing and you do not have to answer any questions you do not wish to. You have ten days following the completion of the interview or work-shadowing to withdraw from the study simply by contacting me by email, you do not have to give a reason in your email.

Who else is involved in the data collection?

Although I am solely responsibility for the data collection, I will be working with a local field guide who will help me interpreter of the local language. The local field guide will be trained to respect your privacy and will not have access to the any of the information collected from you. At any point in the process - during the interview/work-shadowing or before the interview/work-shadowing, if

you do not feel comfortable with the presence of field guide, you have right to object to the presence of the field guide.

Who has ethically reviewed the project?
The project has received ethics approval from the Department of Geography Ethics Committee at the University of Sheffield

Contact
For any questions regarding the research please contact me, Jonas Cromwell:

Phone: +255768493850
E-mail: jcromwell1@sheffield.ac.uk
Address: Department of Geography, University of Sheffield, Sheffield S10 2TN, UK

Complaints
If you are not satisfied with the way you have been treated as a participant in this research, please feel free to contact my supervisor **Dr Megan Blake**:

Phone: +44 114 222 7978; Email: m.blake@Sheffield.ac.uk
Address: Department of Geography, University of Sheffield, Sheffield S10 2TN, UK

If you feel that your complaint has not been sufficiently addressed, the issue can be escalated to the University of Sheffield's Ethics Committee

Participant Consent Form

Reference number:	

Research project: Food Waste and Recovery in Tanzania Avocado Supply Chains
Name of Researcher: Jonas Cromwell

Please take time to read the following statements: **Please tick if you agree**

I confirm that I have read and understand the information sheet explaining the above project ar have had the opportunity to ask questions about the project. ☐

My questions about the study have been answered to my satisfaction and I understand that I may ask further questions at any point ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, or participate in particular activities, I am free to decline. ☐

I understand that my interview responses and other discussions with the researcher will be kept strictly confidential. I understand that my name will not be linked with the research materials, and every effort will be made to ensure that I cannot be identified from any reports or papers that result from the research. ☐

I agree for the data collected from me to be used in future research. ☐

I agree to take part in the above research project. ☐

Name of participant:	**Signature:**	**Date:**
Name of researcher:	**Signature:**	**Date:**

Copies:
Once this has been signed by all parties the participant will receive a copy of the signed and dated participant consent form and the written information sheet. A copy of the signed and dated consent form should be placed in the project's main record in secured location

Appendix 3.4 Participant information sheet and consent form (Swahili)

The University Of Sheffield.

Department Of Geography.

MRADI WA UPOTEVU WA MAPARACHICHI: TAARIFA ZA MSHIRIKI

Kichwa cha Mradi: **Upotevu na Udhibiti wa Chakula: Utafiti wa ugavi wa maparachichi nchiniTanzania.**

Mwaliko wa kushiriki
Unaalikwa kushiriki katika mradi wangu wa utafiti wa shahada ya uzamifu (PhD) ili uweze kushiriki kutoa maarifa na uelewa wako adimu. Awali, ningependa kukuelewesha juu ya umuhimu wa utafiti huu na utahusisha vitu gani. Tafadhali, naomba uchukue fursa ya kusoma maelezo yafuatayo kwa umakini, na kama ukipenda waweza jadiliana na wenzako. Ni uamuzi wako kushiriki au kutoshiriki. Tafadhali, uwe huru kuniuliza maswali kama hujaelewa au ikiwa wataka maelezo zaidi.

Utangulizi na malengo ya mradi
Duniani kote, sehemu ya tatu ya mazao yote ya chakula kwa ajili ya matumizi ya binadamu yanapotea au kupotea katika ugavi wa chakula. Katika Afrika, sehemu kubwa ya upotevu wa chakula hutokea mashambani, na wakati wa uhifadhi na usambazaji. Wakati juhudi zikiwa zimefanywa ili kuelewa upotevu wa chakula baada ya mavuno, na huwa na lengo la kupima upotevu na sababu zinazotokana na ukosefu wa miundombinu na ufanisi katika mfumo wa chakula. Mradi huu umelenga kuelewa jinsi gani taasisi zilizo na zisizo rasmi zinavyoweka kanuni na taratibu zinazochangia katika upotevu au udhibiti wa ugavi wa maparachichi; na kuchunguza mikakati inayotumiwa na mashirika, vikundi na watu binafsi ili kupunguza, kugawa/kuuza tena au kurejesha mavuno ya ziada ya maparachichi.

Utafiti utafanyika kipindi cha miaka 2 hadi 3 katika mikoa ya Arusha na Kilimanjaro, Tanzania. Nijia za utafiti zitahusisha: mahojiano, uchunguzi na majadiliano ya vikundi. Utafiti huu wa shahada ya uzamifu umefadhiliwa na kituo cha Grantham katika Chuo Kikuu cha Sheffield na Baraza la Utafiti wa Uchumi na Jamii (ESRC) Uingereza.

Kwa nini ninatakiwa kushiriki na ushiriki wangu utahusisha nini?
Umechaguliwa kushiriki katika utafiti huu kwa sababu huenda unajihusisha moja kwa moja au isiwe moja kwa moja katika kipengele chochote cha ugavi wa maparachichi kuanzia kulima, usindikaji, ununuaji, usafirishaji na uuzaji. Nina nia ya kuzungumza na kufanya kazi pamoja na mtu yeyote anayehusika katika ugavi wa maparachichi (moja kwa moja au isiwe moja kwa moja). Ikiwa umeamua kushiriki, tafadhali naomba utoe idhini yako. Tafadhali kumbuka kuwa uko huru kujitoa kwenye utafiti wakati wowote na hakuna madhara mabaya kwako ikiwa utafanya hivyo. Huna haja ya kutoa sababu.

Ingawa hakuna faida za haraka kwako kwa ushiriki wako katika mradi huu, ni matumaini kwamba katika kuendeleza ufahamu wa sababu mbalimbali zinazosababisha upotevu wa au ziada ya chakula; na kuchunguza mikakati ya kupunguza, kurudia kugawa/kuuza au kurejesha ziada katika ugavi wa maparachichi. Utafiti huu utasaidia kuunda sera bora na kuingilia kati au kuboresha sera ili kupunguza athari mbaya za upotevu wa maparachichi kwa muda mrefu.

Unatakiwa ushiriki katika mradi huu kupitia ama:

1. Kushiriki katika mahojiano binafsi
2. Ushiriki wa kina ambao unahusisha kumruhusu mtafiti ashiriki kama wewe (kivuli) kwenye kazi (inaweza kuwa kwenye shamba, sokoni, nyumba ya kufungia/kupakia, wakati wa kusafirisha maparachichi au ofisini), na kuhusika katika mahojiano au majadiliano ya mtu binafsi.

Ikiwa utakubali kushiriki katika mahojiano basi yatachukua kama dakika hadi saa moja. Maswali ya mahojiano yatakuwa ya wazi ambayo yatakuwezesha kutoa majibu ya kina. Mahojiano yatarekodiwa ili niweze kuwa na rekodi sahihi ya mazungumzo. Kuna uwezekano wa kuwa na mahojiano mengine ya kufuatilia ikiwa nitaona kuna kitu cha manufaa katika mazungumzo yetu.
Ikiwa utakubali niwe na wewe wakati unafanya shughuli zako, nitakaa nawe kwa masaa machache au siku nzima, na itategemea na aina ya kazi yako. Nitakubaliana na muda ambao unaona unafaa kwako. Wakati unafanya kazi zako nitakuwa ninachukua maelezo ya kile ninachokiangalia.

Nini kitatokea kwa taarifa zilizokusanywa na je, nitatajwa katika utafiti?Tafadhali kumbuka kwamba habari zote ambazo ninakusanya kuhusu wewe wakati wa utafiti zitahifadhiwa kwa siri. Jina lako, na maelezo mengine yanayokutambulisha wewe hayatatumiwa katika ripoti au machapisho ya mradi huu.
Nitafanya haya kwa kuhakikisha kwamba:

- Taarifa zote ninazokusanya kuhusu wewe wakati wa utafiti zitahifadhiwa siri.
- Washiriki wote watabaki bila kujulikana na nukuu yoyote ile ya moja kwa moja itatumika bila kuonesha utambulisho.
- Katika tukio la wahojiwaji watapewa utambulisho wa bandia au kutambuliwa kwa kutumia namba kama A1 kiume (umri) n.k.
- Vidokezo vyovyote vya utambulisho vitaondolewa kwenye nakala.
- Taarifa binafsi (kama vile fomu ya ridhaa) itahifadhiwa kwa usalama sehemu tofauti na mahali penye taarifa za mahojiano.

Matokeo ya utafiti huu yatatolewa katika ripoti, makala za kitaaluma na andiko langu la shahada ya uzamifu, lakini taarifa zisizo na utambulisho wako ndizo zitaingizwa,hivyo hazitaonesha utambulisho wako. Kutokana na hali ya utafiti huu, inawezekana kwamba watafiti wengine wanaweza ona kuwa taarifa zilizokusanywa ni za muhimu katika kujibu maswali ya tafiti nyingine za baadaye. Nitahakikisha kuwa taarifa za mahojiano hazikutambulishi kabla ya kuruhusu watafiti wengine kuzitumia. Jina lako halitaonyeshwa bila wewe kutoa idhini yako katika maandishi.
Baada ya utafiti kukamilika, mimi tu (kama mtafiti mkuu/kiongozi) nitakuwa na maelezo yako binafsi (kama vile fomu yako ya idhini) na hivi vyote vitaharibiwa baada ya kukamiliza kwa masomo yangu ya shahada ya uzamifu.

Inakuwaje kama sitaki kushiriki au nikibadili mawazo yangu?
Ushiriki katika utafiti huu ni wa hiari; hutahitajika kushiriki ikiwa hutaki kufanya hivyo. Wewe uko huru kujiondoa kwenye utafiti wakati wowote, kabla na wakati wa mahojiano au wakati nikiwa nawe katika kazi zako kama mtendaji kivuli na hutakiwi kujibu maswali yoyote ambayo hujisikii kujibu. Una siku kumi baada ya kumaliza mahojiano au nikiwa nawe kama mtenda kazi-kivuli, hivyo ukitaka

FOMU YA KUKUBALI KUSHIRIKI

Mradi wa utafiti: Upotevu na Udhibiti wa chakula katika ugavi wa maparachichi Tanzania

Name of Researcher: Jonas Cromwell

Jina la mtafiti: Jonas

Kumb Na:

Please take time to read the following statements:

Tafadhali soma maelezo yafuatayo:

Nathibitisha kuwa nimesoma na kuelewa maelezo yaliyoambatanishwa katika karatasi hii yanayoelezea mradi tajwa hapo juu, na ninayo fursa ya kuuliza maswali kuhusu mradi husika. Nimeridhika kuwa maswali yangu kuhusu utafiti yamejibiwa barabara na ninafahamu kuwa naweza uliza maswali zaidi wakati wowote.

Nifahamu kuwa ushiriki wangu ni wa hiari na niko huru kujitoa wakati wowote bila kutoa sababu na bila kuleta athari zozote mabaya. Vilevile, najua kuwa niko huru kukataa kujibu swali lolote au maswali yeyote yale au kukataa kushiriki katika shughuli yeyote ile.

Ninaelewa/ninafahamu kuwa majibu yangu ya usaili na majadiliano mengine niliyofanya na mtafiti yatachukuliwa au kufanywa kuwa ni siri. Ninafahamu kuwa jina langu halitahusishwa na taarifa zozote zile za utafiti, na kila juhudi na tahadhari zote zitachukuliwa kuhakikisha kuwa ushiriki w hautotambulika katika ripoti na makala zitakazotokana na utafiti huu.

Ninakubali taarifa/data nilizotoa zitumike katika tafiti hapo baadaye.

Ninakubali kushiriki katika mradi wa utafiti uliotajwa hapo juu.

Jina la mshiriki:	**Sahihi:**	**Tarehe:**
Jina la mtafiti:	**Sahihi:**	**Tarehe:**

Nakala: *Ikishasahiniwa na pande zote, mshiriki atapatiwa nakala yake iliyosahiniwa.*

Appendix 5.1: Standards and Certification in Export Avocado Production

Standard	*Type of Standard*	*Stage in Supply Chain*	*Areas of coverage within production and processing system*	*Responsibility*
The Global Partnership for Good Agricultural practice (GlobalG.A.P.) [111].	Private: Food safety and quality standard	Production	Global standard – Integrated Farm Assurance Standard (IFA) covers all pre-farmgate production processes. It deals with food safety, traceability, quality assurance, site management (sanitary), soil management, fertiliser application management, integrated pest management, plant protection products (PPP) management, and environmental protection (water & energy use, and pollution control). The current GlobalG.A.P IFA standard (v5.3-GFS) is bench-marked by GFSI[112]. Producers must comply with all 218 Control Points and Compliance Criteria (CPCC) in order to be certified. The CPCC define the requirements for achieving the quality standard required by GlobalG.A.P	All growers must be certified – smallholders and commercial growers in order to export – particularly to the EU market
GlobalGAP Risk Assessment on Social Practice (GRASP)	Private: Social standard	Production & packaging/processing	GRASP is an additional scheme in GlobalG.A.P As a social standard. GRASP assess social practices on the farm, addressing specific aspects of workers' health, safety, and welfare. Although, it is voluntary, increasingly, commercial producers must demonstrate certification to access certain supermarkets	Large commercial growers who employ farmworkers.
Tesco NURTURE	Private Food safety & quality standard	Production and packaging/processing	NURTURE since 2017 has become an add-on module in GlobalG.A.P. certification. The NURTURE Module focuses on the Plant Protection Product List (PPPL) management. The standard deals with food safety – from inputs supply to growing process and management practices (irrigation, fertilisation, and pesticides usage) workers safety, environmental protection, efficient use of water, energy and other natural resources and produce handling - harvesting and packaging and processing.	Large commercial growers and Packaging and processing facilities Required to able to supply to Tesco
Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT)	Public (WTO) Food safety standard	Production & packaging/processing	SPS measures deal with aspects of food safety regulations whiles the TBT are regulatory measures that deal with consumer safety, health, and environmental protection.	All growers – achieved through following GlobalG.A.P guidelines
Phytosanitary regulations set in Council Directive 2000/29/EC, Directive 2019/523	Public (EU) Food safety standard	Production	Maximum Residues levels (MRLs) for pesticides and other contaminants. Member State has specific member MRLs levels	All growers – achieved through following GlobalG.A.P guidelines
UNECE standards for avocado (FFV-42: Avocados -2017)	Public (UNECE)	Packaging / Processing	The standard defines and set the quality criteria for processing and packaging. Determines which avocados qualify to be marketed in terms	Packaging and processing facilities

[111] Since 2017, Tesco NURTURE programme has be integrated into GlobalG.A.P. as add-on module in the audit process. See https://www.globalgap.org/uk_en/for-producers/globalg.a.p.-add-on/nurture-module/

[112] GFSI was initiated in 2000 by group of international retailers, the aim is to ensure to consumer protection and confidence. They set requirement for food safety and to improve efficiency and reduce transactional cost in supply chains (Fuchs et al., 2009)

	Food quality standard		of size criteria, appearance and labelling requirements and therefore act as critical criteria used by packhouses for grading avocados.	
The Codex Alimentarius Commission (CODEX). Codex standard for avocados (CXS 197-1995	Pubic (FAO & WHO) Food safety and quality standard	Production & packaging/processing	This is a voluntary international standard that provides guidelines and standards within which countries can set their standards. Codex general standards, guidelines and codes of practice apply to food hygiene and contaminants and food additives. The specific commodity product or food standards covers pesticides residues (MRLs), labelling and export inspection certificate (phytosanitary certificate). The standard for avocado covers labelling, size classification, appearance, and phytosanitary requirements.	Growers – achieved through GlobalG.A.P. certification schemes. Packhouses and processing facilities
British Retail Consortium Global Standards for Food Safety (BRCGS)	Private: Food safety standard	Packaging/processing, and labelling, storage, and distribution	Food safety and quality schemes, product, and process management – packaging facilities and personal hygiene of personnel. Covers packaging and consumer standards. But expanding requirements for the environmental monitoring and development of a security system for food safety. The standard also bench-mark the Global Food Safety Initiative (GFSI)	Packaging and processing facilities
Albert Heijn Protocol (AH)	Private independent scheme: Food safety & quality and social standard	Production & packaging/processing	To provide additional quality and safety assurance to consumers. Deals with traceability and pesticides use to ensure Maximum Residues Levels or standard (MRL) set by the EU and Dutch legislation are met. Involves produce sampling and testing system that ensure standards are met (MRL test). It is an add-on module in GlobalG.A.P.	Large commercial farms and packaging/processing facilities. Needed in order to supply Albert Heijn supermarkets & retail chains
Sedex Members Ethical Trade Audit (SMETA)	Private: Social standard	Production and packaging/processing	SMETA is social standards that deals with workers welfare – pay, holidays, management systems and practices, contracts, avenues for dealing with complains and redress and health and safety.	Large commercial farms and packaging/processing facilities. Needed to access specific markets - supermarkets & retail chains
Hazard Analysis and Critical Control Point (HACCP)		Production, packaging/processing	HACCP is a safety management system that underwrites all food safety and quality standards and certification schemes. It is an approach for identifying and providing options to deal with hazards that is fundamental to modern food safety work. All food safety and quality standards at all stages of the food supply chain embed HACCP system and principle as part of the certification process.	Packaging and processing facilities. They must have Good Manufacturing practices system established as a foundation for development and implementation of successful HACCP plan

Appendix 5.2 Extract from the contract and growing manual for smallholder farmers

Farmer's obligation	*Company's obligation*	*Guidelines and instructions from growing manual*
Planting: • The farmer will plant and cultivate the HASS species seedlings of avocado only. • Farmers will be required to purchase Hass seedlings for planting from the Company • The farmer will be responsible for surveying his/her land, digging holes, planting seedlings, weeding, mulching, watering/irrigating, harvesting, pruning**,** or removing branches and covering labour costs. **Irrigating/Watering:** • The farmer will follow or adhere to advise and instructions from the Company or chairman on when which time and the amount of water required for irrigation. • Dirty and wastewater should not be used for irrigation. **Chemicals/Fertilisers** • The farmer is NOT allowed to use any chemicals or pesticides on trees or avocado fruits and any other plants found within 5 meters from the avocado tree with fruits without a written permit from the Company. • The farmer will use fertiliser by complying strictly with the standards set by the Company.	**Seedlings:** • The Company shall make available Hass seedlings to farmers. **Training and other services** • The Company shall provide training on to prepare farms/fields, planting, irrigation, after-care, pest/disease control, harvesting. Such training will be held in selected locations in each district. • The Company shall provide training in Health and Safety, Hygiene and Emergency action. • The Company shall provide training and guidance and supervision concerning GlobalG.A.P certification standards and requirements. • The Company shall make available at all times the GlobalG.A.P standards at their premises to the farmers • The Company, from time to time, may introduce any other standard/s as required by the market.	**Land preparation and planting:** • Do not plant in shade • Intercropping with maize should be 2 meters, and banana should be 4 meters from the avocado tree • The soil Must be free from waterlogging • The hole should be 1msq for easy root penetration and not round hole • Use compost manure 1 'debe' per hole and should be mixing with the topsoil • Water the hole one day before planting and build up the soil to make a mound at the bottom of the tree to allow for free drainage • Cut the roots 1 inch from the bottom of the pot to remove the ben roots • Do not create "dish" around the tree otherwise the water will collect there and encourage fungus to attack the roots **Irrigating/watering:** • Only use water from a source which has been tested in a laboratory to make sure that there are no harmful bacteria in it. • Make sure the water does not splash the fruit, pour it slowly only to the soil • Irrigate 20 litres for young seedlings per week (10 litres twice per week); for mature trees irrigate with fruits 40-50 litres a week – 20 litres twice per week depending on the soil condition. • The irrigated soil should be moist, not wet • Do not irrigate with large amounts of water for compensating pervious unirrigated days • Proper irrigation is most important after the fruits have formed because it minimises the dropping of fruits **Pesticides/chemicals use** • Do not apply any pesticides to the export avocados. Unauthorised use of pesticides on the farm can lead to all avocados exported from Tanzania being banned for export • Do not apply pesticides to any other crop which is less than 5m from the avocado tree because the spray droplets can be carried in the air **Organic fertiliser use (Manure)**

• If the farmer does not follow and violate any of the articles above, the Company will hold all payments to the farmer. • If fruits indicate any chemical or poisonous substance that is not permitted by the Tanzanian government**, the penalty will be issued as specified in the sanctions section.**	• The Company will ensure that farmers adhere to global quality standards.	• Farmers are to use only organic fertiliser, mainly compost and farmyard manure. It should be well decomposed for at least 4 months to ensure harmful bacteria have been destroyed and it does not damage the tree. • Cow manure should not be applied to young trees and compost, and livestock manure must be stored at least 25m from open water courses to prevent contamination of the water. **Mulching** • Make sure there is always mulch around the tree and must be 30cm from the stem to prevent the stem from becoming wet which can then cause disease • Chop the mulch into small pieces especially when using banana leaves maize residues **Weeding** • Weed between the avocado trees • Using a hand hoe will destroy the feeder roots around the tree hence affecting the growth rate of the plant, so do not use hand hoes **Keeping records** • Keep a record of every activity that you do to the tree – irrigation, organic fertiliser, scouting • Make a record of the amount of water you have applied to which trees and on what date **Hygiene** • Put running water and soap near the toilet or by the entrance to the harvest area.

Contract Instructions:

- The farmer accepts to follow instructions given by Company technical staff in respect of when and how to carry out all operations. Also, the Chairperson of the Association may be given additional instructions by Company on matters concerning the planting, growing**,** and harvesting of the avocado trees. The Chairperson will issue these instructions to the farmer from time to time, and the farmer shall follow these instructions.
- The farmer agrees to comply with the requirements of the GlobalG.A.P Standard.
- This includes but is not limited to compliance with the Company's documented procedures and policies.
- The farmer agrees to comply with occupational safety and health legislation and relevant certification requirement, and not to place at risk his health and safety or the health and safety of any other person.

Contract Sanctions

- If a GlobalG.A.P non-conformance is detected, or the Association's rules are not followed within any GlobalG.A.P registered farm, all fruit from the Association will be subject to the sanctions applied per the GlobalG.A.P standard, General Regulations Part 1.

- The sanctions may result in the suspension of all product supplied by the Association being allowed to use the GlobalG.A.P certificate until the non-conformity is resolved, and may even result in complete cancellation of the GlobalG.A.P certificate for the Association. This may result in all fruit produced by the Association being rejected by the Company.
- The sanction may also apply if the external auditor from a Certified Body identified a non-conformance is adhered to by the producer or Association for the period given. This may result in all fruits being rejected by the Company for 12 months

Appendix 6.1 Anastasia's green-skinned avocados

Box 6.3: Anastazia's green-skinned avocados

Anastazia was the third farmer we were harvesting event with local brokers Mama Abba (Box 6.1). It was around mid-day when we arrived at her farm (18th June 2018). Mama Abba had already gone ahead of us to negotiate the price with Anastazia, while myself, my field assistance and the pickers packed the avocados we have harvested on the second farm. Myself and my field assistant introduced ourselves and explained to Anastazia the research and why we have come with Mama Abba. She showed us avocados that has dropped by itself from the trees. About 100pcs of fruits from 3 different varieties (see image A below). She pointed to one of the avocados (and show us where tree is located on the farm), this avocado is creamer and have good taste among the three varieties. But it is dark green-skinned, and do not change colour when it is ripened. Mama Abba is not buying this avocado because of its skin colour. However, the fruits are matured and have started to drop.

As we started harvesting the other two trees, I subtly, I asked Mama Abba, if we were going to harvest the tree Anastazia has complained to me about. She took 3 types of avocados and asked me if I was in the market and did not know anything about avocados which one would I buy? I pointed to the dark green skinned and said if I know that has good taste, I will buy it. She shakes her head and she said to me "the customer who buys the avocado in Dar es salaam, look at the appearance of the fruit. if the avocado has good appearance, it does not matter the taste, consumer will buy it. Those consumers do not care about the taste".

I wanted to see what would happen to Anastazia's green-skinned avocados. I visited her again in 6 weeks (12 August 2018), she had managed to sell the avocados a week before my visit. Just managed to sell because it was low supply season but she "loss a lot of the fruits" she tells me. Similar to Anastazia's case, in another harvesting event (in Siha district on 15th June 2018), we had just finished harvesting from a farmer, and the neighbour called out to the brokers to buy his avocados. But the brokers' response was: "We have seen those fruits, they are terrible, we will not buy because the avocados are watery and do not change colour when it is ripened".

Image A show three varieties of avocados on Anastazia's farm. Arrow points to green-skinned variety.

Harvesting event (Field Journal, 2018)

Appendix 6.2 Power relations at rural-urban market

Box 6.5
Power relations between wholesale buyers and local brokers

It was Tuesday morning…, I had accompanied two local brokers (Mama Denise and Mama Ericka) whom I was 'following', to harvest avocados on Monday for Tuesday market in Sanya Juu. They had already taken orders from the wholesale buyer (John), whom they have a longstanding trading relationship with. John buys avocados from Sanya Juu market and transport to Dodoma. I arrived at market at 10:00 for general observations, and to see how the Mama Denise and Ericka would sell the avocados we had harvested on Monday. When we arrived at Sanya juu, the brokers have not arrived yet….; but trading has started, and the market was busy and bustling. Heaps of avocados covered almost the open space along the main road. I decided to work John (the buyer) and other local brokers to help with sorting and packing, while we waited for Mama Denise and Ericka.

It is 2 pm, they have still not arrived at the market. We give them a call; they have challenges with the pick-up truck; there are a breakdown and need fixing! As we work with John, he whispered to us, "I am waiting for three brokers; any broker who comes late, I will only "buy the quality avocados - bigger size and good quality". And "if the broker doesn't have good avocados, I will not buy it at all". The three brokers included Mama Denise and Ericka.

Just as he was speaking, a pick-up truck approach the market loaded with avocados, could it be Mama Denise and Ericka, but no, is a different broker (she is among the three brokers John was waiting on). The broker had good fruits; it seems it has just been harvested, and the sizes are big too. John rushed towards the broker; I am buying your fruits. Price negotiated deal is done! John ordered the packers to pack the avocados; there was minimal sorting or grading because of the fruit sizes. It was getting late, around 5 pm, we give Mama Denise and Mama Ericka a call, we are on our way coming, they arrived at the market about 6 pm in with pick-up truck full of avocados. We quickly off-loaded all the avocados and started sorting and repacking. John bought only 6 sack bags (4 from Mama Denise and 2 from Ericka). I could see exhaustion and disappointment on their faces as they grumble over what to do with the rest of avocados. They were both left with five bags of avocados. As for the third broker, there was more disappointment, as John didn't buy any of her fruits, although he had placed an order for them. Not only her, but there were other local brokers whose avocados, John did not buy it does not meet his criteria. John assured them he will speak with another wholesale buyer from Dar es Salaam was coming to the Wednesday market (next day).

As I left the market at 7 pm, I was wondering what would happen to all these avocados….? Keen to see what would happen to the avocados I was following, visited the market again the next day

(Field Journal, 2018)

Appendix 6.3: Sorting and grading at Wholesale market in Dar

Box 6.6

Sorting and grading at Ilala Boma Wholesale/Retail market Dar es Salaam

We (myself and research assistant) are in the indoor portion of Dar es Salaam's Ilala Boma market, standing in the front of the stall of the avocado agent *('Dalali'*) - trader. I could smell avocados –ripe, spoiled and unripe and fruity smell lingers in the air. Ilala Boma is one of the six major avocado markets in Dar (Mwakalinga, 2014). The central portion of the market is a vast open space roof with corrugated iron sheets. Traders, located in the main central part of the market, has a dedicated stall / tablelike (*Kizima*) – some made of concrete slabs and others made of wooden tables. Beneath the concrete or wooden stall is space for storing goods. Outside the main central part of the market, traders trade under makeshift stalls with polytene coverings to provide shade from the scorching sun and rain.

Others conduct their business in the open space. The avocados are displayed on top of the tablelike concrete and wooden stalls and some on the bare floor. The market floor is hectic and noisy. We can hardly hear, as vendors and traders shout out and haggle for potential buyers and advertise their foodstuff. The agent whose stall we stood by, has just taken delivery of avocados from Rombo, Kilimanjaro. He has been in business for 16 years. He brakes one avocado. To do what? To check if it is matured. As the porters off-load the bags of avocados from the waiting truck and ferry it to the stall, he was busy unpacking and sorting. He first sorts the avocado into two categories – based on colour change (blackening) and firmness (ripening).

Avocados that are still green and firm are stored under or behind the stall to start the ripening process. Those that have changed colour and started ripening are sorted into six categories according to size and selling price (from biggest to smallest size - 700 TZS, 600 TZS, 500 TZS, 400 TZS, 300 TZS, 200 TZS per fruit) and displayed to buyers. He must sell these fruits before it crosses the contingent borderline, where because of its firmness may be deemed valueless. As he sorted, there some fruits that looked soft and 'mashy'. He puts them aside. They are overripened! Have crossed the line of acceptable firmness. What are you going to do with these? "If there are no buyers, I take it to the dump". The 'dump' located at centre left towards the main exit of the market seems to be where the avocados journey will end! As we interacted and helped with sorting, a lightly build woman comes. She is a retailer. She looks at the appearance and sizes; she picks only large size avocados and fills two baskets. Why did she buy only bigger sizes? Maybe she sells in an expensive area or neighbourhood, and therefore consumers prefer bigger sizes regardless of the price. Here in the market like other markets, the agents sell to retailers, hoteliers, and restaurants, street vendors and consumers.
(*Excerpt of a Field Journal, 2018).*

Appendix 6.4: Sample Cases of how Trust in the 'credit system' leads to exploitation

Mohammed: case 1	***Mama Mary: case 2***
Mohammed, a wholesale buyer, is in his late 40s, has been in the avocado business for 15 years. He buys avocados mainly from Mamsera market and supply to six different agents in Dar es Salaam markets. He usually conducts his business on the phone and occasionally visits the agents in Dar es Salaam. Mohammed faces many challenges in the trade, one of his greatest challenge**s**, is "when the avocado does not get ripe; that means I will not get any money at all from the agents, not even the money used to buy the avocado". Sometimes, I go to Dar es Salaam to check why the agents are not sending me money, and I find that there are many avocados that the agents are not able to sell. As someone who understands the business, I can see why the agents have not to pay me. However, the most challenging of all, which concern me much, is when the agents are not "faithful or trustworthy". When you send them the cargo, they run away with your money. I sent avocado to one agent in 2017, about 1.6 million TZS (appx. 700 USD) worth of avocado, and he ran away with the money. Recently, on one of my visits to Dar es Salaam with cargo, when I had finished off-loading the avocados from the truck, I went to stay in a guesthouse. I was standing outside the guesthouse, and I saw the agent whom I gave avocados and did not pay me in a coffee bar. He was sitting down happily, drinking coffee with friends. I did not want to drink coffee at that time, but I went there to drink coffee to make sure he was the man owing me the man. When I approached him, he told me that at that time he was having problems and he paid me 1.3 million TZS. *Excerpt from interview PTK_WS_0070, 2018*	Mama Mary is a wholesale buyer in her early 50s, she has been in the avocados since 2016 and buys avocados from Mwika market, Moshi Rural. Like Mohammed, Mama Mary buys avocados and transport it to the agents in Dar es Salaam. The most difficult challenge, in this business, is she send avocados to the agents and does not ripe, or it is too overripened and does not have a market anymore. That is the challenge because I will not get money or capital back; it is a loss. In the last two years, I have lost 540,000 TZS (230 USD). The agent was trading in Mabibo, Dar es salaam, I send avocados to him avocados twice a week (Tuesday and Friday) to him. If I send maybe 300,000 TZS worth of avocados, he will send me 200,000 TZS and say that I have not finished selling them. Then, I send another cargo perhaps 180,000, and send maybe 100,000 and say the avocados have not ripe. He continued to tell me the avocados did not ripen every time I sent cargo to him. He will send me a small amount until the amounts he owed me reach 540,000 TZS. Before I realised, I have lost my trading capital, so I stopped sending avocados to him. However, he still insisted that I should continue to send him avocados. I just considered him to be a thief, because even if the first avocados did not ripe, it could not be true, for all avocados that I sent to him. I call him several times, but he lied to me that he will send the money until today. The last time I communicated with was March this year (2018), he sent 20,000 and ran away with the rest of the money. The challenge is that the traders we sell the avocados to are not trustworthy that is the most challenging thing in this business. *Excerpt from interview PTK_WS_002, 2018*

Mama Regina: case 3	***Mama Patrick: case 4***
Mama Regina is in her 50s and has been in the business for 16 years. She started as a wholesaler, with her husband, they buy avocados from Sanya Jun market, and her husband takes it to Dar es Salaam and sell to agents and other traders. As they were new in the business, some traders conspired to take advantage of the situation as she explained to me "Some of the traders talk to the wholesalers in Dar Salaam that this is a new person who have brought the avocados he does not know anything". Therefore, the traders/agents in Dar es Salaam will collect the avocado on credit and send a little to him to pay the farmers and the brokers, and the transport cost, but not our profit. That continued for some time; we lost about 2.5 million TZS (1077 USD), so we decided, we must stop because it is not profitable for us. After losing our trading capital, I decided that I would continue to buy from the farm and sell at the local market to other wholesalers. Because when I sell in the local wholesale market as a local broker, I will get my trading capital and a small profit, although, is more profitable when you take the avocados to Dar es Salaam. However, even buying from the farmers and selling at the local wholesale market has its challenges also, especially when you bring the avocado to the market and get many rejects *Excerpt from interview PTK_LB_0064, 2018.*	Mama Patrick is a local broker and sells at Mamsera market. This business is very challenging. I have been tricked many times by some wholesale buyers from Dar es Salaam. Not me alone but many traders like myself. In 2016, I brought avocados to the market; the wholesale buyer bought the avocados, packed everything. It was about 350,000 TZS (150 USD). He did not tell me that he did not have money. He waited until we have loaded it into the truck, and I asked for my money, and he said wait someone is sending me money. I waited until it reaches 6:00 pm and he gave me 100,000, and he told you to go home I will send you the rest of the money when I get to Dar es Salaam. What will I do with avocados that are already packed? It was already 6 pm, off-loading the avocados from a truck and unpacking it will take time. Even if I take the avocado back, who will buy and whom I am going to sell to (*mali kuoza*)? It is perishable! I cannot wait until the next market day in 3 days; I just allowed him to take the avocados hoping that the next market I will get my money. At the next market, it was the same story again. I waited until I was hopeless (*kukata tama*). Then I reported him to the police station, he was called, and he argued that the avocados that I sold him were very bad, the avocados did not get ripe. He paid me 150,000 and the remaining balance he never paid. I never trust the police because usually the person owing you will bride them and they will not pay the balance. You do not have anyone to defend you. *Excerpt from interview PTK_LB_004-006, 2018*

Appendix 7.1: Advantages and disadvantages of mode of selling relations

	Selling relation mode 1: contract out-grower scheme		***Selling relation mode 2: Non-contracted farmer association/cooperative***		***Selling relation mode 3: cooperative /associations act as the marketing agent***		***Selling relation mode 4: Side-selling (spot buying relations)***	
	Pros	***Cons***	***Pros***	***Cons***	***Pros***	***Cons***	***Pros***	***Cons***
Farmers' risks	Shared risks between the out-growers and the exporter (processing & marketing) ***** Assurance/ security to sell respective of market conditions. Minimum price guarantees Secure and reliable buyer Access to new markets	Manipulation (of grading standards, prices, and high rejections) Arbitrarily raises quality requirements. High losses due to contract sanctions* Dependency on one buyer High reliance on exporter's harvesting schedule Lack of harvesting decision. Limited options to sell to other buyers. Control and monopoly over selling relation Price disparity and differentiation*	No shared risks. The flexibility of marketing decision (choice of any of the approved buyers by the farmer group). Flexibility to harvest/sell anytime. Reliable and secure buyers. Reduced losses due to the ability to sell to more than one buyer in a season (based on quality/ fruit sizes).	Sanctions if farmer breaks groups rules.	Shared risks (marketing produce) The flexibility of marketing decision (of choice of buyers offering better price). Increased market access -internal/ external. Access to new buyers/markets. Control over the harvesting decisions.	Members must sell through the cooperative. External buyers may not be reliable (brokers). High dependency on cooperative to get a buyer/No flexibility to choose a buyer. High rejections at the farm due to lack of monitoring of buyers' activities**+** Smallholders located in remote areas may not get buyers on time**+** Favouritism in the selection of farmers for buyers**+** Larger farmers may dominate/internal power relations**+**	No shared risks. Flexibility to harvest/sell anytime. The flexibility of choice of a buyer. No membership fees.	High level of rejections. Low market assurance due to unreliable buyers* High losses due to contract sanctions* Risk of buyers running away without paying the farmer.

Farmers' income	Increase income through quality improvement.	Lack of transparency in pricing/cost deductions. No access to price information before harvesting/selling*. Limited/No bargaining power. Late/delayed payment (3-5 months) *. Low price paid to the farmer due to costs deductions and shared profits*.	Increase of bargaining power with buyers. Increase income due to higher prices. Freedom to sell to the buyer offering a higher price. Prompt payment (1-2 weeks wait).	Mandatory entrance and annual membership fees. Reduced income due to mandatory deductions (3%-6% of the price per every kg sold)	Increase of bargaining power with buyers. Improve income due to higher prices. Market access. The price information is known before harvesting/selling Prompt payment (before harvest)	Mandatory membership fees[113]. Reduced income due to mandatory deductions (3%-6% of the price per every kg sold).	Increase bargaining power with the buyer. Improve income due to higher prices. Perceived low levels of rejections compared to selling to contracted buyer* Prompt payment (at the time harvesting)	Loss of income if the farmer fails to get a buyer.
Production efficiency	Provision of capacity building measures (training, support & advice) Increase awareness of production, safety, and quality requirement. Provision of inputs credit/loans**+**	Control over the production system*	Access to free technical training support and advice provider by different buyers. Access to inputs and financial services.	Lack of financial resources and expertise limits the cooperative functions. Generally high rejections due to poor quality fruits	Improved access to capacity building measures through external support. Access to inputs and financial services. Improve production of quality avocado fruits that can	External support causes dependency. Lack of financial resources and expertise limits the cooperative/ association functions. Generally high rejections due to poor quality fruits	The farmer may still have access to free training support and advice provided by other buyers**^**	

[113] MBEAFA - Entrance fees of 10,000 TZS and a member should buy five (5) shares, each share is equivalent to 20,000 TZS (100,000 TZS). NAFN – Annual membership fee of 13,800 TZS. UWAMARU AMCOS – Entrance fee of 20,000 TZS and membership share of 10 shares at cost 10,000 per share (100,000 TZS). * Denote issues prevalent in the northern highlands. ^ denote issues specific to the Southern highlands. + represent issues unique to Njombe Avocado Farmers Network (NAFN).

			meet market standards.	
Value chain efficiency	Aggregation of production. Provision of infrastructure (e.g., storage and cooling facilities). Value-adding and marketing activities.	Aggregation of production and provision of infrastructure (e.g., storage and cooling facilities) by buyers	Aggregation of production. Plans for future joint investments in infrastructure (offices, storage, and cold room facilities). Joint investments in value-adding and marketing	Lack of financial resources and expertise limits the cooperative functions.

Appendix 7.2 Resistance against exporters power and control

Box 1 Resistance against monopsony power: A large-scale farmer turned a broker

Mr Nko (age 60) is a large-scale avocado farmer, owns over 1,300 trees on a 42 acres orchard located at the foot of Mount Meru in Bangata village - an administrative ward in the Arumeru district - Arusha. He is the ward councillor and runs a tour operator business alongside his farming. Nko started growing avocados in 2012, before, he was growing vegetables for export and a greater portion of his 42 acres land was used for timber plantation. He tells me: "the time and cost involve in growing vegetables is too much and the return is very low; even with the timber it takes 10-15 years to mature, and a matured timber can only earn you 50, 000 TZS (approx. 21.57 USD). As an export farmer, he saw opportunity in growing export avocados, and he joined Africado ltd contracted outgrower scheme.

In the first year of harvest, 2.5 tonnes from the first 230 trees planted in 2012; that increase to 5 tonnes in the second harvest and 8 tonnes in the third harvest (2017). Convinced by the increase yield and returns on investments, he decided to increase the number of avocado trees but did not have money to buy the seedlings: "I went to the company and asked them, I have an area I want to plant more avocados, they were like, ok, but we are not going to borrow you the seedlings. I did not have money, look we are in November, and you are harvesting in April, what is the big deal? Eh, give me the seedlings and deduct the cost from my sales when you harvest". As one of Africado's promising farmers', he was paid higher price per kilo compared to other smallholders, to motivate him because potential to become a large-scale farmer (section 7.5). However, he was not happy with the company's mode of operations and expressed dissatisfaction with lack of transparency in pricing system, long wait before payment and how rejects and grading is done. Discontented by these issues, in 2018, he decided to breach his contract with Africado:

> *"Before Africado came around to assess the fruit maturity and estimate my harvest, I had some Kenyans brokers, who were coming around to convince me to sell to them. So, when the Africado refused to advance me the money [….], I decided to sell to the Kenyans. The price was good, they offered me 1,500 TZS [0.65 USD] per kg, whereas with Africado, the highest price I could get would have been 1,200 TZS [0.52 USD] per kg. The good thing is that with the brokers, it is down payment before they harvest. I wanted this money! So, I decided to swallow the baits and face the conditions [that comes with breaching the] contract. Because, if you sell your fruits to another buyer, they remove you from their list [contract]. I said OK, let it come, I will bear that risk'.*

Prepared for the risks, he sold 9 tonnes of his fruits to the Kenyan brokers, but only matured and big fruits were picked leaving him with an estimated 4 tonnes of fruits on the tress (which be ready in June).

The brokers promised to come back in June to harvest the remaining fruits, but did not turn up and Africado would not harvest the remaining fruits because of contract sanctions:

"I had a bit of losses because of over-matured fruits, once the fruits change colour, you cannot export it; that one, I agree. But I was smart enough, that I had my money before Africado started harvesting [in the area]"

Faced with losses of about 4 tonnes, Nko, did not give up, he started his own nursery and in 2018 distributed over 2000 seedlings to other farmers. By creating a cluster of farmers, Nko, believes they will "become stronger" and in the future they will have an advantage, able to negotiate for better prices with brokers and the village is closer to Kenya [4-5hour drive] were there are many exporters. Haven build network with buyers in Kenya, in 2019, Nko, started buying from other farmers, as off-taker and selling to the Kenyan brokers. In 2019, he harvested 16 tonnes in May (main season) and about 5 tonnes in December (off-season). But for three years that he had contract with Africado, he could not sell his off-season fruits because the company would not harvest from farmers due to high transactional cost. In his first year as off-taker, he bought between 35 - 40 tonnes from other farmers in addition to 21 tonnes from his farm. The Kenyan brokers have built a charcoal cooling storage house to help store the avocado before transporting to Kenya for processing.

As he had anticipated, in 2019, Africado sent a field officer to negotiate with him. He welcomed the opportunity; but "demanded to know the offer price in advance and the terms of payment". A demand, Africado was not prepared to yield too. His 'off-taker' activity is booming, and more farmers are side-selling to him because of good price and prompt payment. A phenomenon which has gaining traction among discontented farmers in the NH.
Nko, has expanded his avocado nursery and is expecting to be harvesting over 80 tonnes a year from his farm when all 1,300 trees mature.

Excerpts from interviews, and conversations with Nko. I followed Nko for three years (2018-2020) [PTA_EFLS_0139/0163/0227]

Appendix 7.3: Materiality, harvesting decision and farm losses/waste

Box 7.1: Fruit maturity, harvesting decision dilemma, losses, and waste: Perspective from Exporter

In Rungwe district, we have an excellent harvesting window [April -June] that is when the fruits are mature, but we have a high level of rejects on the farms. The rejects come from three core areas: the first one is false cold mould (FCM), FCM contributes to 30% of the rejects, the second one is fungi diseases which accounts for another 30%, and the third is sunburn which causes another 30% of rejects. So, these three are the significant issues that farmers loss a lot of their crop on. We are in a very high humid environment; what we have observed is that from February-March, it is very dry, so the prevalence of diseases is less, which means the rejects is very minimum if we harvest. But the fruits are not yet matured; once you go into April, the fruits are starting to mature, and it is almost ready to harvest. However, because of the high humidity in April – June – is the rainy season and in this place, it literally pours 24 hours a day, 7 days a week. We do not see the sun, you cannot harvest avocados under those conditions and pest infestation also increased drastically. So, once you start to harvest from April or May into June, you get huge losses due to rejects. Between 2013 - 2017, we were harvesting in May, and on average, 50% of fruits harvested from the out-growers was being rejected. Then, in 2018-2019, we decided to harvest a bit earlier; we started harvesting in February and harvested 90% of the fruits. But we ran into other problems; the quality [fruit maturity] was not yet ready for the market. The fruits left the packhouse in a nice and good, hard, firm, perfect green condition. But when it arrived on the market, the internal quality was not good, leading to losses and waste at markets. So is a dilemma; if we harvest early in February, we will minimise losses at the farm and packhouse, but you have losses at the market due to poor quality. Fortunately, our buyers accepted the fruits, but the margins that we got was so bad, we made losses rather than marking profit. Now, some of the markets [buyers] have said to us next year don't send out-grower fruits to us, others are saying let discuss how we are going to manage next year fruits. That is the challenge we are going through - how do we balance harvesting under those conditions, get the quality right and supply it on the right window of the market? So, we are trying to see how we balance [reduce losses and waste] between late harvesting and early harvesting. We are still planning, and we are projecting that in 2020, instead of harvesting in Feb, we monitor maturity level and move the harvesting time to mid-March and beginning of April, so we try and balance the two forces together. So that is our projection going forward.

Interview with a Technical Manager of Large Avocado Company, 26/7/2019.

Box 7.2: Materiality, harvesting decision and losses and waste: A case of commercial grower

It was a bright and sunny day on the 13th of August 2018, and I set out early in the morning around 8 am from the small town of Njia Panda outside the city of Moshi to Usa River, the district capital of Meru District, some 23km east of the city of Arusha for harvesting observation event. I arrived around 10 am at Usa River estate, a former coffee estate converted into an avocado orchard since 2009. The over 70 hectares avocado orchard is set at the foot of the Mountain Meru and has a mixture of matured trees – 32 hectares of typical Hass variety – which are over 8 years old and 30 hectares of young trees (2-3 years old) of 'Hass - Carmen' variety (early maturity variety – fruits matures' in March/April). As the farm is set in lowlands, the standard Hass variety reaches optimal maturity in May and is picked over two months (May-early July). However, in 2018, because of the lower prices in the EU market, the exporter delayed harvesting for almost two months, and the fruits were picked between July and August, which caused huge losses and waste. As I observed the pickers and participated in the picking myself, the fruits were over-matured, started ripening, and many fruits had already dropped to the ground. Even fruits that looked 'perfect green', the kind of quality appearance required by the market - the stalk easily popped off/snapped while picking or cutting the stalk -resulting in rejections at the farm before grading at the packhouse.

After initial sorting and grading on the farm, 193 crates (approx. 2,800 kg) was delivered to the packhouse for processing. Of this, 1,905 kg was graded as first grade – of exportable quality; the remaining 896 kg (representing 32%) was graded as second grade (rejects) mainly due to over maturity or blackening of fruits. This was aside rejections on the farm, which was about 10% (280 kg) of what we had harvested. However, if the fruits were picked at the optimal harvesting time, the rejects at the packhouse would be between 15-17 %, according to the farm manager and the field officer from the export company supervising the harvesting. Therefore, the farm manager reckoned that "delaying the harvest alone, resulted in over 2 tonnes of rejects on the farm. Conversations with the packhouse manager and field officers of the export company revealed that in 2018, due to delayed harvesting, rejects at the packhouse for commercial growers doubled to about 30% over previous years. This means that for Usa River estate, this represents 72 tonnes of rejects, as its exported 240 tonnes quality fruits in the crop year, thus approximately over 74 tonnes of losses and waste including farmgate rejects.

Exporters' decision to delay harvesting leads to losses, but total dependence on one exporter presents risks and vulnerabilities to even contracted larger commercial growers like Usa River. The next day, I returned to the orchard for a second harvesting observation; it was the last day of fruit picking. As we were harvesting, the field officer from the export company (inspecting the process) received a call from the office around noon. "We should stop picking, and the truck transporting the fruit must leave the farm within an hour to get to the packhouse by 3 pm for processing and grading of the fruits". The fruit was needed to fill a container that had to leave the packhouse by 6 pm to Mombasa harbour, Nairobi, Kenya. We had not finished picking from the block we were harvesting; there were still good quality fruits on the trees. I asked the farm manager what was going to happen to the remaining fruits? He commented: "the remaining fruits would be for the birds and the animals [squirrels]; we will pick whatever remains when we are pruning the tree. If the fruits are still good, I will put it in a small truck and send it to the packhouse". Nevertheless, with the fruits already blackening, unharvested fruits become wasted, as a later conversation with the farm manager pointed out.

Excerpts from field note – harvesting observations 13th -14th August 2018; & follow-up conversations in April 2019.

Box 7.3: Materiality, harvesting decision and food losses and waste – contracted smallholder avocado grower

It was Wednesday (8th Aug 2018), I arrived at Mama Niki's farm around 9:30 am. Niki, a widow, in her late 60s (around 68), is a retired social worker, and highly educated. I had arranged with the field officer I was 'following' to spend the day helping Mama Niki (to observe and help with harvesting). She lives on 8 acres farm in the lowlands area of Hai district, Kilimanjaro. Five acres of the estate is avocado orchard with over 500 trees – under five years old at the time of fieldwork. It was her second year of harvest. Due to her location, the fruit mature early, and the optimal picking time is late April. But we are harvesting in August, a delay of over two months.

We started picking around 11am, the fruits were overmatured, blackened, poorly shaped and have started ripening. The fruits do not meet the required maturity and quality standard for export. all I was seeing was rejections and wondered how these fruits would go through the packhouse grading? I could not tell mama Niki that the fruits would not pass grading at the packhouse. Am I becoming an expert? Based on what I have observed at the packhouse in the previous week and harvesting observations with other smallholders in the highlands, none of the fruits I was picking qualified to go through the grading at the packhouse. It would be classed straightway as rejects. Some of the fruits I had witnessed graded as rejects on the packing lines had a better appearance than what I was harvesting. By 2 pm, we had finished picking the fruits - 37 crates in total (approx. 750 kg). After initial sorting at the farm, we rejected 5 crates – 100 kg, about 14.2% of the total harvest – which is higher than farmgate rejections in the highlands – the impact of elevation and climate. We packed the 650 kg (32 crates) into Mama Niki pickup truck, the driver and Swai (labourer) sent it to the packhouse at 5 pm, and I left the farm, a day of hard work in the scorching sun.

Not surprising, I received series of text messages from Mama Niki around 10 pm. It was about what had transpired at the packhouse when the fruit was delivered.

Captioned "Live example":

"[..] When Swai took the fruits to the packhouse, the manager was very rude, and he even did not want to weigh the fruits. He harshly remarked [..], 'these fruits are overripened, they are not good!'. I do not know how many of the fruits were graded and how many were rejects. Last night, the packhouse manager showed Swai a sample of fruit needed at the packhouse – 'very green and hard' [firm]. He told him this is how you bring your fruits to the grading house. But how could I have started harvesting without the field officer or the extension officer being present? I told the field officer; I would pull out of the contract if the fruit is rejected. Yes, it will be hard initially, but I have a nephew in Nairobi he will find buyers for me. I was told they could not secure market in June and July. Accordingly, they waited until now, but the fruits are overripened.

But there is communication problem. Around May, I called the field officer, that the fruit are ready to be picked. I called twice and sent text messages, because I noticed that the fruits have started dropping and some of the trees have started flowering. I did not know what to do, but there was no reply from her"

I follow Mama Niki's avocados to see what happen to them at the packhouse, the payment process and if it was rejected, how it was treated. All the 650 kg was graded as rejects as I had initially envisaged. Like mama Niki, all the smallholders, I had interviewed, and I observed, even those with farms at a higher elevation, complained of high-level of rejections at the packhouse compared to previous years. Rejections at the packhouse for smallholder out-growers in 2018 was 23% of all fruits processed, which is 100% increase over normal rejection levels which is between 10-13%.

Photo shows sample of rejected fruits at the farm due to sun burn

Because of the institutional arrangement where all fruits from the smallholders are aggregate together for processing at the packhouse; mama Niki's rejects were added to rejects from other out-growers and shared among all the farmers in association. On my second visit to Mama Niki the following year (in April 2019), she lamented about her experience - the payment she received: "I got very little money, and the price was very, very low. For the whole year, you get 300,000 TZS (approx. 96.5 USD). Is it worth the trouble? ...because that amount is just two months' salary for Swai (farm labourer), not talking about money for myself. It does not pay, it is very, very discouraging!" Due to the poor quality of her fruits, she was paid 450 TZS (0.15 USD) per kg, while other smallholders were paid between 685 - 760 TZS (0.23 - 0.25 USD) per kg depending on the quality and quantity of fruits delivered to the packhouse.

Excerpts from interviews, observation, and informal conversations with Mama Niki. I followed Mama Niki for two years (2018-2019) [PTK_EF_0118-0120/0137/]

Appendix 7.5. Transparency in contracted relation

Box 7.4: "We are transparent and make zero profit from outgrowers"

[...] It is very difficult when you are saying to small-scale producers to be on side - as we do. But when you have competition coming in and people [brokers] start saying, ok, you are being paid 1000 TZS per kg for your fruits. We are going to pay you 1,500 TZS per kg, and we will pay you cash. But, well, we can't compete with that, because we have certifications, we to have pick the fruits at certain quality. There is huge risk involve, and it is backfiring politically. If people are being suspicious of you for not being transparent. When they start hearing these things [brokers are paying higher prices], they think you are cheating the farmers. But what you are doing is just building long-term quality product and giving farmers a fair share. **We try to be transparent. Can I tell you something! We make zero profit on our export from the out-growers**. **For us, we are really trying do it as part of our cooperate social responsibility (CSR)**. **You know, it does not bring us any profit, but it brings us a lot of rewards from our partners**. These farmers are lacking in cash crops, they have always had coffee, but very few farmers now take coffee very seriously. They are very depressed about coffee. Here is an opportunity that they have another commercial crop; and they are getting way more money from avocados than coffee and other crops [...]."

Extract from interview with Director of a major export company [PTK_MD_0151] 09/04/2019

Appendix 7.6 Summary of quality standard for avocados.

Harvesting guidelines and rules+	*Quality & selection criteria at farm+*	*Packhouse grading and quality Standard (UNECE & CODEX Standards for marketing of avocados) ^*	*Export certifications and Standards – Required docs*
• Pickers must wear clean clothes (not soiled with mud, oil, food, or other matter) • Pickers must wash hands with soap or sensitizer • No wearing of clothes with large tears exposing the body parts • No eating, smoking, or drinking is allowed • No wearing of jewellery, earrings and rings or anything sharp • Short sleeves must be worn or long sleeves must be rolled up. • Only use harvesting material supplied company • Fruits must be delivered to packhouse within 24 hours of harvest. • Gentle handle of fruits – place fruits in crates, never throw fruits into crates • Crates should not be over filled	• Fruit maturity – moisture content should be between 73 -75% Fruits that fall into the following categories are not picked/rejected: • **Smaller size fruits** - if the fruit can fit in your palm when you closed it. • Fruits with sunburns, scares, and blemishes due to wind damage and lenticle damage • Fruits that hang low and touches the ground • Blackening fruit – fruits that are over matured and have started ripening • Fruits infested by fruit flies (whitish spot on the fruit) • Deformed / misshaped fruits • Black spots & pepper spots • **Fruits with snapped or pop-off stalk.** The stalk must be present and intact, and nicely cut at 10mm • Fruits that fall to ground during picking/ packing/ loading. • No bruises	***A. Maturity requirement:*** • A minimum dry matter content should be 21 %. ***B. Minimum quality requirements:*** For all classes and the tolerances allowed, the avocados must be: • intact and sound; produce not affected by rotting or deterioration such as to make it unfit for consumption is excluded • clean, practically free of any visible foreign matter • practically free from pests • free from damage caused by pests affecting the flesh • free from damage caused by low temperature • having stalk not more than 10 mm in length which must be cut off cleanly. ***However, its absence is not considered a defect on condition that the place of the stalk attachment is dry and intact*** • free of abnormal external moisture • free of any foreign smell and/or taste. • must be able to withstand transportation and handling. ***C. Fruit classification: 3 classes:*** ***(i)*** ***'Extra' Class:*** must be of superior quality; free from any defects; very slight superficial defects allowed but must not affect the general appearance of the fruit. If present, the stalk must be intact ***(ii)*** ***Class I:*** must be of good quality; a slight defect in shape, in colouring and skin defects (corkiness, healed lenticels and sunburn) are allowed provided they are not progressive; the maximum total area should not exceed 4cm^2*;* the defects should not affect the fruit flesh; the stalk, if present, may be slightly damaged. ***(iii)*** ***Class II:*** Must meet all minimum requirements specific above. Defects in shape, in colouring and skin defects (corkiness, healed lenticels and sunburn) allowed provided they are not progressive; the maximum total area should not exceed 6 cm^2. ***D. Size requirements:***	The following key documents are required for exportation of avocados: • Buying documents (packing list, invoice, airway/ship bill) • Export License from Business Registration and Licensing Agency (BRELA) • Export Permit from the Ministry of Agriculture • Quality and Standard Analysis Report/Certificate from Tanzania Bureau of Standards (TBS) • Certificate of Radioactivity Analysis from Tanzania Atomic Energy Commission (TAEC) • Certificate of Origin from Tanzania Chamber of Commerce, Industries, and Agriculture (TCCIA) • Phytosanitary Certificate from the Ministry of Agriculture • Global Gap Certificate for the EU market from Global G.A.P Certified Agencies. • Additional certifications from supermarkets chains (BSRI, GlobalG.A.P., GRASP,

	Determined by the weight or count of the fruit - minimum weight of for a piece of avocado >80 grams and packed in 4kg box, according to sizes which range from size 4 to size 32*

* The size number determines the number of pieces of avocado that fits into 4kg box. For Hass avocados due nature of its size compared to other varieties, packaging start with size 12 -32. **+** Interviews with farmers, field officers and packhouse staff. **^** Interviews and extract from United Nations Economic Commission of Europe (UNECE) quality standard for avocados (2018 edition) and CODEX Alimentarius (2015) Standard for Avocados – CXS 197-1995

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