The influence of large-scale investment in agricultural land on household food security in Nanyuki area of Kenya

by

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Submitted in partial fulfilment of the requirements for the degree of

Master of Science in Agriculture (Agricultural Economics)

in the

Department of Agricultural Economics, Extension and Rural Development

Faculty of Natural and Agricultural Sciences

University of Pretoria

Pretoria

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July 2022

ABSTRACT

Over the past decade, agribusiness, investment funds and government agencies have shown a growing interest in the acquisition of large-scale agricultural land in developing countries. Much of the interest has been linked to global food price and energy crisis of 2007/2008, driven by various factors such as food security concerns, biofuel demand, carbon markets, water and financial speculation. Despite much research on these acquisitions, empirical evidence on the effects of large-scale agricultural investments on household food security appears to be limited in Africa.

This dissertation explores the influence of large-scale investments in agricultural land on household food security in the rural Nanyuki area of Kenya as part of the African Food, Agriculture, Land and Natural Resources Dynamics (AFGROLAND) project. The sample of 545 households was classified into households (i) in which at least one member was employed or (ii) contracted to the agribusiness, (iii) households in the same area that were neither employees nor contractors (non-engaged) and (iv) counterfactual households from a neighbouring community. The study used food security measures to assess sampled household food security levels. Principal Component Analysis explored the effect of large-scale agricultural investments on food consumption patterns and assessed the adoption of coping strategies by households.

The results revealed that payment received through contract farming strengthened household food security, increased asset accumulation and improved dietary diversity among contract households. Households with an employed member were better off with regards to diet quality and asset ownership. However, they occasionally adopted coping strategies such as skip eating days that are likely to compromise their long-term food consumption. Smaller land sizes were noticed among non-engaged households who had more difficulty in coping with food shortages. Counterfactual households were better off in terms of dietary quality, resilience but adopted some severe coping strategies. Female-headed households were affected by a lack of employment opportunities in the factual zone of the large-scale investments. The study concluded that large-scale agricultural investments might improve food security through contract farming schemes. However, large-scale agricultural investments should be closely monitored to ensure sustainable employment, particularly for women. Policymakers should

consider large-scale agricultural investments aligned with local objectives of improving food security for rural households.

Keywords: Large-scale agricultural investment, food security, dietary diversity, coping strategies, Kenya

DECLRATION

I, Livhuwani Carnatian Masola, declare that this dissertation, which I submit for the MSc Agriculture (Agricultural Economics) at the University of Pretoria, is the result of my own original work and has not previously been submitted by me for a degree at this or any other tertiary institution. I declare that I have acknowledged all sources cited in this work.

DEDICATION

I dedicate this dissertation to my late father, Frans Malose Masola and my late grandmother Johanne Mudadzo Manyama. May your souls continue resting in eternal peace.

ACKNOWLEDGEMENTS

Special thanks to my supervisor Professor Sheryl L. Hendriks, for the encouragement, suggestions, support and necessary professional guidance offered for the research. I will be forever gratefully for all the kindness she showed me over the years.

My heartfelt gratitude goes to Aurélien Reys for always responding to my emails and making time for skype meetings whenever I needed help.

This research formed part of the African Food, Agriculture, Land and Natural Resource Dynamics (AFGROLAND), in the context of global agro-food-energy system changes project. I am grateful to have been part of the research team.

I also wish to thank the National Research Foundation (NRF), grant number 102230 for awarding me a bursary to undertake my research.

Many thanks go to my family and friends for their tireless support and never-ending inspiration. Special thanks to my mother, Mpho Masola and my uncle, Jonathan Mashamba, for your love and support rendered throughout my study.

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LIST OF ABBREVIATIONS AND ACRONYMS

AFGROLAND	African Food, Agriculture, Land and Natural Resources Dynamics
AFDB	African Development Bank
CARI	Consolidated Approach to Reporting Indicators of Food
CFS	Committee on World Food Security
CSI	Coping Strategies Index
FAO	Food and Agriculture Organization of the United Nations
FIAN	Food First Information and Action Network
FCS	Food Consumption Score
FEWS NET	Famine Early Warning System Network
FSI	Food security Index
GRAIN	Genetic Resource Action International
HDDS	Household Dietary Diversity Score
HLPE	High-Level Panel of Experts
IFAD	International Fund for Agricultural Development
ILC	International Land Coalition
IFC	International Finance Corp
MAHFP	Months of Adequate Household Food Provision
NEPAD	The New Partnership for Africa's Development
NRF	National Research Foundation
OECD	Organisation for Economic Cooperation and Development
PCA	Principal Component Analysis
SDGs	Sustainable Development Goals
SPSS	Statistical Package for the Social Sciences
UNICEF	United Nation International Children's Emergency Fund
UNCTAD	United Nations Conference on Trade and Development
USAID	United States Agency for International Development
VAM	Vulnerability Analysis and Mapping
WDDS	Women's Dietary Diversity Score
WFP	World Food Programme

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CHAPTER ONE: INTRODUCTION

1.1 Background

Over the past decade, there has been an increase in the acquisition of agricultural land for large-scale investments in developing countries (Cotula, 2012; Thaler, 2013). The acquisition of agricultural land, more commonly known as large-scale agricultural investments, refers to the leasing or concession of a large tract of land (usually more than 200 hectares) by domestic or foreign companies, government or individuals for undertaking commercial agriculture (Anseeuw et al., 2012a; Antonelli et al., 2015). These acquisitions occur between the investor and the host country in the form of purchase or, more commonly, contract agreements within a timeline of 25 to 99 years (Lay and Nolte, 2018).

The extent of land acquisitions made between 2008 and by the end of 2009 was reported to be 56 million hectares globally, of which 40 million hectares were in Africa (Deininger et al., 2011; Odusola, 2014). Anseeuw et al. (2012b) note that large land acquisitions were triggered by the 2007/2008 global food, fuel and financial crisis. The interest in these acquisitions were driven by various factors such as food security concerns, biofuel demand, expanding carbon markets, demand for water and financial speculation (Cotula, 2012). Although the rate of land acquisition increased between 2009 and 2010, it slowed in 2011 due to short-term stability in commodity prices (Baiker, 2018). Between 2015 and 2020, deals involving an estimated 51 million hectares were concluded globally, of which more than 15 million hectares were acquired in Africa (Land Matrix, 2020). Some studies predict a substantial increase in land deals in developing countries, particularly in Africa and Latin America (Deininger and Byerlee, 2012; Antonelli et al., 2015).

Sub-Saharan Africa has been the prime target for investors because the region is perceived to have underutilised arable land, abundant water resources, a favourable climate for the production of various crops and relatively cheap labour (Deininger et al., 2011; Cotula, 2012). In contrast, countries in Latin America are of less interest because of recently implemented restrictions on land acquisition made by foreign investors (HLPE, 2011). Historical ties also play a role in targeting host countries (Nolte et al., 2016). For example, Portuguese investors typically target Portuguese-speaking former colonies such as

Mozambique and Angola (Schoneveld, 2014). For the Gulf States, cultural and religious similarities influence land acquisitions concentrated in African Islamic countries of North Africa and the Horn of Africa (Anseeuw et al., 2012b).

A range of private and public investors are involved in acquisition of the large-scale agricultural land investments (Liu, 2014), particularly with the largest share of investors emerging from investment funds, private companies, stock exchange-listed corporations, and state-owned entities (Nolte et al., 2016). Generally, investors are from developed countries in North America, Europe, South America, the Gulf and East Asia (GRAIN, 2016; Nolte et al., 2016). Domestic investors are also involved in large-scale agricultural investments but appear to acquire smaller land areas, usually accounting for one-third of total land deals (Zoomers and Quack, 2013; Conigliani et al., 2018).

1.2 Problem statement

Over the past decade, different views have been voiced over the acquisition of large-scale agricultural investments in sub-Saharan Africa (Balestri and Maggioni, 2021). A few studies have addressed the impact of large-scale agricultural investments focusing on livelihood, environmental, land tenure and social issues in sub-Saharan Africa (Hufe and Heuermann, 2017; Moreda, 2018; Zaehringer et al., 2021).

There is a growing body of literature on the impacts of large-scale agricultural farming in Kenya. A study by Hall et al. (2015) detailed the unequal power relations that may favour investors in Kenya between 2011 and 2013. Conflicts were witnessed between smallholder farmers and large-scale agricultural operations in areas of Kenya (FIAN, 2010; Smalley and Corbera, 2012). Nolte and Väth (2015) reported that weak land tenure system that lead to the displacement and reduced land sizes for the farming community of Tana River in Kenya. Zaehringer et al. (2018) demonstrated how large-scale agricultural investments had negatively affected the environment and small-scale farmers livelihoods in Mount Kenya. The acquisition of land for crop production in some parts of Kenya reportedly strained land use for livestock production and wildlife conservation, further contributing to human-wildlife conflicts (Njuguna and Mburu, 2022). None of these studies evaluated the effect of large-scale agricultural investments on household food security in Kenya.

To date, only two published studies by Mutea et al. (2019) and Fitawek and Hendriks (2021) have discussed the outcome of large-scale agricultural investments based on food security dimensions in Kenya. The study by Fitawek and Hendriks (2021) formed part of the same international study as this study. These authors presented a comparative assessment of the impact of large-scale agricultural investments in Kenya, Madagascar and Mozambique. This dissertation seeks to address the gap in literature by assessing the influence of large-scale agricultural investments on household food security in depth in the Nanyuki area of Kenya.

1.3 Research objectives

The study's general objective was to assess whether large-scale agricultural land investments in the Nanyuki area in Kenya affected household food security. To address this objective, the study set out to:

- **i.** Compare the food security status of households living in areas of large-scale agricultural investments with counterfactual households in a neighbouring community without a large-scale agribusiness investments.
- **ii.** Explore the effect of large-scale agricultural investments on household food consumption patterns.
- **iii.** To assess the adoption of coping strategies by households (employed, contract and non-engaged) in areas of large-scale agribusiness investments and the counterfactual area.

1.4 Research hypotheses

This research evaluated the effects of large-scale agricultural investments and the variations in household food security in Nanyuki area of Kenya, examining the following hypotheses.

Hypothesis 1: Households (employed, contract, non-engaged) within the zone of large-scale agribusiness investments are more food secure than those in the counterfactual area with no large-scale agricultural investments.

Hypothesis 2: Large-scale agricultural investments have no effects on household food consumption patterns.

Hypothesis 3: Contract households would adopt fewer coping strategies and have less difficulty coping with food security shocks, given that they could produce food on their own land and supply to the large-scale agribusiness.

1.5 Outline of the dissertation

This dissertation consists of five chapters. Chapter one outlined the introduction, study objectives and hypotheses. Chapter two discusses the relevant literature on large-scale investment in agricultural land, the acquisitions of large-scale agricultural investments in the context of Kenya and concludes with a review of Kenya's national food security status. Chapter three presents a detailed methodology for the study. Chapter four presents the findings of the study. Chapter five presents a summary of key findings, the conclusion and recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Food security and agricultural food production

Globally, the effect of the 2007/2008 food price and financial crisis left millions of people exposed to the vulnerabilities of hunger (Moreda, 2018). It was reported that about 690 million people were hungry in 2019 (before the rise of the Coronavirus Disease (COVID-19) pandemic), with many living in developing countries (FAO et al., 2020). The United Nations Sustainable Development Goals (SDGs) include food security as a critical instrument for sustainable development. Goal two of the Sustainable Development Goals (SDGs) includes ending hunger, achieving food security, improving nutrition and promoting sustainable agriculture (United Nations, 2019).

By definition, "food security exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO et al., 2015:P53).Conceptualisation of food security constitutes six pillars: food availability, accessibility, utilisation, stability, agency and sustainability (HLPE, 2020). Availability refers to the physical presence of adequate food; accessibility refers to capability by individuals to obtain food requisite for a nutritious diet; utilisation refers to nutrition and stability entails having access to adequate nutritional intake at all times and not losing access to such intake (FAO, 2008; Barrett, 2010). Agency and sustainability are central in understanding the right to food and were recently recognised as additional pillars of food security (HLPE, 2020). Agency to food security relates to individual decision making concerning what food to eat, how and what food to produce, how it is processed and distributed and engaging in policy processes that shape food systems. Sustainability refers to food system practices that contribute to the long-term regeneration of natural, social and economic systems and the ability of the present generation to meet their food needs without compromising the food needs of the future generation (HLPE, 2020). Measuring food security must cover all six pillars to ensure the attainment of food security for all people.

Global food production has been steadily increasing over the past five decades, such that there is sufficient food to feed all the people in the world (FAO, 2017). However, food is not

always available, affordable, or equally distributed among the poor in developing countries (Holt-Giménez et al., 2012). According to the FAO (2018) estimates, global agricultural food production must increase to 70 percent by 2050 to sustainably feed the world population of nine billion. This target can be achieved in different ways, including productivity increase in existing farming areas under cultivation and the expansion of cultivation into new farmland (Chamberlin et al., 2014).

Currently, much of the world cropland is already in use and the amount of land available for cropland expansion is still not well established (Chamberlin et al., 2014). Furthermore, land distribution across continents is unequal, with developing regions of sub-Saharan Africa and Latin America estimated to have sizeable uncultivated land suitable for crop production expansion (Antonelli et al., 2015). Barbier (2019) noted that global expansion of agricultural land for crops, biofuels and pasture is expected to increase by 420 million hectares between 2010 to 2050, 60 percent of which could be uncultivated land in Africa. However, recent literature shows that uncultivated land is estimated at 65 percent and concentrated in relatively few African countries, some of which have ongoing political and social conflict (Chamberlin et al., 2014). Hence, land expansion in African countries will likely pose serious threats in terms of competing land uses between forest reserves, protected areas, human settlements and agricultural production (Barbier, 2019).

2.2 Large-scale land acquisitions in Africa

Globally, large tracks of land have been acquired over the years, with substantially larger transactions occurring in Africa (Anseeuw et al., 2012b; Nolte et al., 2016; D'Odorico et al., 2017). These large-scale land acquisitions were acquired for various purposes, including agricultural food production and non-food agricultural commodity (Schoneveld, 2014). Zoomers (2010) identified nature conservation, urban expansion, infrastructure works, tourism, retirements and residential migration as motivations behind acquiring land in developing countries. The magnitude of these land acquisitions made by international investors into developing countries varies substantially across sources, due to different reporting periods and whether the statistics included intended or concluded deals (Cotula and Polack, 2012; Odusola, 2014).

These variations have also raised concerns regarding the reliability of the data, reported by both the media and the land matrix database (Cotula et al., 2014). By way of examples:

- Friis and Reenberg (2010) reported that about 51-63 million hectares of land in Africa were transferred under large-scale agriculture acquisition from 2008 and 2010.
- Deininger et al. (2011) reported that 40 million hectares were under agriculture acquisition in Africa between 2008 and 2009.
- Anseeuw et al. (2012a) reported 56.2 million hectares of agricultural land acquired in Africa under long-term lease contracts between 2000 and 2012.
- Nolte et al. (2016) reported that 10 million hectares of agricultural land were acquired successfully in Africa as of April 2016.

The Land Matrix has since developed a system for reporting land deals detailing areas under negotiation and contract, the intended crops, and the implementation stage of land deals (Nolte et al., 2016). As of May 2020, the Land Matrix database contained reports of 1812 large-scale land deals internationally for food production, biofuel, non-food crops, carbon sequestration, conservation and tourism (Land Matrix, 2020). The geographical distribution of land deals shows that Africa has been the most targeted continent (Table 2.1), with 586 concluded agricultural deals involving a total area of over 15 million hectares. However, the most significant investments have been in Eastern Europe, with a total area of over 16 million hectares concluded through fewer (469) deals.

Table 2. 1: Continental breakdown of target regions for agricultural deals

Region	Number of concluded deals	Total area of concluded deals (million hectares)
Africa	586	15,2
Asia	408	6,8
Eastern Europe	469	16,6
Latin America	310	9,2
Oceania	39	3,7
Total	1812	51,5

Source: Land Matrix, 2020.

2.2.1 The acquisition of large-scale investments on agricultural farmland in Kenya

As with many African countries, large-scale agricultural land investments in Kenya date back to the colonial era (Huggins, 2011; Hall et al., 2015). During the colonial period, the British government passed several laws that favoured white settlers acquisitions of large tracks of land for agricultural purposes (Kariuki and Ng'etich, 2016). The most fertile land known as the "Crown lands" was used to produce crops such as coffee, flowers and tea destined for export to Europe (Pickmeier, 2011). Local populations were denied legal rights to customary land (Hall et al., 2015), instead they were only allowed to have user rights for less fertile land called reserves (Schubiger, 2015). In some cases, threats and violence were used to displace Kikuyu farmers and Massai and Kalenjin herders from fertile agricultural farmland allocated to the settlers (Huggins, 2011; van Heukelom, 2013). Consequently, the affected local farmers began an uprising known as the "Mau Mau" in the 1950s (Klopp and Lumumba, 2017).

At independence, the appropriated land did not revert to the indigenous farmers (Hall et al., 2015). Instead, President Jomo Kenyatta's government established a "willing buyer, willing seller' programme that facilitated the transfer of former British-owned land to Kenyan elites, government officials and wealthy politicians (Huggins, 2011; Klopp and Lumumba, 2017). As a result, foreign-based investors and government-owned agencies emerged as main actors in acquisition of farmland in Kenya (Garcia et al., 2015).

Most of these investments preceded the 2007/2008 food crisis (Klopp and Lumumba, 2014; Nolte and Väth, 2015). According to Garcia et al. (2015), 17 documented large-scale agricultural investments occurred between the 2007/2008 food crisis and the end of 2015, covering an estimated 735000 hectares of land in Kenya. The commodity coverage of the large-scale investments included flowers, jatropha, maize, oilseeds, rice and sugar cane (Klopp and Lumumba, 2014). However, many deals have been cancelled or stalled due to corruption (FIAN, 2010; Reys et al., 2018). European, American and Asian countries are among the investors taking advantage of Kenya's potential for biofuel, flower, food and oilseed production (Klopp and Lumumba, 2014).

As of November 2020, the Land Matrix (2020) database has documented 12 large-scale transnational land deals (11 signed contract deals and one oral agreement) acquired since the year 2000 in Kenya. These deals amounted to 311038 hectares of land, mainly for food crops, biofuels, carbon sequestration, non-food agricultural commodities, livestock and renewable energy production. All but three of these large-scale investments were in operation as of November 2020 (Land Matrix, 2020).

The government of Kenya is also actively promoting large-scale agricultural investment, developing strategies and policies responsible for attracting investment (Hall et al., 2015). Kenya's Vision 2030 was developed in 2008 with an objective to transform Kenya into a food secure middle-income country by 2030 (Government of Kenya, 2010). The strategy considers foreign agricultural investment crucial in increasing productivity and agricultural growth within the agriculture sector (Government of Kenya, 2010). As such, investors are permitted to take long term land lease agreements for up to 99 years (Nolte and Väth, 2015). Depending on the type of land targeted in Kenya, investors can sometimes be engaged in consultation processes with host communities or investments contracts can be entered in secrecy and in the absence of free consent from the indigenous people, smallholder farmers and pastoralist of communal land (Moreda, 2018).

Kenya's land legislation is still undergoing reform. The current system is a remnant of both colonial and post-colonial laws (García, 2015). For example, the 1915 government land act (Klopp and Lumumba, 2017) enabled government officials to use their power (as custodians of the land) to entrust vast tracts of farmland to foreign investors (Klopp and Lumumba, 2014), despite the land being central to subsistence farming and local food security (Crabtree-Condor and Casey, 2012).

2.3 Drivers of large-scale agricultural investments

The growing interest in large-scale agricultural land investments in developing countries is mainly linked to the food, fuel and financial crisis of 2007/2008 (Hall and Paradza, 2012). As reported by many studies, food security concerns have been driven by volatility in commodity prices (De Schutter, 2011). While biofuel feedstock production is driven by policy incentives and an increase in oil prices, the growth of the carbon market in response

to climate change and investor strategies from the financial crisis (Borras et al., 2011; Matondi et al., 2011; Anseeuw et al., 2012b). These events and their drivers are among the causes of the recent surge of large-scale agricultural investments in developing countries, as explained in the subsequent sections of this chapter.

The food crisis of 2007/2008 saw aggregate agricultural commodities (rice, maize, wheat and soybeans) double in price due to the low level of stocks in the global market. Many key agricultural countries (such as Argentina, Russia and Indonesia) imposed export restrictions, leading to food supply constraints in many parts of the world (Cotula, 2012; Fader et al., 2013). In response to increasing food prices and food insecurity concerns, governments and companies worldwide renewed their interest in large-scale agricultural land investments (De Schutter, 2011).

Wealthy countries with limited fertile land (such as the Gulf states) and dependent on food imports sought to acquire large-scale farmland to cultivate food crops in developing countries (Zoomers, 2010; Hufe and Heuermann, 2017). The rising food demand caused by population growth and changing dietary consumption patterns in the emerging economies of East Asia also influenced the acquisition of large-scale agricultural land in the global south (Cotula, 2012). Global studies carried out by both International Land Coalition (ILC) research projects and the Land Matrix report food production as the main driver in acquiring large-scale agricultural investments (Huggins, 2011; Nolte et al., 2016).

Biofuels have been another driving force behind the acquisition of large-scale agricultural land (Cotula, 2012). The interest in biofuel production has been linked to high oil prices of 2007/8 and growing concern regarding global warming and climate change caused by greenhouse gases (Anseeuw et al., 2012b). The interest in biofuel production has also been influenced by the policies of the European Union (EU) and the United States of America (USA), who set targets for alternative sources of energy for the transportation sector and electricity generation (Hall and Paradza, 2012; Santangelo, 2018).

These policies and 2007/8 oil price shocks saw diversion of some food crops (e.g. maize, sugar cane, soya) into biofuel production for export markets by these and other countries in developing countries (Anseeuw et al., 2012b). Giovannetti and Ticci (2016) have argued that

investors from the Organisation for Economic Co-operation and Development (OECD) countries and those from producer countries of Southeast Asia had established biofuel markets were significant players in large-scale transnational investments involving biofuel production. Herrmann et al. (2018) reported that 70 percent of land deals in sub-Saharan Africa between 2000 and 2010 were for biofuel production. However, biofuel production has recently declined in some countries of sub-Saharan Africa, with many of the projects either failing to materialise or being cancelled (Cotula et al., 2014; von Maltitz et al., 2016).

The production of biofuels may also pose a detrimental impact on local food security because land and water resources may be diverted from traditional food production to biofuel crop production (Cotula, 2012; Behrman et al., 2012). Literature also stresses that the cultivation of biofuel crops could lead to higher food prices in the local market (Anseeuw et al., 2012b). Under such circumstance, the rise in food prices could be detrimental to displaced farmers who depend on wage employment to buy food (Kleemann and Thiele, 2015).Similarly, smallholder farmers who produce their own food and still participate in local markets as buyers may also be affected by high food prices (Di Matteo and Schoneveld, 2016).

A global financial crisis followed the food price boom, creating financial speculation in large-scale agricultural investments (Deininger et al., 2011). As a result, the acquisition of agricultural land in Africa and Latin America became an attractive investment option for financial companies (hedge funds) interested in increasing their returns and lowering portfolios risk (McMichael, 2012; Lawrence et al., 2015; Kareem, 2018). According to Cotula (2012), 66 financial investors invested in large-scale agricultural investments compared to before the 2008 financial crisis. Some studies even argued that the financialisation of agriculture has led to a restructuring of the global food industry, whereby investors directly control agricultural production, processing and distribution along the value chain (German, 2015; Lawrence et al., 2015). McMichael (2012":682") calls this kind of financialisation the “global ordering of international food production” and argues the collapse of crop farming activities in rural communities.

Carbon markets have emerged as a fourth driver of large-scale land investment in developing countries (Hall and Paradza, 2012). Afforestation projects such as those under the Reduced Emission from Deforestation and Forest Degradation (REDD+) appear to have increased

demand for land in sub-Saharan Africa (including in South Africa, Kenya, Namibia, and Zambia) (Odusola, 2014). However, the extent of land acquisitions for carbon markets remains unclear (Davis et al., 2015).

Water is another driver in acquiring large-scale agricultural land, but water rights are often excluded during the negotiation process of land deals (Cotula, 2012; Fonjong and Fokum, 2015). The underlying causes of such land acquisition have led to some researchers arguing that water scarcity on the side of investor countries is a motive behind acquiring large-scale agricultural land in developing countries (Rulli et al., 2013). This suggests that water use rights attached to land play an essential role in investor decisions (Breu et al., 2016). Furthermore, land with access to water and irrigation potential is also considered necessary for generating profit margins in large-scale land investments (Woodhouse, 2012). large-scale agricultural investments can lead to a situation where investors take control of water resources at the expense of rural communities (Dell'Angelo et al., 2018). As Franco et al. (2014) have argued, most investors favour land with good water and irrigation potential access. Anseeuw (2013) and Fonjong and Fokum (2015) agree that large-scale industrial agricultural operations are often located in proximity to major river basins. This is strategically planned to gain access to irrigation at the expense of smallholder farmers, pastoralists and rural poor community members who already lack sufficient access to water resources for their sustainable livelihoods (Anseeuw, 2013).

Agricultural production in many developing countries is associated with lower yields and food insecurity (Hall et al., 2015). Some critical constraints limiting productivity growth in developing countries include declining development aid and low public investment in agriculture (Liu, 2014). Therefore, it is not surprising that many African countries welcome large-scale agricultural investments, motivated by the idea that such investments will contribute towards technology transfer, infrastructure development and an increase in the productivity of the agricultural sector (Chakrabarti and Da Silva, 2012). Many financial institutions such as the International Finance Corporation (IFC), the African Development Bank (AFDB) and the Organization of the Petroleum Exporting Countries (OPEC) Fund for International Development offer financial support to investors who want to establish large-scale agricultural investments projects in developing countries (Faye et al., 2013).

Governments in many host African countries are also seeking to attract foreign investors, thereby adopting agricultural investments strategies and land policies meant to encourage and enable the investors to secure long term land leases (McMichael, 2012; German, 2015). For example, Kenya's Vision 2030 Strategy (Government of Kenya, 2007), Ghana's Food and Agricultural Sector Development Policy (Ministry of Food and Agriculture, 2007) and Ethiopia's Agriculture Development Led Industrialization (The Oakland Institute, 2011) encourage such investment. These strategies seek to enhance national food security and revitalise the agricultural sector through a pull-effect programme, integrating the small-scale farming sector into the commercial economy through large-scale acquisitions (Anseeuw, 2013).

In addition to policies, host governments may attract investors by offering incentives such as low export tariffs, short-term property tax reductions and offering low land rental rates (Anseeuw et al., 2012b). However, some incentives schemes like tax reductions and subsidies granted to foreign investors have generated a debate concerning the net decrease in public revenue in host countries (Häberli and Smith, 2014). Furthermore, there are concerns that incentive schemes continue to encourage foreign investments without recognising the right of indigenous host communities, sometimes leading to unfair practices such as dispossession of communal land and environmental damages (Jayne et al., 2014b).

Some studies have argued that the likelihood of a country being targeted for such investments is positively correlated with weak land governance and government failure to protect customary rights (Deininger and Byerlee, 2012; Arezki et al., 2015). Thus, the host government's corruption and weak governance could be factors behind many large-scale land deals in African countries (Hall et al., 2015). Overall, the land tenure system in Africa is regarded as weak (Holmén, 2015). In many cases, poor governance enables local elites to engage in opportunistic behaviours such as a lack of community consultation, displacing the rural poor and leasing land to investors without community consent (Holmén, 2015).

Another aspect that motivates some developing countries to seek foreign investments is the misconception of underutilised large tracks of land within African countries (Pesche et al., 2016). Earlier research on "underutilised" land estimated about 198-446 million hectares of unused land suitable for rain-fed agricultural production in Africa (Deininger et al., 2011).

However, these estimates were based on aerial and satellite images and did not consider that land may be used for multiple purposes, including grazing, cultural and religious practices (HLPE, 2011; Holmén, 2015).

Recent studies conducted by Headey and Jayne (2014), Jayne et al. (2014a) and Jayne et al. (2014b) have reported substantially lower values for underutilised land in developing countries, particularly in Africa where smallholder farming areas are also experiencing land shortages. Furthermore, the rural population of African countries is expected to grow by 50 percent between 2012 to 2050, which will increase competition for limited fertile land between rural communities, foreign company and domestic investors (Jayne et al., 2014a).

2.4 The impact of large-scale agricultural investments on local communities

The debate on the impact of large-scale agricultural investments in targeted countries, particularly in sub-Saharan Africa, has two sides (Meinzen-Dick and Markelova, 2009). The first school of thought focuses on mitigating risks and managing large-scale agricultural investments in a manner aligned with the development objectives of the host countries (Deininger et al., 2011; Moreda, 2017). This narrative is led by supporters of large-scale investments in agricultural land, including the Food and Agricultural Organisation of the United Nations (FAO), the World Bank, United Nations Conference on Trade and Development (UNCTAD) and International Fund for Agricultural Development (IFAD). The second school of thought opposes large-scale agricultural investments, particularly those that target the host countries of sub-Saharan African (Borras et al., 2011; McMichael, 2012). The following sections explore the potential benefits, risks and food security impacts of large-scale agricultural investments on local communities.

The promoters of large-scale agricultural investments argue that these can provide employment opportunities and bring about improved farming technology for local populations (Deininger et al., 2011; Baumgartner et al., 2015). Employment opportunities are often offered during the preparation stages of the labour-intensive land clearing process and peak cultivation periods of large-scale agricultural investments (German, 2015). Employment effects can also vary depending on the type of projects (food and non-food crops) investors establish, making it difficult to generalise about the number of jobs created

(Holmén, 2015). Evidence from case studies suggest that cash crops like flowers, oil palm, rubber and tea have the capacity to create ten to thirty times more job opportunities per hectare than large-scale agricultural food farming (Deininger et al., 2011).

Some researchers on the other hand, have argued that employment benefits may offer low pay for domestic labour and high pay wages to skilled or managerial positions usually occupied by foreign nationals or persons originating from areas beyond the project location (Liu, 2014). For example, Chinese investors have been accused of importing labourers into countries such as Ghana and Rwanda (Tsikata and Yaro, 2011; Veldman and Lankhorst, 2011). The sustainability of employment creation is another concern. Often the number of jobs created is lower than promised due to farming becoming a more mechanised and less labour intensive process (Davis et al., 2014). Agricultural wage employment is also often taken up by unskilled people, landless youth and an active adult population lacking the ability to find alternative non-agricultural jobs (Herrmann, 2017).

Improved farming technology could increase productivity, close the existing food crops yields gaps, and allow host communities to move from subsistence to commercial farming (Rulli and D'Odorico, 2014). However, evidence seem to suggest mixed findings with regard to technology transfer benefits from large-scale land investments in rural communities (Speller et al., 2017). For instance, technology transfer may not reach local farmers if the project is in the early stages of establishment (Liu, 2014). Several studies report technology transfer in joint venture partnership between the investors and the local communities in contract farming or out-grower schemes (Vermeulen and Cotula, 2010a; Boche and Anseeuw, 2013; Herrmann, 2017). In such partnerships, the smallholder farmers could provide labour and produce for the large-scale agriculture investor. In return, the investor may provide access to improved farming inputs (seeds varieties and fertilisers) at a reasonable price (Vermeulen and Cotula, 2010a; Nolte and Ostermeier, 2017). Furthermore, investors can also encourage or transfer new farming practices among smallholder farmers (Deininger and Xia, 2016). However, in some cases, technology transfer benefits may not be ideal for smallholder farming or smallholder farmers may lack necessary skills to make use of the technology within their farms (Speller et al., 2017).

Sometimes an investor will provide access to markets for the smallholder farmers and share farming tools and machinery through contract farming (Speller et al., 2017). Contract farming allows smallholder farmers to continue to grow their food crops to meet household food needs without leasing land to investor. Burned and Colin (2012) have reported an increase in smallholder income and access to credit through inputs provided in out-grower schemes. This seem to support the argument that access to farming inputs can improve crop production and increased revenue, enabling farmer to purchase a more diverse range of foods in local markets (Nolte and Ostermeier, 2017).

Many large-scale investment projects are legally bound to expand social and economic infrastructure such as building schools, health clinics, construction of electricity poles, providing safe drinking water, and improving road infrastructure in rural communities (Meinzen-Dick and Markelova, 2009; Gunasekera et al., 2015). Several studies conducted in region of sub-Saharan Africa seem to confirm that rural communities have benefited from such infrastructure provision (Hufe and Heuermann, 2017). Furthermore, it is argued that acquisitions can facilitate the development of public services (water, roads and electricity) in local communities (Saravia-Matus et al., 2013). However, investment agreements are not always specific on the delivery of infrastructure, making provision challenging to track or costly for host state to monitor and tricky to sanction the investor upon failure to deliver on development commitments (German et al., 2011).

Apart from the benefits promised by the investors, large-scale agricultural land investments may also be promoted by the host government to generate revenue through tax income, rent and exports tariffs (Robertson and Pinstrup-Anderson, 2010; Hall et al., 2015). However, the prospects of generating revenue through land taxation have not been fully exploited in many host countries (Baiker, 2018). In Africa, host governments often offer land at almost no cost (Anseeuw et al., 2012b). This is mainly reflected in case of Ethiopia whereby the land fees were charged at three to ten US Dollar per unit of output produced annually in year 2011 (Saravia-Matus et al., 2013). Christiaensen (2017) noted that land markets were largely absent in Africa, making it challenging to assess land values. Moreover, contracts negotiations involving large-scale land investments seems to favours the investor in many occasions and does not allow renegotiation of land taxes, culturing low rent returns for the timeline of the lease period (Robertson and Pinstrup-Anderson, 2010; Baiker, 2018).

The opponents of large-scale agricultural land acquisitions often emphasise the potential risks for rural communities (De Schutter, 2011; Anseeuw, 2013). The consequences of these land acquisitions depend on many factors, including the land tenure system of the host country (German, 2015). As indicated above, large-scale agricultural investments often occur in host countries where the land tenure governance systems are weak and seldom recognise customary land rights (Vermeulen and Cotula, 2010b; Schoneveld, 2017). Often, the land targeted for large-scale agricultural investment is under customary law and is being used as a shared resource by rural communities (Anseeuw et al., 2012b). Furthermore, land acquisitions agreements are often negotiated by host governments and tribal leaders as representatives of community members (Moreda, 2017).

Several studies conducted in developing countries seems to suggest that many large-scale agricultural investments have been negotiated in secret without formal consultation with community members (Schoneveld, 2014). Under such circumstances, smallholder farmers, pastoralists and indigenous people are vulnerable to displacement from their customary land (Odhiambo, 2011; Hufe and Heuermann, 2017; GRAIN, 2020). Anseeuw et al. (2012a) noted that the displacement of communities is fairly common, with 25 of the 40 known cases of not less than 1000 people per case dispossessed from their land in developing countries. Moreover, ten of the reported cases led to over 10000 people dealing with displacement from their communal land.

In some cases, displaced households are compensated financially for losing their land (Speller et al., 2017). A study by Bottazzi et al. (2018) showed that communities members in northern Sierra Leone were compensated for displacement through wage employment of adults, resulting in 70 percent rise in wages for the affected individuals in 2014. Sometimes compensation may not be enough to reimburse households for a change of livelihoods (Kleemann and Thiele, 2015). This view was supported by Yengoh and Armah (2015), who demonstrated that wages were usually meagre compared to the income previously derived from the production of crops by small-scale farmers. Another compensation issue emerges when payments are unequally distributed among community members (Oberlack et al., 2016). For example, the local elites (chiefs or local government agents) may have the power to engage in opportunistic behaviour, receiving compensation for personal gain and leaving

most communities with little or no payment for the loss of land (Kleemann and Thiele, 2015). A study conducted in Sierra Leone showed that households with no landholdings (tenants) were subjected to minimal compensation compared to landowners who leased the land to an agribusiness company (Bottazzi et al., 2018).

Resettlement can also occur when the host government allocates customary land to land-based agricultural investments (Moreda, 2017). This is particularly harmful to households when the relocated land is unsuitable for traditional livelihood activities (pastoralism or crop farming) (Hufe and Heuermann, 2017). In addition, the alternative land allocated to rural communities is often small and inadequate, compelling households to resort to walking long distances to farm in other areas (Hufe and Heuermann, 2017; Speller et al., 2017). In some cases, households have reported a decline in their ability to secure livelihood resources such as hunting, wood fuel collection, gathering wild food and water collection due to the distances involved (Hamenoo et al., 2018; Fitawek et al., 2020).

Some academic literature explored the impact of large-scale land acquisition from the perspective of gender inequality (Behrman et al., 2012; Shete and Rutten, 2015; Darkwah et al., 2017). The main argument suggest that employment opportunities offered to women in large-scale agribusiness have been associated with low pay in tasks requiring "feminine" traits such as grading, packaging and harvesting (Speller et al., 2017). At the same time, most skilled positions were filled by men for higher pay (Lanari et al., 2016). Sometimes, women have been left out of land concession negotiations and consultation processes, even though they are involved in fulfilling household food provision responsibilities through farming the land (Nolte and Voget-Kleschin, 2014). This implies that women may be vulnerable to adverse changes concerning agricultural activities (Osabuohien et al., 2019).

Water acquisition by large-scale agricultural investments can have various implications for local communities (Franco et al., 2014). Due to intensive agricultural practices, communities may suffer from water pollution and limited water access for personal and household use (Lumumba, 2014). Sometimes, land deals include a clause that gives the investor priority access to water in times of water scarcity (Cotula, 2011). For example, countries like Mali and Sudan have granted investors unrestricted access to water use (Provost, 2012). This could give rise to conflict during periods of water scarcity.

Additional adverse environmental impacts may also be caused by large-scale agricultural investment operations (Deininger and Byerlee, 2012). Smalley and Corbera (2012) reported how land provided to large-scale investments companies in the Tana Delta area of Kenya had affected the environment. Fewer animals are being seen in a once densely populated habitat and some bird species are now considered endangered (Sindayigaya, 2011; Kariuki and Ng'etich, 2016). Another impact include soil quality deterioration due to the continuous practice of mono-cultivation on large farmland (Saravia-Matus et al., 2013). The extensive use of agrochemicals and pesticides can also cause soil and water contamination in host communities (Hufe and Heuermann, 2017). Furthermore, spray drift from agrochemicals was reported to have caused damage to indigenous food crops grown by local farmers located nearby the large-scale investments company in Tanzania (Speller et al., 2017).

2.5. The implications of large-scale agricultural investment on food security

The acquisition of large-scale agricultural land has raised concerns over the attainment of food security (German, 2015). However, large-scale agricultural investments may bring about increased technology transfer and agricultural productivity of food crops that will potential improve local food security (Hufe and Heuermann, 2017). It can further leads to reduction in the reliance of food imports by host countries (Speller et al., 2017). Although the modernisation of agricultural farming technology can increase food productivity, a challenge arises when food produced is exported back to the investor country (De Schutter, 2011; Thaler, 2013).

Some studies critique land acquisitions there by detailing how these could contribute to food insecurity through changes in land use patterns and sizes (Oberlack et al., 2016; Zaehringer et al., 2021). The literature shows that foreign investors often take up vast tracts of land for farming activities, leaving limited land available for food production by host communities (De Schutter, 2011; Moreda, 2018). The underlying causes of such acquisitions have led to a decrease in farming activities for local communities, as farmers are more likely to resort to alternative livelihoods (Di Matteo and Schoneveld, 2016; Speller et al., 2017). Furthermore, when investors focus on cash crops (for example, cotton, flowers, jatropha and oil palm) rather than food crops, such acquisitions can increase food insecurity through rising food prices for local communities (De Schutter, 2011; Yengoh and Armah, 2015). To date, few

studies have been conducted on the matter of large-scale agricultural investments and its impact on food security in host countries. Table 2.2 present a summary of some available studies and their findings.

2.6 The status of food security in Kenya

As with many African nations, Kenya has been struggling for years to ensure access to sufficient food for its citizens (D'Alessandro et al., 2015). About 1.3 million people out of 52.57 million were classified as food insecure in 2019 and needed food assistance in Kenya (USAID, 2020). The Kenyan people were faced with transitory or acute food insecurity(USAID, 2020) . Transitory food insecurity signifies food supply constraints while acute food insecurity forces vulnerable households to sell off any productive assets to secure food for the household(USAID, 2020). A study by Liebetrau (2019) showed that Kenyan people were vulnerable to high food prices due to the country's reliance on imported food. Similarly, the 2019 Global Food Security Index ranked Kenya as 86th out of 113 countries, with 29.4 percent of the population undernourished (EIU, 2019).

The level of households food insecurity in Kenya varies based on several factors including low agricultural productivity, agro-ecological factors, population growth, large-scale land acquisitions and an inefficient food distribution system (D'Alessandro et al., 2015; Welborn, 2018). The North and North-eastern regions of Kenya are often considered marginalised due to geographical remoteness. Furthermore, household food utilization was known to be poor in those areas due to limited access to quality water, sanitation and electricity (Korir et al., 2021).

Table 2. 2: Overview of studies on impacts of large-scale agricultural investments on food security in host countries

Author	Country	Purpose	Methodology Type	Findings
Alamirew et al. (2015)	Ethiopia	Evaluate the contribution of large-scale international investment to local employment and food security	Propensity score matchings Food consumption score (FCS)	Land deals decreased household's food consumption score and offered minimum wages along with few employment opportunities to local people. Thus, having negative effect on household food security.
Dye (2015)	Tanzania and Ethiopia	Examine how food security and land tenure were affected by large-scale land acquisitions	Case study	The results mention that land acquisition in both Tanzania and Ethiopia supported actions of economic, social and political systems that led to low food security and lack of access to land.
Yengoh and Armah (2015)	Sierra Leone	Examine the food security effects of land acquisitions	Qualitative and quantitative methodologies used to measure household food security.	A higher proportion of households in Northern Sierra-Leone were food insecure with moderate hunger. This is due to decline in household income from agricultural production activities, wages from employment were low to meet staple food needs and Farmer Development Programme (FDP) programme put in place to mitigate food insecurity did not materialise.
Shete and Rutten (2015)	Ethiopia	Examine large-scale land acquisition influence on household income and food security	Propensity score matching Food security indicators	The results mention a decline in household food security and income due to large-scale land acquisitions. This is due to reduced access to cultivation land and livestock grazing areas. Furthermore, households adopted more severe strategies when faced with food shortages.
Jiao et al. (2015)	Cambodia	Impact of large-scale land concession on rural household income	Propensity Score Matching (PSM)	The results showed adverse impacts on communal land, primarily reduced land holdings, livestock grazing areas and forests. The promise of jobs was not fulfilled and decrease in household income was also reported.
Nonfodji (2011)	Benin	China farmland rush in Benin and how it constitutes to win-win situation of economic cooperation model	Case study	The study argues that local farmers were coerced into the diversion of Cassava harvest towards biofuel production destined for the exports market. Wage discrimination was reported, whereby Chinese employees received high pay and local African employees received low wages.

Author	Country	Purpose	Methodology Type	Findings
Aabø and Kring (2012)	Mozambique	Examine the impactions of land acquisitions on food security, livelihoods, and employment opportunities	Reviewed literature	Land acquisition led to loss of land without compensation, land conflict and forced displacement. However, employment opportunities were generated through large-scale infrastructure projects.
Hufe and Heuermann (2017)	22 countries in sub-Saharan Africa	Examine the characteristics of land acquisitions and their impact on local livelihoods	Reviewed literature	Out of 146 projects, only four projects have reported a decrease in food security. Other projects reported mixed results that do not necessarily negatively impact food security status. Environmental degradation and land conflicts. Inadequate compensation for land lost. Employment creation and improvement of social infrastructure were reported.
Bottazzi et al. (2018)	Sierra Leone	Evaluating large-scale agricultural investment and its impacts on rural community livelihood	Genetic matching Food security indicator (MAHFP)	The findings mention decreased access to communal land, reduction of rice yield and livestock production for households. Increased income from wage employment. Gender inequality regarding access to jobs offered mainly to men rather than women. Increased household food access for six or more months.
Moreda (2018)	Ethiopia	The implications of right to food in context of land acquisitions	Case study	Large-scale agricultural investments in Ethiopia have entailed a decline in forest, communal land for crop and livestock farming. This perverted the realisation of food security among the rural poor.
Schneider (2011)	Cambodia	What shall we do without our land? Land grab and resistance.	Case study	23 000 people were affected by forced evictions. Resettlement of rural poor to less fertile land. Food shortages and concerns about future household food provision.
Speller et al. (2017)	Ethiopia, Tanzania, Mozambique and Cambodia	Impact of large-scale agricultural investments on local communities	Case study	Large-scale agricultural investments resulted in increased income and savings for the local population. Access to markets for contract schemes, improved livelihoods for the locals, transfer of skills through training and development of infrastructure around the investment areas.

Prolonged droughts and extreme weather conditions have been the major cause of food insecurity in Kenya (Mutea et al., 2019). For instance, food insecurity worsened due to a locust plague (Njeru and Ayieko, 2020) that damaged over 760.000 hectares of crop and forage land in Turkana, Marsabit, Isiolo and Samburu counties by the end of March 2020 (FEWS NET, 2020), resulting in destroyed livelihoods exposing households to high food prices due to supply constraints (USAID, 2020). The gap between food consumption and food production in Kenya is also expected to rise by 2030, driven by projected population growth of 15 million people (Welborn, 2018). The International Futures (2018) predicts that Kenya's food demand is expected to surpass food production by almost 20 million metric tons per annum in year 2040. Areas that are considered viable for agricultural production in Kenya, particularly those in Tana River and Laikipia counties are known to host majority of large-scale agricultural investments (Hall et al., 2015). A stud by Müller-Mahn et al. (2021) detailed how the government of Kenya formed a partnership with a foreign investor and established a food security project (Galana-Kulalu) along the Kilifi and Tana River areas, hoping to boost local food production and reduce the reliance on imports for staple foods. However, the project posed a severe threat to the livelihoods of small-scale farmers (Kariuki and Ng'etich, 2016). It led to the loss of farmland for farmers who cultivated vegetable crops on the Tana Delta River edge. Moreover, Kimani (2015) reported that the Galana-Kulalu project might reduce access to the forest, loss of biodiversity wildlife species and conflict between farmers and pastoralists may occur over water and grazing land. Kenya has a social protection programme in place that aim to improve household food security for the poor (Government of Kenya, 2017). Social protection programmes support households within the arid and semi-arid counties with food and cash transfers amid the current drought conditions (WFP, 2021).

Mutea (2019) collected data data from 600 randomly selected respondents in the Mount Kenya area of Kenya between January to March 2017. The authors made use of six food security indicators: the Coping Strategy Index (CSI), Food Consumption Score (FCS), Household Dietary Diversity Score (HDDS), Household Food Insecurity Access Scale (HFIAS), Months of Adequate Household Food Provisioning (MAHFP) and Food Security Index (FSI). Their findings revealed that 32 percent of the respondents were classified as food secure and 68 percent were food insecure. Very little research has been conducted in Kenya on the influence of large-scale agricultural investment on household food security.

This dissertation set out to investigate the influence of large-scale investments on agricultural land on the food security levels of households in rural Nanyuki Kenya.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The study used secondary data collected as part of a larger project called African Food, Agriculture, Land and Natural Resources Dynamics (AFGROLAND). Kenya was selected as one of the case studies among three countries (Kenya, Mozambique and Madagascar) chosen to carry out the analysis. The study was undertaken in the Nanyuki area of Kenya due to the presence of various large-scale agricultural investments (Reys et al., 2018). A detailed description of these is given in subsequent sections of this chapter.

3.2 Distribution of the study area

The AFGROLAND research team considered two factors in selecting the study area. Firstly, the sub-locations were chosen based on the presence of large-scale agricultural investments (fully operational businesses for more than ten years). The second was that, except for two enterprises, the large-scale agricultural investments in the Nanyuki area covered more than 200 hectares (Fitawek and Hendriks, 2021). The study targeted five sub-locations within the Nanyuki area of Kenya, where large-scale agricultural investments produced flowers and vegetables (Figure 1). The sub-locations (considered as the "factual" zone for the households with at least one member employed by a large-scale agricultural investment or LSAI) included:

- **Buuri**, where the farm *Blooming Dale Roses* was located (roses)
- **Tigithi**, where the farm *AAA Growers* was located (vegetables)
- **Kangaita**, where the farm *Kairiki Limited* was located (flowers)
- **Nyariginu**, where the farm *Equinox* was located (flowers)
- **Naibor**, where the farm *KHE* was located (vegetables).

During the survey, it was discovered that only a few households participated in out-grower contract schemes (six of 360 households interviewed) in these five sub-locations. Therefore, the survey area was expanded to include two additional sub-locations, Mutarakwa and Kiambogo, where 400 farmers were contracted to VegPro (a producer and exporter of fresh vegetables and flowers). A "counterfactual" zone, Barrier, located to the northeast of the

other areas, was selected for comparison purposes. The Barrier area had no large-scale investments. There are two ways in which mechanisms of large-scale agribusiness investments could impact the local populations of Nanyuki area. Firstly, through offering inputs like seeds to contract farmers to produce on their own land and supply (vegetables) to large-scale agribusiness investment. Lastly, the agribusiness offers employment opportunities to some local populations living within the zones of large-scale investments.

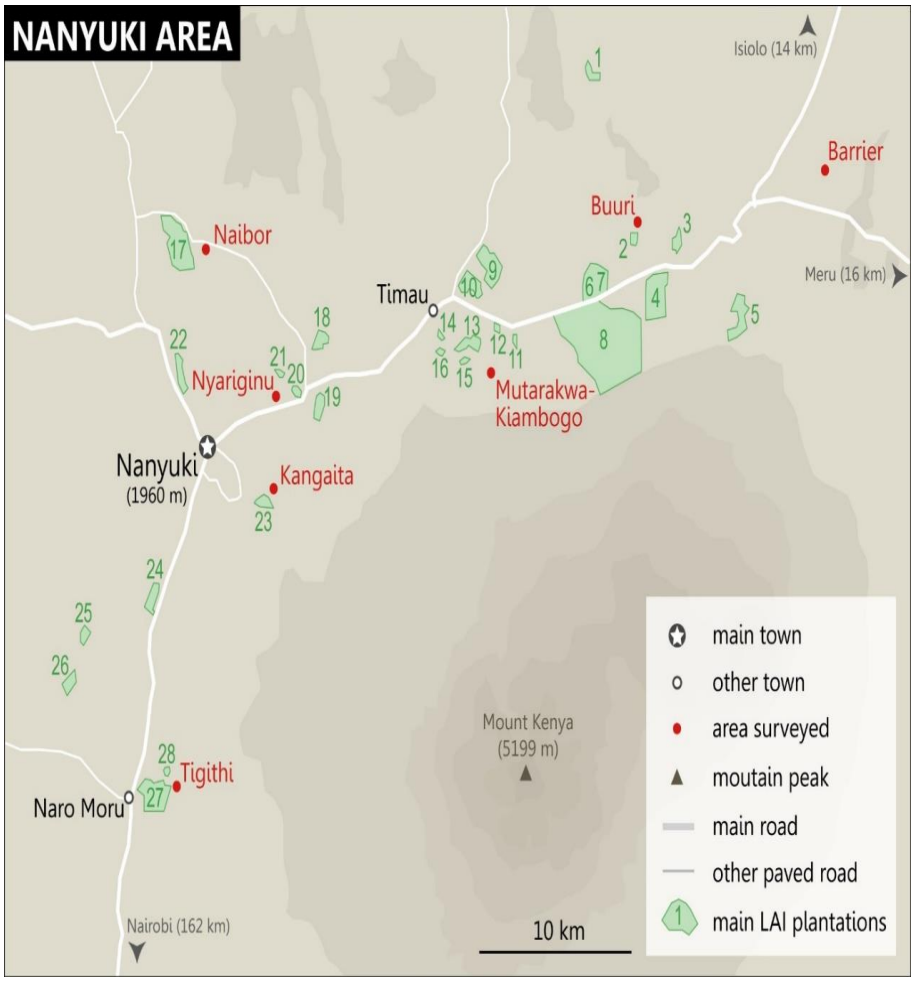

Figure 3.1: Map showing sub-locations in Nanyuki area, Kenya

Source: (Reys et al., 2018).

3.3 Sample selection

The study used a three-stage stratified random sampling technique. The first stage purposely selected six sub-locations namely: Burri, Tigithi, Kangaita, Nyariginu, Naibor and counterfactual Barrier (Table 3.1). The second stage selected different agribusiness companies

within sub-locations of the factual zone. These companies were selected based on farming activities (flowers and vegetable production), farm establishment and land acquisition information (more than 10 years). The third stage selected roughly 20 percent of the population per strata in the factual zones and the counterfactual Barrier location. Due to lack of information on contract farming within the random sampled-sublocations of the factual zone, the study had to select two additional sub-locations (Mutarakwa and Kiambogo) in the vicinity of Timau using snowballing method. The snowballing method was used on sixty contract farming households that were contracted to the VegPro agribusiness company. Thus, a total of 545 households were interviewed. Table 3.1 presents the detailed sample distribution.

The households were classified into four groups:

- Households located in the factual zones where at least one member was employed by a company (employed households)
- Households in Mutarakwa and Kiambogo where at least one member of the household participated in contract farming with the Vegpro company (contract households)
- Households in the factual zones in which members were not employed or contracted to the companies (non-engaged) and
- Counterfactual households that were located in the Barrier area.

The data was proportionally weighted to counteract the underrepresentation of employed and contract farmers and the overrepresentation of non-engaged and counterfactual households in the analysis (Table 3.1).

Table 3.1: Nanyuki area survey details

Type of zone	Sub-location surveyed	Main farm found (main crop)	Approx. total households within sub-location surveyed	Total interviews completed	Weight-total of households represented by one interview
Factual zone	Buuri	Blooming Dale (roses)	2100	111	19
	Tigithi	AAA Growers (vegetables)	600	53	11
	Kangaita	Kairiki Limited (flowers)	1200	52	23
	Nyariginu	Equinox (Flowers)	1500	52	30
	Naibor	KHE (vegetables)	600	57	12
Contract farming households	Mutarakwa-Kiambogo	VegPro (peas)	-	-	1
Counter-factual zone	Barrier	No investment farm found	600	170	4

Source: Reys et al. (2018).

3.4 Data collection and treatment

The study used a household survey that was carried out between 23 January and 25 March 2017 (Reys et al., 2018). The data collection was carried out by ten enumerators supervised by two team leaders, Dr Aurélien Reys and Emily Mutea. The local enumerators were chosen based on their abilities to converse in local languages, knowledge of the study area, and willingness to participate. Before the household survey, all enumerators were trained on the sample design, survey techniques, survey instruments and the confidentiality protocol. A semi-structured questionnaire was used to collect data across sub-locations in the factual and counterfactual zones. The data collected contained information about food security, agricultural activities and household demographic data (age, asset ownership, education level, size of farmland and household). The questionnaire is presented in Annex 1.

Descriptive analysis was used to assess the socioeconomics and demographic variables of the households. The p-value of the chi-square was also tested for all socio-economics characteristics at the five percent level of significance. Computer packages such as Microsoft Excel, Stata and SPSS were used to conduct the analysis.

3.5 Study ethics

The Ethics Review Committee of the Faculty of Natural and Agricultural Sciences at the University of Pretoria approved the AFGROLAND study protocol where this study was conducted. Formal authorisation was obtained from the AFGROLAND project to use the data for the purpose of this study.

3.6 Computation of household food security indicators

Food security is a multidimensional concept and has no single measure that captures all the six dimension of food security aspects (Hendriks et al., 2016). Therefore, seven internationally accepted food security indicators were used to evaluate the food security of the sampled households as follows:

- Household Dietary Diversity Score – HDDS (Kennedy et al., 2011)
- Food Consumption Score – FCS (WFP, 2006)
- Women 's Dietary Diversity Score –WDDS (Kennedy et al. 2011)
- Months of Adequate Household Food Provision –MAHFP (Bilinsky and Swindale, 2010)
- Coping Strategy Index – CSI (Maxwell and Caldwell, 2008)
- Asset ownership (Browne et al., 2014) and
- Consolidated Approach to Reporting Indicators of Food Security– CARI (WFP, 2015).

The Household Dietary Diversity Score (HDDS) is an indicator of the food access dimension that measures diet quality at household level (FAO, 2013). HDDS captures diversity of food groups consumed at household level over 24 hours period (FAO, 2011). HDDS questionnaire included binary questions about the consumption of 16 food groups (Swindale and Bilinsky, 2006). The food groups included: cereals, eggs, fish, fruit (vitamin A rich fruit and other fruit), legumes (nuts, seeds) , milk (milk products) , meat (flesh meat and organ meat), oils, sweets, vegetables (dark green leafy vegetables, vitamin A rich vegetables and tubers, other vegetables) and white roots and tubers (Kennedy et al., 2011). Food groups such as fruit (vitamin A rich fruit and other fruit), meat (organ meat and flesh meat) and vegetables (vitamin A rich vegetables, dark green leafy vegetables and other vegetables) were

aggregated which resulted in total of 12 food groups used to calculate HDDS. The HDDS was calculated as the sum of binary responses from 12 food groups ranging between 0 and 12. The study adopted the consumption thresholds developed by Swindale and Bilinsky (2006) to group the households into three categories as: inadequate dietary diversity (HDDS ≤ 3), moderate dietary diversity (HDDS 4 and 5) and adequate dietary diversity (HDDS ≥ 6).

The Food Consumption Score (FCS) is a composite score that considers dietary diversity, food frequency and the relative nutritional importance of food groups (WFP, 2008; Hendriks et al., 2016). FCS reflect the quantity and quality of both food access and food availability dimensions at household level (WFP, 2012). Similarly to HDDS, the FCS data was based on consumption frequency of food groups within the last seven days recall period. (WFP, 2008). The frequency of consumption of each food group was multiplied by the assigned weight to obtain the FCS (WFP, 2008). See Table 4.2 for the weightings of the food groups. The food groups were assigned weights according to their nutritional densities following the method explained by the World Food Programme (WFP, 2008).

Table 3. 2: food groups and weights for food consumption score

Food items	Food groups	Weights
Maize, maize porridge, rice, sorghum, millet pasta, bread, and other cereals	Main staples	2
Cassava, potatoes, and sweet potatoes, other tubers, plantains	Pulses	3
Vegetables, leaves	Vegetables	1
Fruits	Fruit	1
Beef, goats, poultry, pork, eggs and fish	Meat and fish	4
Milk, yoghurts and other dairy	Milk	4
Sugar and sugar products, honey	Sugar	0.5
Oils, fats and butter	Oil	0.5
Spices, tea, coffee, salt, fish power, small amount of milk for tea	Condiments	0

Source: WFP (2008).

The FCS considers nine main foods groups: condiments, fruit, meat, milk, oil, pulses, staples, sugar and vegetables (WFP, 2008). The summation of the food groups provides the FCS. The results were categorised into three groups (see Table 4.3) as follows: FCS lower than 21

represented poor food consumption, a score between 21.5 and 35 represented poor or borderline food consumption, while greater than 35 indicated acceptable food consumption which is food secure households as indicated by WFP (2008).

Table 3.3: Classification of food security measures

Indicators	Category number	Category description	Range
HDDS	1	Adequate dietary diversity	≥ 6
	2	Moderate dietary diversity	4-5
	3	Inadequate dietary diversity	≤ 3
FCS	1	Acceptable	>35
	2	Borderline	21.5-35
	3	Poor	0-21
WDDS	1	Adequate dietary diversity	≥6
	2	Moderate dietary diversity	4-5
	3	Inadequate dietary diversity	≤ 3
MAHFP	1	Least food insecure	≥10
	2	Moderate food insecure	6 – 10
	3	Most food insecure	≤6
CSI	1	Food Secure	0- 2
	2	Mildly food insecure	3 – 12
	3	Moderately food insecure	13 -40
	4	Severely food insecure	> 40
ASSET INDEX	1	More resilient	≥10
	2	Moderate resilience	6 – 10
	3	Least resilient	3 – 6

The Women's Dietary Diversity Score (WDDS) assessed the dietary quality in particular the micronutrient adequacy for women of reproductive age (15 – 49 years) (FAO and FANTA, 2014). The WDDS is used to capture the quality components of food access (Leroy et al., 2015). The questionnaire used a 24- hour recall period for the nine food groups, derived from the dietary diversity index data (Chagomoka et al., 2016). Only data from female-headed households were included for this indicator. The scores and threshold used followed those developed by Chagomoka et al. (2017): where the lowest dietary diversity was ≤ 3 food groups, medium dietary diversity was 4-5 food groups and highest dietary diversity was ≥ 6 food groups.

The Months of Adequate Household Food Provision (MAHFP) is an indicator that measures stability of food dimension and it covers the regularity of food supply over a designated period of one year at household level (Bilinsky and Swindale, 2010). The MAHFP was calculated by summing the number of months a household experienced adequate food

provision in the previous 12 months (Bilinsky and Swindale, 2010). The households were classified into three categories as indicated in the Africare (2007) food security review study as follows: (≥ 10 MAHFP) household classified as least food-insecure, (6-10 MAHFP) as moderately food insecure and (≤ 6 MAHFP) as most food insecure.

The Coping Strategies Index (CSI) measures household behaviour when inadequate food is available (Maxwell and Caldwell, 2008). The CSI is an indicator for food access dimension of food security (Maxwell and Caldwell, 2008). The respondents were asked questions about food consumption behaviours in the face of food shortages and the frequency of adoption during the immediate prior seven-day period (Hendriks et al., 2016). A higher CSI indicated that a household experienced severe food insecurity (Maxwell and Caldwell, 2008).

The CSI of the households was calculated using the following equation:

$$\mathrm{CSI} = (\mathrm{FCS1} * \mathrm{SCS1}) + (\mathrm{FCS2} * \mathrm{SCS2}) + \cdots + (\mathrm{FCS7} * \mathrm{SCS7}),$$

where CSI denoted the household coping strategy, FCS1 represented the frequency of strategy adopted by the household, which is the number of days each strategy was adopted in the previous seven days and the SCS1 represented the severity of the strategy (Maxwell and Caldwell, 2008).

Following the methodology by Maxwell and Caldwell (2008), households were classified into four categories: food secure (CSI 0-2), mildly food insecure (CSI 3-12), moderately food insecure (CSI 13-40) and severely food insecure (CSI > 40).

Assets are tangible goods that household has ownership over and can be exchanged for food or cash to buy food (Sen, 1981). Access to assets influences the ability to prevent, mitigate and cope with shocks, therefore assets ownership capture food access dimension of food security (Clapp et al., 2022). The asset holding was used as a proxy indicator that reflect ability of the household to cope with shocks (Maxwell and Smith, 1992; Browne et al., 2014). Asset ownership score is derived as the simple sum of assets(farm equipment and household asset) owned by households (Hendriks et al., 2016). However, the sum of assets did not reflect the value of assets (Browne et al., 2014). The asset ownership categories were developed following Browne et al. (2014) and categorised as follows : more resilient (high

assets ownership household), moderately resilient (medium assets ownership household) and least resilient (low assets ownership household)(Table 4.3).

The Consolidated Approach to Reporting Indicators of Food Security (CARI) is a comparative analysis indicator that measures household food insecurity (WFP, 2015). The CARI combined the FCS, the food expenditure share and a livelihood coping strategies indicator into a summary indicator called Food Security Index (FSI) (Butaumocho and Chitiyo, 2017). The CARI assess availability and access to food dimension through measuring current status of household consumption. The CARI also measures the ability of household to stabilize consumption over time by measuring coping capacity through vulnerability and livelihood coping strategies (WFP, 2021).

The consumption status of the household was determined using the FCS derived as described in the above. The households coping capacity was determined using livelihood coping strategies and food expenditure share (WFP, 2015). The livelihood coping strategies was determined based on households engaging in strategies deemed as either stress strategies (borrowing money), crisis strategies (selling productive assets) and emergency strategies(selling land) (WFP, 2015). The data for some of the consumption-based coping strategies were used to compile livelihood coping strategy as a component of the CARI. The food expenditure share measures household economic vulnerability, that is the more household direct expenditure towards food, the more vulnerable to food insecurity (Maxwell et al., 2014). The food expenditure share was calculated by dividing the total household food expenditure by the total household expenditure. The FSI measures the overall food security status by calculating the average of current status score (food consumption score) and coping capacity score (food expenditure share and coping strategy index) (WFP, 2015). All indicators included within the CARI console were transformed into a CARI four-point scale and classified as: (1) food secure; (2) marginally food secure; (3) moderately food insecure and (4) severely food insecure (Table 3.4) (WFP, 2015).

Table 3. 4: Classification of food security indicators based on the CARI console

Domain		Indicator	Food secure (1)	Marginally food secure (2)	Moderately food secure (3)	Severely food insecure (4)
Current status	Food consumption	Food consumption score	Acceptable		Borderline	Poor
Coping Capacity	Economic vulnerability	Food expenditure share	<50%	50-60%	65-75%	>75%
	Asset depletion	Coping strategy index	None	Employed stress strategies	Employed crisis strategies	Employed emergency strategies

Source:(WFP, 2015).

Spearman's correlation was used to examine the non-parametric relationship among food security measures (HDDS, FCS, MAHFP, CSI and Asset).

3.7 Principal Component Analysis of the food consumption and coping strategies

Principal Component Analysis (PCA) was used to examine the food consumption and coping strategies among the four groups of households. PCA is a technique that transforms the input variable into reduced uncorrelated variables called the factors or principal components (Smith et al., 2013). The PCA model generated three principal components to identify and compare patterns in relation to four categories of households. The number of components that best represent data were selected based on eigenvalues (greater than one) and its interpretability (Shrestha et al., 2016). Each component describes a pattern. The linear combination of input variables allows the calculation of a component score for each household (Smith et al., 2013). The pattern of each component can be interpreted by the factor loading magnitude of ≥ 0.3 or- ≤ 0.3 (Wineman, 2016). The higher the factor loadings, the stronger the association with a pattern. However, a negative factor loading indicated lower consumption of a food group (McCann et al., 2011). The factors or principal components were rotated with an orthogonal varimax rotation to improve interpretability and minimise the correlations between the factors (Smith et al., 2013). The first principal components represent the maximum percentage variance, whereas the second and the third represent the remaining percentages variance

3.8 Study assumptions

It was assumed that household respondents gave honest responses and that the household head represented the overall food security status of all members per household surveyed. Secondly, it was also assumed that the data collected were valid and measured the desired outcome of household food security status. The final assumption was that all households in the factual zone areas had equal employment opportunities with the agribusinesses.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Description of the sample

This section describes and compares the four household groups regarding their demographic and socio-economic characteristics, as presented in Table 4.1. The sex distribution indicated a very high proportion of male-headed households (more than 70 %) in all groups. There was a slightly higher proportion of female-headed households among non-engaged (25%) and counterfactual (22%) households than in the contract (10%) and employed (6%) households. This signified that only a few female-headed households participated in contract farming or were able to secure employment with an agribusiness company. Most household heads were married (more than 70%) across all the groups. The divorce rate was proportionally low among counterfactual (5%) and non-engaged (3%) households. No employed and contract household heads that were divorced.

The household size ranged from one to 14 members. Thirty-seven percent of non-engaged and counterfactual households had small household sizes (between one and three members) compared to 23 percent of employed and 19 percent of contract households. More than half of the households in all groups had medium (four to six) family members. Very few households (less than 11%) in all four groups consisted of more than six persons. The age of household head was categorised into five categories (Table 4.1). The majority of employed (39%) and contract (35%) household heads were younger (between 30 to 39 years). On the other hand, both non-engaged (34%) and counterfactual (35%) households had older household heads (over 60 years of age). The results of chi-square revealed a non-significant difference for education and family size ($p > 0.05$) at 5 % level of significance. The other variables showed significant level among household groups ($p < 0.05$ at 5% level of significance).

Over 70 percent of households in all four groups were migrants from nearby areas. There were proportionally more household-heads without formal education in counterfactual (24%) and non-engaged (21%) households than in employed (19%) and contract (15%) households. About one-third of the employed (30%) household heads had completed secondary level education compared to 22 percent among contract, non-engaged and counterfactual households. Few household heads had tertiary education. Land size varied

among households and was classified into three categories: small (<1 ha), medium (1-3 ha) and large (>3 ha). The majority of employed (67%), contract (61%) and non-engaged (66%) households had land holdings of less than one hectare. A proportionally higher number of counterfactual households (48%) had medium-sized holdings of between one to three hectares of land. The results also showed that the counterfactual households had large areas of land - more than three hectares. Many households practiced livestock farming, with contract households (75%) holding between one and four livestock (cattle, chicken, goats and sheep). The counterfactual (62%), employed (58%) and non-engaged (55%) households were also active in livestock farming. Some contract (14%) and counterfactual (12%) households owned more than four animals.

Table 4. 1: Demographic characteristics for households, 2017

Demographic Variable	Variable description	Sample Size	Employed (n=48)	Contract (n=57)	Non-engaged (n=270)	Counterfactual (n=170)
			%	%	%	%
Sex	Male	545	93.31	89.47	74.15	77.06
	Female		6.69	10.53	25.85	22.94
Age	Age < 30	545	5.96	3.51	4.77	4.71
	Age 30-39		38.91	35.09	16.01	17.06
	Age 40-49		25.31	31.58	17.39	23.53
	Age 50-59		11.51	19.30	27.04	19.41
	Age >60		18.31	10.53	34.76	35.29
Education Status	No school	545	19.46	15.79	21.86	24.71
	Primary		48.12	56.14	49.47	44.71
	Secondary		30.44	22.81	22.73	22.35
	University/ College		1.99	5.26	5.95	8.23
Marital Status	Single	545	3.14	1.75	7.44	3.53
	Married		91.32	94.74	73.91	77.65
	Divorced		0.00	0.00	3.94	5.88
	Widowed		5.54	3.51	14.72	12.94
Family size	Small (1-3)	545	22.91	19.30	37.32	37.06
	Medium (4-6)		66.74	71.93	52.87	58.82
	Large (>6)		10.36	8.77	9.81	4.12
Land size	Small (<1 ha)	545	67.78	61.40	66.57	40.00
	Medium (1-3 ha)		30.96	33.33	27.18	47.65
	Large (>3 ha)		1.26	5.26	6.25	12.35
Migrant	Far	545	9.41	1.79	10.92	3.57
	Nearby		70.71	83.93	77.61	71.43
	No migrant		19.87	14.29	11.48	25.00
Livestock ownership	No livestock	545	39.12	10.53	35.88	24.12
	Small (1-4)		58.89	75.44	55.62	62.94
	Large (>4)		1.99	14.04	8.80	12.94

Source: author's own computation from AFGROLAND survey data (2017).

4.2 The food security outcomes

This section compares the food security status of households using seven internationally accepted food security indicators.

4.2.1 Results of Household Dietary Diversity Score (HDDS) analysis

Cereals, milk, oils, spices and vegetables were widely consumed every day by over 90 percent of sampled households (Table 4.2). The relatively high consumption of milk and milk products can be attributed to household livestock ownership. The second widely consumed food groups were legumes and sweets. More contract (89%) and counterfactual (89%) households consumed legumes compared to non-engaged (63%) and employed (60%) households. This can be possible explained by the fact that contract and counterfactual households have large land size holdings, enabling them to produce crops such as legumes for consumption.

The consumption of fruit varied, with a higher proportion of contract (63%) households consuming fruit compared to employed (54%), non-engaged (53%) and counterfactual households (47%). This could be that prices of fruits were noticeable high in most supermarkets stores in Kenya during 2018, making it un-affordable to most households (IFPRI, 2018). More than 40 percent of contract households consumed meat compared to less than 30 percent of employed, non-engaged and counterfactual households. The proportion of households consuming eggs was meagre, with an average consumption of once a week. The consumption of fish and seafood was negligible, possibly due to distance to the coast and the absence of cold storage facilities.

Table 4.2: Dietary diversity food groups consumed by households, 2017

Food groups	Employed (n=48)		Contract (n=57)		Non-engage (n=270)		Counterfactual (n=170)	
	count	%	count	%	count	%	count	%
Cereals	47	97.92	55	96.49	262	97.04	165	97.06
White tubers and roots	33	68.75	50	87.72	173	64.07	129	75.88
Vegetables	46	95.83	55	96.49	267	98.89	167	98.24
Fruits	26	54.17	36	63.16	144	53.33	80	47.06
Meat	14	29.17	25	43.86	62	22.96	36	21.18
Eggs	12	25.00	22	38.60	69	25.56	57	33.53
Fish and other seafood	0	0.00	1	1.75	2	0.74	1	0.59
Legumes, nuts, and seeds	29	60.42	51	89.47	172	63.70	152	89.41
Milk and milk products	47	97.92	56	98.25	254	94.07	166	97.65
Oils and fats	48	100.00	56	98.25	267	98.89	167	98.24
Sweets	41	85.42	48	84.21	232	85.93	151	88.82
Spices, condiments, and beverages	48	100.00	56	98.25	264	97.78	169	99.41

Source: author's own computation from AFGROLAND survey (2017).

Figure 4.1 shows that over 90 percent of all households had adequate dietary diversity, with contract households consuming more diverse food groups than other households. A possible explanation is that money received from contract farming enables the consumption of more diverse diets. The results also indicated that very few households (less than 10%) consumed diets of moderate diversity. However, no households consumed inadequately diverse diets. The HDDS indicator showed a statistically significant difference in the consumption diversity among the groups (p=0.000 at 5% level of significance).

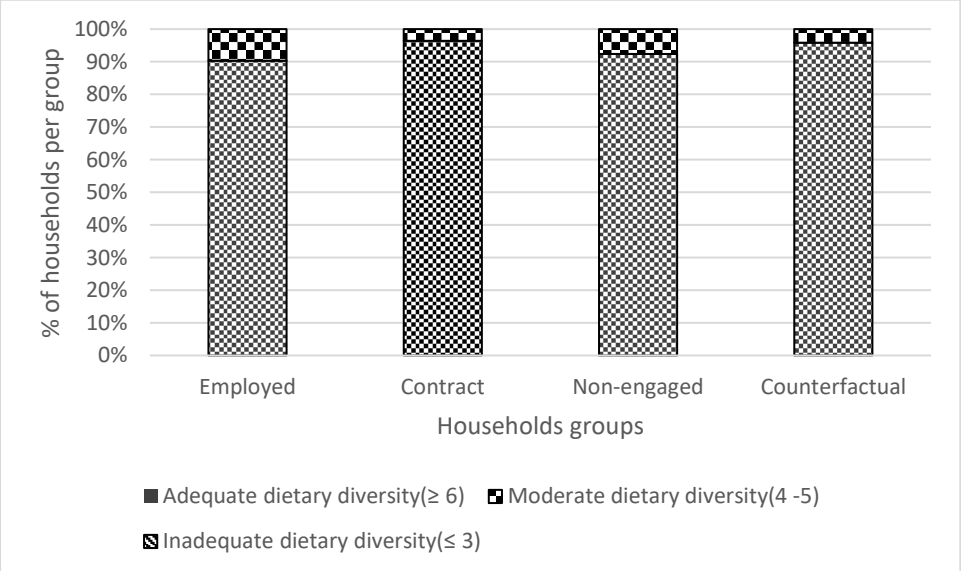

Figure 4.1: Households dietary diversity score, 2017

Source: author's own computation from AFGROLAND survey (2017).

4.2.2 Results of the Food Consumption Score (FCS) analysis

The majority of households consumed staples, particularly cereals over seven-day recall period. This may be explained by the fact that maize is commonly consumed as a main staple food in Kenya (Abodi et al., 2021). Condiments, oils, and vegetables were also consumed by households in the seven-day recall (Table 4.3). More counterfactual households consumed milk and pulses than other households. A higher proportion of contract households (87 %) consumed fish and meat compared to 83 percent for employed households and 82 percent for both non-engaged and counterfactual households. The was low consumption of fruit compared to other food groups amongst the sampled households. On average fruit was consumed three times a week. The low consumption of fruit can be partly explained by the shift in dietary towards highly processed calories, salt and sugary foods in the general population of Kenya reported between 2015 and 2019 (Pengpid and peltzer, 2018; Nyanchoka et al., 2022).

Table 4. 3: Seven-day recall of food groups consumed by households, 2017

Food groups	Employed (n=48)		Contract (n =57)		Non-engaged (n=270)		Counterfactual (n=170)	
	count	(%)	Count	(%)	count	(%)	count	(%)
Main staples	48	100.00	56	98.25	267	98.89	170	100.00
Pulses	46	95.83	55	96.49	258	95.56	168	98.82
Vegetables	48	100.00	56	98.25	267	98.89	169	99.41
Fruits	40	83.33	47	82.46	231	85.56	137	80.59
Meat and Fish	40	83.33	50	87.72	224	82.96	141	82.94
Milk	47	97.92	55	96.49	259	95.93	168	98.82
Sugar	42	87.50	51	89.47	253	93.70	159	93.53
Oils and fats	48	100.00	56	98.25	267	98.89	169	99.41
Condiments	48	100.00	56	98.25	264	97.78	169	99.41

Source: author's own computation from AGROLAND survey (2017).

As seen in Figure 4.2, more than 97% of all four groups of households had acceptable food consumption scores. Very few households had borderline FCSs – only two percent of employed households and one percent of contract, non-engaged and counterfactual

households. Even fewer households reported poor FCSs. Overall, contract and counterfactual households had higher FCSs. The f-test results showed a statistically significant difference between the FCS for the households groups (p-value 0.000 at 5% level of significance).

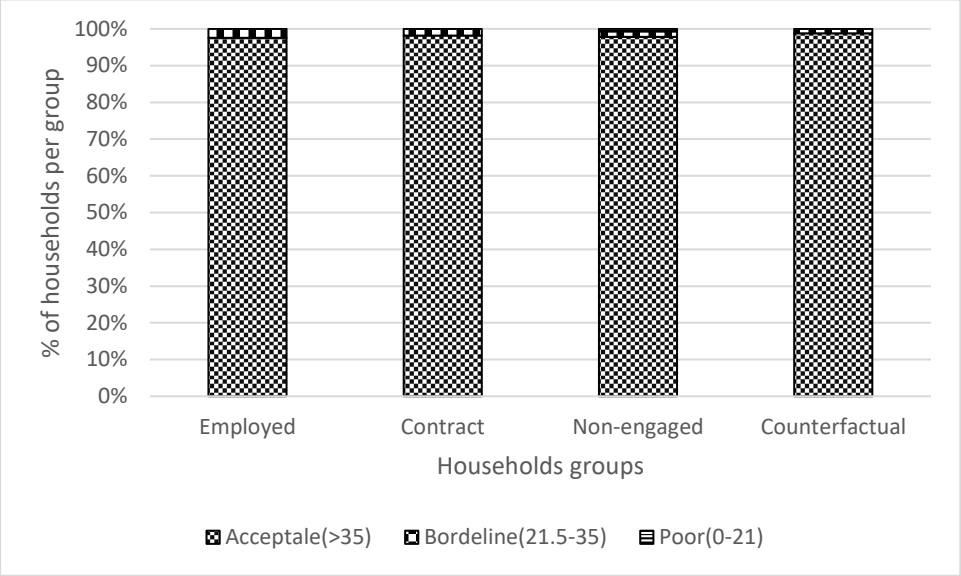

Figure 4.2: Food Consumption Score, 2017

Source: author's own computation from AFGROLAND survey (2017).

4.2.3 Results of the Women's Dietary Diversity Score (WDDS) analysis

In this analysis, only data for female-headed households were considered (Table 4.4). As with the above dietary indicators, most female-headed households consumed food groups such as milk and milk products, organ meat, other fruit and vegetables and starchy staples. None of the employed female-headed households consumed other vitamin A-rich fruit and vegetables and organ meat. The results also showed that less than a third (30%) of female heads in employed, contract, counterfactual and non-engaged households had low consumption of fish and meat. This can be partly explained by remoteness from lake, making it difficult for women to access fish (de Bruyn et el., 2021). Another possible reason linked to the low consumption of meat may be explained by high cost of animal sourced meat that was reported between 2015 to 2021 in Kenya (de Bruyn et al., 2021).

A high proportion of female-headed households (89%) in counterfactual areas consumed legumes in comparison to the contract (66%), non-engaged (64%) and employed households (50%).

Table 4.4:Women's dietary diversity score, 2017

Food Groups	Employed (n= 4)		Contract (n=6)		Non-engaged (n=73)		Counterfactual (n= 37)	
	count	(%)	count	(%)	count	(%)	count	(%)
Starchy staples	4	100.00	5	83.33	73	100.00	37	100.00
Green leafy vegetables	3	75.00	5	83.33	49	67.12	30	81.08
Other vitamins A rich fruits & Veg	0	0.00	3	50.00	37	50.68	14	37.84
Other fruits and Veg	4	100.00	5	83.33	73	100.00	37	100.00
Organ meat	0	0.00	1	16.67	2	2.74	2	5.41
Meat and fish	1	25.00	1	16.67	6	8.22	6	16.22
Eggs	2	50.00	2	33.33	11	15.07	9	24.32
Legumes, nuts, and seeds	2	50.00	4	66.67	47	64.38	33	89.19
Milk and milk products	4	100.00	5	83.33	70	95.89	35	94.59

Source: author's own computation from AGROLAND survey (2017).

A high proportion of female-headed contract households (80%) consumed six or more food groups. In comparison, very few females in employed (46%), counterfactual (45%) and non-engaged households (28%) that had consumption of the same food groups (Figure 4.3). This indicated that more female-headed contract household enjoyed adequate dietary diversity than other households. About two-thirds of non-engaged households (67%) and just over half of employed (53%) and counterfactual (51%) female-headed households fell into the moderate dietary diversity category. Households in this category consumed between four or five food groups (out of nine). None of the employed or contract female-headed households had inadequate dietary diversity. Few non-engaged and counterfactual female-headed households had very low dietary diversity (less than three food groups). The f-test showed that there was no statistical significant differences between the households groups to the WDDS at 5% level of significance, p-value = 0.349 (Table 4.10).

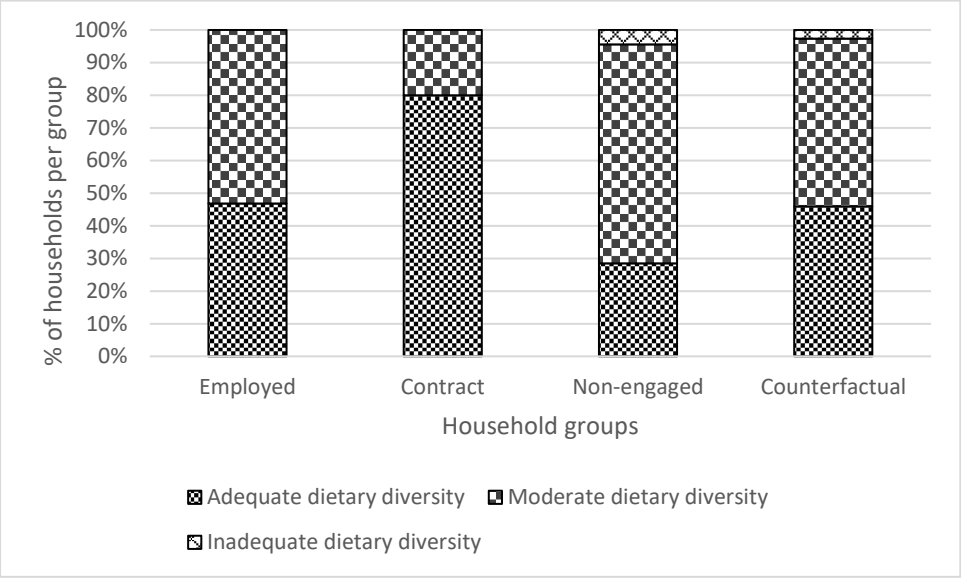

Figure 4.3: Women Dietary Diversity Score, 2017

Source: author's own computation from AFGROLAND survey (2017).

4.2.4 Results for the Months of Adequate Household Food Provision (MAHFP) analysis

The majority of households in all groups experienced adequate food access during the months of February, March, April, May, June, July, August and September (Table 4.5). The highest proportion of households that reported adequate food provision was employed group in months of February (95%) and May (95%), the contract households in June (94%) and July (96%), the non-engaged group in April (96%) and May (96%) and the counterfactual households in months of March (97%) and April (95%). All households generally experienced inadequate food provision during the months of October, November, December and January. These findings suggest that food access and availability was more of seasonal problem. Another possible explanation is that the most difficult months to access food coincided with agricultural lean season and when food prices are usually high in Kenya (FEWS NET, 2021).

Table 4.5:Months of adequate household food provision, 2017

Months	Employed (n=48)		Contract (n=57)		Non-engaged (n=270)		Counterfactual (n=170)	
	Count	%	Count	%	Count	%	Count	%
January	36	75.00	41	71.93	182	67.41	130	76.47
February	46	95.83	46	80.70	224	82.96	162	95.29
March	45	93.75	49	85.96	247	91.48	164	97.06
April	44	91.67	53	92.98	251	92.96	163	95.88
May	46	95.83	52	91.23	251	92.96	160	94.12
June	46	95.83	54	94.74	249	92.22	161	94.71
July	44	91.67	55	96.49	247	91.48	154	90.59
August	40	83.33	53	92.98	224	82.96	129	75.88
September	42	87.50	49	85.96	215	79.63	126	74.12
October	37	77.08	49	85.96	203	75.19	112	67.06
November	38	79.17	49	85.96	195	72.22	105	62.94
December	39	81.25	48	80.70	193	71.48	101	59.41

Source: author's own computation from AFGROLAND survey (2017).

The MAHFP outcomes revealed that 60 percent of contract and 57 percent of employed households fell into the least food insecure (Figure 4.4). The results infer that a high proportion of contract and employed households we able to secure food access for ten or more months in a year. More than 50 percent of counterfactual and non-engaged households were moderately food insecure (able to access food for 6 to 10 months) compared to employed (39%) and contract (35%) households. Very few households in all groups were in the most food insecure category. The f-test results showed that there was no statistical significance between household groups at 5% level of significance (p-value= 0.148) for MAHFP.

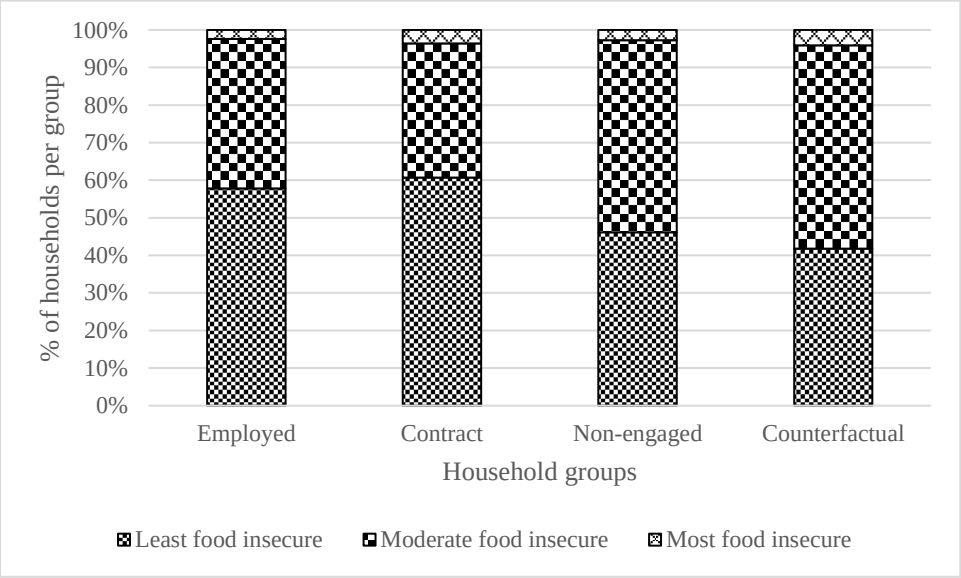

Figure 4.4:Months of adequate household food provision, 2017

Source: author's own computation from AFGROLAND survey (2017).

4.2.5 Results of the Coping Strategies Index (CSI) analysis

Many households consumed less expensive foods, limited portions of food and bought food on credit (Table 4.6). A similar proportion of households in employed (37%) and non-engaged (38%) limited portion of food sizes, compromising nutrition. Coping strategies such as begging, eating elsewhere and feeding working members were used the least. More households in the counterfactual (20%) and employed (18%) groups borrowed food compared to non-engaged (14%) and contract (8%) households. This possible expose counterfactual and employed households to more likely compromising their long-term food consumption.

Consuming seed stock was practiced by counterfactual (22%) and non-engaged households (16%). This strategy undermines the household's future food security. The severe coping strategy of skipping days without eating was adopted by very few employed (8%), counterfactual (5%) and non-engaged (4%) households. This may suggest that the employment remuneration offered by agribusiness was insufficient to prevent the adoption of severe coping strategies.

Table 4. 6: Coping strategies used by the households, 2017

Coping Strategies	Employed (n=48)		Contract (n=57)		Non-engaged (n=270)		Counterfactual (n=170)	
	count	(%)	Count	(%)	count	(%)	count	(%)
Consume less expensive	27	56.25	29	50.88	158	58.52	104	61.18
Borrow food	9	18.75	5	8.77	39	14.44	35	20.59
Buy food on credit	28	58.33	23	40.35	127	47.04	106	62.35
Gather wild food	3	6.25	1	1.75	22	8.15	21	12.35
Consume seed stock	6	12.50	7	12.28	44	16.30	39	22.94
Eat elsewhere	2	4.17	0	0.00	6	2.22	6	3.53
Beg	0	0.00	0	0.00	2	0.74	2	1.18
Limit portion of food	18	37.50	15	26.32	103	38.15	72	42.35
Restrict adult cons.	5	10.42	2	3.51	23	8.52	13	7.65
Feed working members	1	2.08	0	0.00	0	0.00	1	0.59
Reduce the number of meals	13	27.08	3	5.26	49	18.15	31	18.24
Skip days without eating	4	8.33	0	0.00	12	4.44	10	5.88

Source: author's own computation from AFGROLAND survey (2017).

Almost half of the contract households were classified as food secure (48%) compared to 37 % of employed, 33 % of non-engaged and 23 % of counterfactual households (Figure 4.5). These findings suggest that households generally adopted few (CSI 0-2) coping strategies. Roughly the same proportion of households in each group were classified as mildly food insecure (about a third of all households). The highest proportion of moderately food insecure were counterfactual households (38%). This was possible because more counterfactual households rationed food (see Table 4.6) than other households. Very few (less than ten percent) of the households were severely food insecure. The f-test analysis showed a statistically significant difference (p-value = 0.013) between groups with regards to the coping strategy index.

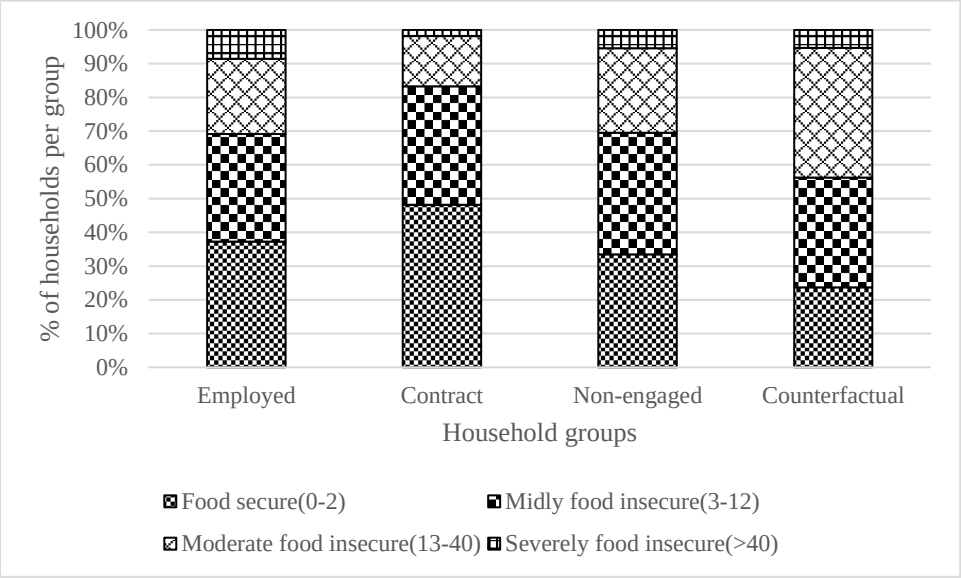

Figure 4.5: Coping strategies adopted, 2017

Source: author's own computation from AFGROLAND survey (2017).

4.2.6 Results of the asset ownership analysis

The results of the asset ownership indicator were consistent with the food security measures reported above. Essential, durable assets such as bed mattresses, sofa sets, tables and mobile phones were owned by more than 90 percent of the households (Table 4.7). A high proportion of contract and counterfactual households owned agricultural equipment such as irrigation systems (98% and 52%, respectively), manual sprayers (94% and 81%, respectively) and oxcarts (8% and 27%, respectively). The ownership of domestic assets such as televisions, working radios, tapes recorders and electric stoves was higher among contract, employed and non-engaged and for a few households in the counterfactual group. Overall, contract households had more assets compared to the employed, counterfactual and non-engaged, respectively.

Table 4.7: Asset classes owned by households, 2017

Assets	Employed (n=48)		Contract (n=57)		Non-engaged (n=270)		Counterfactual (n=170)	
	Count	%	Count	%	Count	%	Count	%
Bed mattress	48	100.00	55	96.49	265	98.15	169	99.41
Sofa set	44	91.67	56	98.25	246	91.11	152	89.41
Table	46	95.83	55	96.49	259	95.93	164	96.47
Electric Stove	21	43.75	28	49.12	96	35.56	56	32.94
Working radio	41	85.42	53	92.98	231	85.56	144	84.71
Mobile phone	46	95.83	54	94.74	262	97.04	166	97.65
Tape/CD/DVD	13	27.08	21	36.84	80	29.63	29	17.06
Television	29	60.42	33	57.89	149	55.19	65	38.24
Plough	7	14.58	7	12.28	21	7.78	64	37.65
Weeder	25	52.08	21	36.84	97	35.93	50	29.41
Irrigation system	20	41.67	56	98.25	110	40.74	90	52.94
Ox-cart	3	6.25	5	8.77	15	5.56	47	27.65
Manual sprayer	37	77.08	54	94.74	194	71.85	139	81.76

Source: author's own computation from AFGROLAND survey (2017).

Almost a third of contract households reported owning assets from ten or more asset classes, making them more food secure in the face of food shocks (Figure 4.6). The results infer that contract households were likely more resilient than other household groups. A high proportion of employed (85%) households fell into the moderately resilient category compared to roughly the similar proportion of households in the contract (76%), non-engaged (75%) and counterfactual (74%) groups. On average, these households owned between six or ten asset classes.

About 15 percent of households in the non-engaged and counterfactual samples were classified as least resilient, compared to relatively fewer households in the employed (6%) and contract groups (1%). This implies that non-engaged and counterfactual households could be less resilient to shocks due to their low asset ownerships. The f-test showed that there was a statistically significant difference between the values of asset ownership among the groups of households (P value= 0.000) at 5 % level of significance.

Figure 4.6: Categorised asset ownership results, 2017

Source: author's own computation from AFGROLAND survey (2017).

4.2.7 Results of the Consolidated Approach to Reporting Food Security Indicators (CARI) analysis

As explained in the methodology section, the CARI console index was calculated using data for three food security indicators (food consumption score, food expenditure share and livelihood coping strategy) to obtain the food security index. The FCS data was used as a component of CARI and showed that more than 95 percent of all four household groups were food secure. Just over 60 % of all households in the four groups had low food expenditure shares, which classified them as food secure (Table 4.8).

Majority of the households adopted low livelihood coping strategies and fell into food secure category. However, some of households in counterfactual (43%) and non-engaged (34%) were adopting crisis strategies and therefore fell into the moderately food insecure category. According to the Food Security Index (FSI), more than 40 percent of households across four groups were classified as food secure and no household was severely food insecure. A small percentage of the households among contract, non-engage and counterfactual (less than 5%) were considered moderately food insecure. The dimensions of food security captured in the CARI console index showed consistency with the above food security measures. Overall, the

f-test showed a significant difference in CARI console index across the four groups of households at 5 % level of significant with a p-value of 0.000.

Table 4. 8: CARI console, 2017

Domain	Indicator	Household Group	Food secure (1)	Marginally food secure (2)	Moderately food insecure (3)	Severely food insecure (4)
Current Status (CS)	Food Consumption Score	Employed (%)	100.00	0.00	0.00	0.00
		Contract (%)	98.15	0.00	1.85	0.00
		Non-engaged (%)	99.53	0.00	0.47	0.00
		Counterfactual (%)	99.40	0.00	0.60	0.00
3Coping Capacity (CC)	Food Expenditure Share	Employed (%)	62.92	14.39	9.74	12.91
		Contract (%)	72.22	16.67	7.41	3.70
		Non-engaged (%)	65.24	18.54	6.41	9.81
		Counterfactual (%)	68.45	13.10	7.74	10.71
	Livelihood Coping Strategy	Employed (%)	75.76	0.00	23.28	0.00
		Contract (%)	87.04	0.00	12.96	0.00
		Non-engaged (%)	65.38	0.38	34.24	0.00
		Counterfactual (%)	55.36	0.00	44.64	0.00
Food Security Index (FSI)		Employed (%)	57.78	42.22	0.00	0.00
		Contract (%)	77.78	20.37	1.85	0.00
		Non-engaged (%)	54.29	45.24	0.47	0.00
		Counterfactual (%)	41.67	57.74	0.60	0.00

Source: author's own computation from AFGROLAND (2017).

4.3 Correlations amongst the food security indicators

A Spearman's correlation was used to examine the correlation coefficients amongst the five food security indicators (HDDS, FCS, MAHFP, CSI and Asset). The indicators were chosen because they capture different aspects of food security. The WDDS indicator was excluded from this analysis due to its low sample size. All food security measures were significantly correlated at a one percent significance level (Table 4.9). There was a positive correlation relationship between the FCS, HDDS, MAHFP and asset ownership indicator. As expected, the dietary diversity measures (HDDS and FCS) were relatively strongly correlated (r=0.636). The MAHFP indicator showed a weak positive correlation with the other indicators, except for the CSI. The CSI had a negative correlation relationship with the HDDS, FCS, MAHFP and asset indicator, which was expected as a low CSI portrays a level of food security. The findings

also revealed a moderate positive correlation of the FCS with the asset ownership indicator (r= 0.402). This can be explained by the fact that high asset ownership can increase household resilience.

Table 4.9: Spearman's correlations between food security indicators, 2017

	HDDS	FCS	MAHFP	CSI	Assets
HDDS	1.00				
FCS	0.636**	1.00			
MAHFP	0.221**	0.282**	1.00		
CSI	-0.230**	-0.229**	-0.505**	1.00	
Assets	0.363**	0.402**	0.291**	-0.256**	1.00

** Correlation is significant at the 0.01 level (2-tailed).

Source: author's own computation from AFGROLAND (2017).

4.4 Overall observations of the food security outcomes

Table 4.10 presents the summary of food security indicators. According to the HDDS and FCS measures, the vast majority (over 90%) of all households were classified as enjoying adequate dietary diversity. Very few households fell into the moderate or borderline dietary diversity categories. No households experienced poor nor inadequate dietary diversity. Overall, there were statistically significant differences between the household groups for these dietary quality indicators.

Regarding WDDS, the proportion of women consuming foods from various food groups differed between the dietary diversity categories. A very high proportion of female-headed contract (80%) households had diverse diets, consuming more than six food groups. In contrast, two-thirds of female-headed households among the non-engaged (67%) and over half of employed (53%) and counterfactual (51%) households consumed moderate dietary diversity diets. Very few female-headed households had inadequate dietary diversity.

For the months of adequate household food provision, the highest proportion of contract and employed households were food secure, followed by non-engaged and counterfactual households. However, the proportion of food secure households was lower than for the HDDS and FSC indicators.

Coping strategies are adopted by households in response to food shortages. Majority of households in the employed and contract group were food secure, while a similar proportion of all households were considered mildly food insecure. Some households in counterfactual, non-engaged and employed groups fell into the categories of moderately food insecure (over 20 %) and severely food insecure (less than 10%). The results infer that these households could not smooth consumption and regularly faced the need to adopt consumption-based coping strategies.

Very few households fell into the most resilient category for asset ownership. One-third (21%) of contract households fell into this group compared to ten percent of counterfactual and eight percent of the non-engaged and employed households. Over seventy percent of the households in the study area were moderately resilient, indicating their ownership of six to ten asset classes. The same proportion of households (15%) in non-engaged and counterfactual households were considered to have low assets holdings and were vulnerable to food insecurity.

The above analysis of food security indicators suggested that some households were classified as food secure for some indicators and food insecure for other indicators. Overall, the majority of households in all four groups were food secure in terms of the HDDS and FCS indicators. This was reiterated by the findings of the WDDS that indicated a higher proportion of contract female-headed households were more food secure than female-headed households in the other groups. Over 40 percent of all households had adequate food provision for more than eight months of the year. A slightly high number of households in contract and employed groups were food secure compared to non-engaged and counterfactual households in terms of the CSI. Contract households seemed to be more resilient in terms of asset holdings compared to other groups. According to most food security indicators, contract and employed households were more food secure than non-engaged and counterfactual households.

Table 4.10: Summary of food security outcomes, 2017

Indicator	Category no.	Category description	Range	Employed (n=48)	Contract (n=57)	Non-engaged (n=270)	Counterfactual (n=170)	F-test
				%	%	%	%	P-value
Household dietary diversity score (HDDS)	1	Adequate dietary diversity	≥ 6	90.29	96.43	92.37	95.86	0.000
	2	Moderate dietary diversity	4-5	9.71	3.57	7.63	4.14	
	3	Inadequate dietary diversity	≤ 3	0.00	0.00	0.00	0.00	
Food Consumption Score (FCS)	1	Acceptable	> 35	97.59	98.15	97.84	98.81	0.000
	2	Borderline	21.5- 35	2.41	1.85	1.45	1.19	
	3	Poor	0-21	0.00	0.00	0.71	0.00	
Women's dietary diversity score (WDDS)	1	Adequate dietary diversity	≥ 6	46.88	80.00	28.46	45.95	0.349
	2	Moderate dietary diversity	4- 5	53.13	20.00	67.10	51.35	
	3	Inadequate dietary diversity	≤ 3	0.00	0.00	4.44	2.70	
Month of adequate household food Provision (MAHFP)	1	Least food insecure	≥ 10	57.85	60.71	46.17	41.76	0.148
	2	Moderate food insecure	6- 10	39.75	35.71	51.10	54.12	
	3	Most food insecure	≤ 6	2.41	3.57	2.72	4.12	
Coping Strategy index (CSI)	1	Food secure	0-2	37.30	48.15	33.46	23.67	0.013
	2	Mildly food insecure	3-12	31.81	35.19	36.04	32.54	
	3	Moderately food insecure	13-40	22.29	14.81	25.12	38.46	
	4	Severely food insecure	>40	8.57	1.85	5.38	5.33	
Asset Indicator	1	Most resilient	≥ 10	8.05	21.43	8.90	10.06	0.000
	2	Moderately resilient	6-10	85.17	76.79	75.33	74.56	
	3	Least resilient	3-6	6.78	1.79	15.77	15.38	
CARI (Food Security Index)	1	Food secure		55.78	77.78	54.29	41.67	0.000
	2	Marginally food secure		42.22	20.37	45.24	57.74	
	3	Moderately food insecure		0.00	1.85	0.47	0.60	
	4	Severely food insecure		0.00	0.00	0.00	0.00	

Source: author's own computation from AFGROLAND (2017).

4.5 Results of food consumption patterns

This analysis explored the effect of large-scale agricultural investments on household food consumption practices. The PCA revealed three principal components or factor loadings patterns for each household category. The factor loadings for the food associated with each pattern are presented in table 4.11. The higher the factor loadings for food, the stronger the association of that food with a pattern. However, a negative factor loading indicated the lower use of a coping strategy (McCann et al., 2011). Food types that clustered together on the primary factors in the analysis were more likely to be consumed together and constitute a significant part of the household's diet.

Table 4.11 sets out the results of the PCA analysis for food groups. Some food groups (condiments, fish and seafood, oil and fats) were dropped in the analysis due to homogeneity in the data. The first principal components (PC1) indicates that there were noticeable differences between the food consumption patterns of employed. Contract, non-engaged and counterfactual households. The diets of employed households were more diverse than other groups, given that they regularly consumed cereals, eggs, fruit, meat, vegetables and white roots together. Contract households were more likely to consume cereals, condiments, milk, oils and vegetables together. The non-engaged households had the least diverse dietary consumption pattern in contrast to other groups. Cereals, condiments, oils and vegetables were more likely to be consumed together by non-engaged households. The food consumption pattern of counterfactual households was more diverse compared to non-engaged households. Counterfactual households were more likely to consume eggs, fruit, meat, oils and vegetables together. Sweets were less likely to be consumed by the counterfactual households. Possible reason for employed households to have diverse food consumption patterns maybe due to the income received by employed households from large-scale agribusiness.

Table 4. 11:Pattern matrix of food consumption

Food type	Employed			Food type	Contract			Food type	Non-engaged			Food type	Counterfactual		
	PC1	PC2	PC3		PC1	PC2	PC3		PC1	PC2	PC3		PC1	PC2	PC3
Cereals	0.653			Cereals	0.339			Cereals	0.359			Vegetables	0.412		
White roots and tubers	0.513			Vegetables	0.424			Vegetables	0.522			Fruits	0.487		
Vegetables	0.330			Milk& milk products	0.424			Oils and Fats	0.522			Meat	0.388		
Fruits	0.499			Oil and fats	0.424			Condiments	0.436			Eggs	0.395		
Meat	0.528			Condiments	0.424			Fruits		0.442		Oils and Fats	0.383		
Eggs	0.473			Fruits		0.516		Meat		0.571		Cereals		0.544	
Legumes		0.472		Meat		0.550		Eggs		0.502		Legumes		0.533	
Milk &milk products			0.3638	Eggs		0.447		Fish and seafood		0.302		Sweets			0.602
				Legumes			-0.464	White roots and tubers			0.411				
				Sweets			-0.607	Legumes			0.668				
								Sweets			-0.548				
Eigenvalue	1.73	1.30	1.24	Eigenvalue	5.19	1.89	1.23	Eigenvalue	3.27	1.47	1.26	Eigenvalue	1.68	1.45	1.25
Percentage variability	49.2	14.4	13.8	Percentage variability	43.2	15.7	10.3	Percentage variability	27.3	12.3	10.5	Percentage variability	15.3	13.2	11.3

Source: author's own computation from AFGROLAND survey (2017).

4.6 Results of coping strategies adopted

The PCA results in Table 4.12, showed that a total of 12 coping strategies were included in the analysis. There were variations in patterns of coping strategies adopted by four categories of households. Employed households frequently adopted six coping strategies, two of which were regarded as most severe (thus gathering of wild foods and skip eating days). The other four primary strategies that were less severe included borrowing of food, eating elsewhere, limiting the portion sizes and restricting the consumption of adults. The employed households hardly adopted strategies such as consumption of seed stocks and reducing the number of meals.

Contract households generally implemented five coping strategies: eating less expensive foods, gathering wild food, restricting consumption of adults, and reducing the number of meals. The analysis showed that contract households adopted fewer and less severe strategies making them food secure in comparison to employed, counterfactual and non-engaged households. This could be due contract households having high assets ownership (such as larger size of land, high number of livestock etc) making contract households more resilient against food shocks. Contract households occasionally adopted fewer, less severe strategies such as borrowing food and limiting portion sizes. The consumption of seed stock held for next season was rarely practised among contract households.

The non-engaged households generally adopted six coping strategies, as shown in the first principle component (PC1) results in Table 4.12. Five of the adopted strategies were less severe along with skipping eating strategy that was regarded as most severe strategy. The non-engaged households also occasionally adopted the severe strategy of sending household members to beg for food and a less severe strategy of sending household members to eat elsewhere and restricting the consumption of adults. Similarly, the counterfactual households also adopted six coping strategies (PC1), five of which were similar to those of adopted by non-engaged: borrowing food, consuming less expensive food, reducing the number of meals eaten in a day and skipping entire days without eating. Restricting the consumption of adults was the other primary strategy implemented by the counterfactual households. Coping strategies such as consuming seed stock, feeding working members and purchasing food on credit were rarely practised by the counterfactual households. Counterfactual households occasionally sent household members to eat elsewhere and sent household members out to beg for food.

Table 4. 12: Pattern matrix of coping strategies adopted

Coping strategy	Employed			Coping strategy	Contract			Coping strategy	Non-engaged			Coping strategy	Counterfactual		
	PC1	PC2	PC3		PC1	PC2	PC3		PC1	PC2	PC3		PC1	PC2	PC3
Borrow food	0.345			Less expensive	0.380			Less expensive food	0.385			Less expensive food	0.390		
Gather wild food	0.327			Purchase food on	0.443			Borrow food	0.307			Borrow food	0.348		
Eat elsewhere	0.332			Gather wild food	0.473			Purchase food on credit	0.395			Limit portion size	0.403		
Limit portion size	0.304			Restrict cons of	0.440			Limit portion size	0.376			Restrict cons of adults	0.355		
Restrict cons.	0.382			Reduce no of meals	0.423			Reduce no of meals	0.408			Reduce no of meals	0.407		
Skip eating days	0.338			Borrow food		0.350		Skip eating days	0.324			Skip eating days	0.361		
Purchase food on		0.414		Limit portion size		0.591		Eat elsewhere		0.488		Eat elsewhere		0.556	
Feed working		0.422		Consume seed stock			0.311	Begging		0.537		Begging		0.582	
Consume seed stock			0.563	Eat elsewhere				Restrict cons of adults		-0.344		Purchase food on credit			0.517
Reduce no of meals			-0.673	Begging				Gather wild food			0.837	Consume seed stock			0.309
Less expensive				Feed working				Consume seed stock				Feed working members			0.333
Begging				Skip eating days				Feed working members				Gather wild food			
Eigenvalue	5.75	1.58	0.99	Eigenvalue	3.51	1.58	0.97	Eigenvalue	3.15	1.83	1.06	Eigenvalue	2.81	1.52	1.28
Percentage	52.3	14.3	9.1	Percentage	43.9	19.8	12.1	Percentage	28.6	16.6	9.6	Percentage	23.4	12.7	10.6

Source: author's own computation from AFGROLAND survey (2017).

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Synopsis of the research findings

The study's overall objective was to understand how large-scale agricultural land investments in the Nanyuki area of Kenya affected household's food security. Three sub-objectives and three hypotheses guided the study. The first hypothesis being: food security levels would be high for households within the zone of large-scale agricultural investments compared to the counterfactual households. Sub-objective one tackled this by comparing the food security status of the employed, contract, non-engaged and counterfactual households with the use of several food security indicators.

No baseline data to compare household food security levels before the arrival of large-scale agricultural investments in the study area. The study findings showed that large-scale agricultural investments did not lower or negatively affect the food security levels of households within the factual zone and therefore the study accepted the first hypothesis. The study noted that contract households had higher dietary quality, along with higher resilience and food security. The steady income received by employed households enabled asset accumulation, diverse diets and smoothed consumption. Non-engaged households had acceptable diets along with adoption of some severe strategies. Female-headed households displayed moderate levels of dietary diversity in the factual zone area. Counterfactual households had acceptable dietary quality and adopted few severe coping strategies such as consuming seed stocks, compromising their long-term food consumption.

The second hypothesis of the study state that large-scale agricultural investments have no effects on household consumption patterns. However, the analysis showed that employed households had diverse and quality food consumption patterns compared to other households. Therefore, the second hypothesis is rejected. The study further explored the argument underlying the third hypothesis that contract households would adopt fewer coping strategies patterns and have less difficulty coping with food price shocks given that they could produce food on their own land in the absence of large-scale agricultural investments. The results illustrated that employed households had diverse food consumption patterns, adopting some coping strategies. The contract farming households were regarded as food

secure with diverse food consumption patterns. The non-engaged households had the least diverse diets and experienced high levels of food insecurity. The counterfactual households seemed to enjoy diverse food consumption patterns. However, they also adopted many coping strategies, including some severe coping strategies that are likely to compromise their ability to secure long-term food consumption. Therefore, the third hypothesis of this study was accepted.

5.2 Conclusions and recommendations

In conclusion, the study notes that different levels of food security status exist among employed, contract, non-engaged and counterfactual households. The income received by employed households smoothed consumption and provided adequate food provision. However, employed households were faced with the need to adopt coping strategies that may have compromised long-term food security. Contract farming earnings improved household dietary diversity, food provision and more asset accumulation which may provide relief in the face of food security shock. Similarities between non-engaged and counterfactual households were noticeable in terms of dietary diversity, asset ownership and the adoption of some severe coping strategies that erode resilience. Very few female-headed households were offered employment or contracted by the large-scale agribusiness companies. Overall, the findings of first objective led to the conclusion that large-scale agricultural investments in Nanyuki area of Kenya had the potential to improve household food security, particularly when contract households are incorporated in the agribusiness farming operations.

Overall, it is difficult for the study conclude that large-scale agricultural investments have a responsive positive effect on household food security due to lack of a baseline study. However, distinct food consumption patterns were seen between employed, contract, non-engaged and counterfactual households. Large-scale agricultural investments improved dietary diversity and food quality, particularly for employed households. Lastly, the study demonstrated that households in both factual zone and counterfactual zone adopted some level of coping mechanism when faced with food shortages. Contract households tended to adopt less severe food coping strategies that were less likely to compromise their long-term food consumption.

The implications of the findings are to ensure that local government, policy makers, investors and local stakeholders must consider the agribusiness investments that do not compromise the sustainability of household food security. This means that recipient governments should not be quick to accept or dismiss large-scale agricultural investments. There is need to critical weigh the benefits and risks in terms of all stakeholders within the vicinity of the agribusiness farms. Few female-headed households were involved with the large-scale agricultural investments. This calls for government policies that foster gender equity by ensuring that women also benefit from opportunities offered by large-scale agricultural investments, strengthening women 's access to productive resources such as land, inputs, farming equipment and market information. Based on the results and the conclusion of the study, it is further recommended that policy makers should consider policies that promotes contract farming scheme when introducing large-scale agricultural investments. This could potentially improve food security realisation thereby improving access to inputs, output markets, farming skills through training and facilitating credit for contract farming households when incorporated into the investor farming operations.

This study used cross-sectional data, which makes it difficult to quantify the food security status over a long period of time. The reason may be that season in which data was collected influenced the food security positively. It is therefore, recommended that future study make use of panel data, pre and post data that can assess food security status across different time periods.

5.4 The contribution to knowledge

This study has contributed to the existing body of literature on large-scale agricultural investments, narrowing it down to country-specific within Africa instead of the broader context. The study has also contributed to the ongoing debate of how large-scale agricultural investments impact food security at the household level. It has provided new evidence for governments, investors, civil society organisations, smallholder farmers and policymakers to consider when negotiating large-scale agricultural investments.

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ANNEX 1: FOOD SECURITY SURVEY QUESTIONNAIRE

	Did household members eat this food in the last 24 hours?	How many days per week is this food group usually eaten in the household?	How many days per month is this food group usually eaten in the household?	Where was the food obtained from (source)?	Where was the food obtained from other
Cereals Consumption *Cereals: maize, rice, wheat, sorghum, millet, and any other foods made from cereals such as porridge, bread and noodles*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
White roots and tubers Consumption *White roots and tubers: Potatoes, white sweet potato and cassava*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town	

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				• Supermarket in town • Other(Restaurants, middlemen…)	
Orange-flesh vegetables Consumption *Orange-flesh vegetables: Pumpkin, carrot, butternut or sweet potato*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
Dark green leafy vegetables Consumption *Dark green leafy vegetables, including wild/indigenous vegetables*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town	

	Did household members eat this food in the last 24 hours?	How many days per week is this food group usually eaten in the household?	How many days per month is this food group usually eaten in the household?	Where was the food obtained from (source)?	Where was the food obtained from other
				• Supermarket in town • Other(Restaurants, middlemen…)	
Other vegetables Consumption *Other vegetables: tomato, onion, green beans, gem squash, eggplant, including wild/indigenous vegetables*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
Orange-coloured fruit Consumption *Orange-coloured fruit:ripe mango, apricot, spanspek, papaya, dried peach and 100%*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town	

	Did household members eat this food in the last 24 hours?	How many days per week is this food group usually eaten in the household?	How many days per month is this food group usually eaten in the household?	Where was the food obtained from (source)?	Where was the food obtained from other
fruit juice made from				• Supermarket in town • Other(Restaurants, middlemen…)	
Other fruit Consumption *Other fruit: oranges, banana, apple, pear etc.), including wild/indigenous vegetables*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
Organ meat Consumption *Organ meat: liver, kidney, heart or other organ meats or blood-based*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town	

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				• Supermarket in town • Other(Restaurants, middlemen…)	
Meat Consumption *Meat: beef, goat, sheep, poultry, pork, insects*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
Eggs from any animal Consumption *Eggs from any animal*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops	

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				• Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
Fish and Seafood Consumption *Fish and Seafood: fresh, tinned or dried and shellfish*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
Dried beans Consumption *Dried beans, peas, lentils, nuts, seeds or foods made from these*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops	

	Did household members eat this food in the last 24 hours?	How many days per week is this food group usually eaten in the household?	How many days per month is this food group usually eaten in the household?	Where was the food obtained from (source)?	Where was the food obtained from other
				• Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
Milk Consumption *Milk and milk products (e.g. yoghurt, maas cheese)*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
Oils and fats Consumption *Oils and fats: e.g. sunflower, margarine, lard, butter added to*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops	

	Did household members eat this food in the last 24 hours?	How many days per week is this food group usually eaten in the household?	How many days per month is this food group usually eaten in the household?	Where was the food obtained from (source)?	Where was the food obtained from other
food or used for cooking				• Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
Sweets Consumption *Sweets: e.g. sugar, honey, sweetened juices or fizzy drinks, sugary foods such as chocolate*	• Yes • No			• Self Production • Donations/event Gift/food bank/school feeding • Local Market • Local shops • Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	
Spices Consumption	• Yes • No			• Self Production • Donations/event Gift/food	

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Spices (e.g. pepper and salt), condiments (e.g. tomato sauce), coffee, tea, alcoholic beverages				bank/school feeding • Local Market • Local shops • Small shop in town • Supermarket in town • Other(Restaurants, middlemen…)	

Section F: Coping Strategies

F92. In the past 7 days, how many days, your household used this mechanism: Rely on less preferred and less expensive foods? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7
F93. Borrow food, or rely on help from a friend or relative? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4

	• 5 • 6 • 7
F94. Purchase food on credit? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7
F95. Gather wild food, hunt, or harvest immature crops? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7
F96. Consume seed stock held for next season? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7

F97. Send household members to eat elsewhere? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7
F98. Send household members to beg? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7
F99. Limit portion size at mealtimes? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7
F100. Restrict consumption by adults in order for small children to eat? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5

	• 6 • 7
F101. Feed working members of HH at the expense of non-working members? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7
F102. Reduce number of meals eaten in a day? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7
F103. Skip entire days without eating? *Show how many days, in the last 7, did the household engage in these mechanisms?*	• 0 • 1 • 2 • 3 • 4 • 5 • 6 • 7

Section F Experience of Hunger

F81. In the past 12 months, did any adult (18 years and above) in this household go hungry because of a lack of resources to get food?	• Never • Rarely (1 – 2 times a month) • Sometimes (3 – 10 times a month) • Often (more than 10 times a month) • Always • Not applicable (No adults in household)
F82. In the past 12 months, did any child (17 years or younger) in this household go hungry because of a lack of resources to get food?	• Never • Rarely (1 – 2 times a month) • Sometimes (3 – 10 times a month) • Often (more than 10 times a month) • Always • Not applicable (No adults in household)
F83. In the past 12 months, did any child (17 years or younger) in this household eat less often than you feel they should because of a lack of resources to get food?	• Never • Rarely (1 – 2 times a month) • Sometimes (3 – 10 times a month) • Often (more than 10 times a month) • Always • Not applicable (No adults in household)
F84. In the past 12 months, did any child (17 years or younger) in this household eat smaller meals than you feel they should because of a lack of resources to get food?	• Never • Rarely (1 – 2 times a month) • Sometimes (3 – 10 times a month) • Often (more than 10 times a month) • Always • Not applicable (No adults in household)
F85. In the past 12 months, was there any young person, aged 5 - 17 years, who has left this household, and you do not know his/her whereabouts or to live on the streets?	• Yes • No • Do not know • Not applicable (No children in household)

F86. Did your household run out of money to buy food during the past 12 months?	• Yes • No
F87. Has it happened 5 or more days in the past 30 days?	• Yes • No
F88. Did you cut the size of meals during the past 12 months because there was not enough food in the house?	• Yes • No
F89. Has it happened 5 or more days in the past 30 days?	• Yes • No
F90. Were there months, in the past 12 months, in which you did not have enough food to meet your family's needs?	• Yes • No
F91. Which were the months (in the past 12 months) in which you did not have enough food to meet your family's needs?	• January • February • March • April • May • June • July • August • September • October • November • December