The influence of large-scale investments in agricultural land on household food security in the Gurué and Monapo districts of Mozambique

by

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Abstract

Empirical evidence of the impact of large-scale land transfers on household food security is scarce in Africa. Large-scale agricultural investments have the potential to achieve long-term development objectives such as improving access to markets and technology, scaling up physical infrastructure and providing improved opportunities for employment. At times, these investments occur at the expense of rural communities. Displacement and environmental degradation can occur eroding local development.

This study investigated the effect of large-scale agricultural investments on food security in the Monapo and Gurué districts of Mozambique as part of a larger project called AFGROLAND that set out to improve the understanding of how changes in the global agricultural, food and energy system affect countries in Africa. The study used both descriptive and statistical models. The sample of 504 households included households (i) in which at least one member was employed by the large-scale investment agent in the areas selected for the study (ii) households in the same area that were not employed by the agribusiness (termed non-engaged households) and (iii) counterfactual households from another community without a large-scale investment. The study made use of seven food security indicators. These were compared and evaluated through the use of Principle Component Analysis.

Although a third of households in the factual zones reported having lost land through displacement because of plantation expansion, severe hunger and food insecurity were not commonly observed from the assessment of the seven indicators. Employed households reported better dietary quality (measured as Household Dietary Diversity Score, Food Consumption Score and Women's Dietary Diversity Score), food security (measured as the Consolidated Approach for Reporting Indicators of Food Security), and resilience in terms of food security (measured as Coping Strategy Index, Monthly Adequate Household Food Provision and Asset ownership). Overall, the counterfactual households had better dietary quality than non-engaged households in the factual zones. In the case of female-headed households, the dietary quality was worse among employed households as women had less time to gather firewood and prepare food.

The study concluded that large-scale agricultural investments may provide employment opportunities in remote areas and improve household food security. It is not possible to draw concrete conclusions on whether the large-scale agricultural investments had a negative effect

on household food security as the results could be influenced by a number of factors inclusive of climate change, soil quality and gradient, in addition to human factors such as infrastructure development, health and sanitation. However, policymakers and investors should insist on employment quotas for women when providing access to employment. Food security concerns should remain a key consideration for government assessment of investment opportunities with appropriate policy measures implemented to minimize the risks to households' food security and livelihoods (such as lost access to land and environmental degradation). Monitoring and evaluation of the impacts of large-scale agricultural investments should be conducted.

Declaration

I, Zaka Diana Mawoko, student 11210291, declare that the dissertation, which I hereby submit for the degree MSc Agric (Agricultural Economics) at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

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Signature Date

Dedication

This project would not have been possible without the support of my Lord and Saviour, Jesus Christ, my supervisor Prof. S. Hendriks and my amazing parents, Dr. Philippe Kuhutama and Mrs. Eugenie Makwela Mawoko who truly kept me going through my studies. I would like to express my sincere appreciation and gratitude for their intellectual guidance, encouragement and support.

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Table of Contents

List of Acronyms and Abbreviations

ATE	Average Treatment Effect
ATT	Average Treatment Effect on the Treated
CARI	Consolidated Approach for Reporting Indicators of Food Security
CSI	Coping Strategy Index
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agricultural Organization
FCS	Food Consumption Score
FSIN	Food Security Information Network
HDDS	Household Dietary Diversity Score
IFPRI	International Food Policy Research Institute
LSAI	Large-Scale Agricultural Investments
MAHFP	Months of Adequate Household Food Provision
MDGs	Millennium Development Goals
PCA	Principle Component Analysis
PSM	Propensity Score Matching
SDG	Sustainable Development Goals
UN	United Nations
UNEP	United Nations Environment Programme
UNECA	United Nations Economic Commission for Africa
WDDS	Women's Dietary Diversity Score
WFP	World Food Programme

List of Figures

List of Tables

Chapter One: Introduction

1.1. Background

Achieving national food security requires a host of complementary factors such as increased food production, access to information and markets, improved infrastructure and good health (FAO, 2017). To feed nine billion people globally by the year 2050, more research, technological development and investment in agriculture and international trade will be necessary; this is true in Sub-Saharan Africa where the population is projected to nearly double (FAO, 2013).

Africa has one of the world's fastest growing populations (Campos, 2017). This growth in both the economy and population has contributed to an increase in the net inflow of foreign direct investments (Ahlerup & Tengstam, 2015). Large-scale agricultural investments have recently gained increasing attention due to the accelerated pace at which land deals took place after the 2007/2008 world food and economic crisis (Anseeuw, et al., 2013). Over the last ten years, foreign investment in African land increased by 70 percent (The World Bank, 2017).

Africa is an attractive prospect for many foreign investors due to their perceptions about the availability of cheap land and labour, coupled with few stringent legal obligations compared to other regions of the world (Aabø & Kring, 2012) (Anseeuw, et al., 2013). Here, agriculture is generally characterised by poor smallholder farmers with low yields, small plots and low levels of commercialisation (Aabø & Kring, 2012) (Collier & Dercon, 2009). Large-scale investments in land could offer opportunities for economic development and improvements in food security. Such investment could stimulate agricultural transformation by generating the demand for labour and improve access to new technologies and credit (Cotula & Oya, 2014). For the majority of the rural population that depends on agriculture, investment in land could have a potential influence on economic development and in effect, food security. Large-scale land investments could contribute to the improved gross domestic product, export growth, foreign exchange earnings, employment opportunities in related sectors, improved infrastructure, technological diffusion and market access to local community members (Cotula, 2009) (Deininger, et al., 2015) (Hall, 2011). Investors may facilitate access to markets for smallholders in the surrounding areas, providing opportunities for access to food, water and livelihoods (Deininger, et al., 2015).

However, there are conflicting views about the benefits and ethics of these acquisitions in developing countries. Deininger *et al.* (2015), assert that the benefits from large-scale agricultural investments do not always lead to notable increases or improvements to the access to jobs, output markets, and production yields. Investors could prioritise their own drive for profit at the expense of vulnerable communities, leaving them displaced and without adequate compensation (Aabø & Kring, 2012). For example, large-scale agricultural investments may lead to the development of super or mega farms characterised by monopolies with land exploitation and limited benefits for the community (Collier & Dercon, 2009). Non-government organisations such as GRAIN claim that these acquisitions are a threat to the livelihoods of local people through displacement, rising land prices and limitations of access to water, firewood and other natural resources. In the context of increasing the pressure on land, these investments may also have negative environmental impacts (GRAIN, 2015). Large-scale agricultural investments could restrict people's access to land and other productive resources, including income, impinging on their right to food (Zhan, et al., 2015).

Case studies that have analysed the effects of large-scale investments note that the expected positive spillovers or benefits have often not materialised (Anseeuw, et al., 2013) (Deininger, et al., 2015). In many cases, the projects have failed due to a lack of technically qualified investors, unsustainable finance and poor coping methods due to the complexity of agricultural production (Anseeuw, et al., 2013) (Deininger, et al., 2015).

While academic and popular media express concern over the possible negative effects of large-scale agricultural investments in developing countries (Anseeuw, et al., 2013), little empirical evidence exists on the impact of these investments on the food security of local communities.

1.2. Statement of the problem

Since the 2007/2008 world food crisis there has been renewed interest in agriculture and a rush to acquire land to increase agricultural production (Cotula, 2009) (Anseeuw, et al., 2011). The impact of this rush has an effect on land availability, a households engagement in agriculture and supply chains, however the status on food security at the local and household level has not really been assessed as evaluations typically focus on short-term case studies level, without considering broader agrarian and socio-economic transformations (Borras, et al., 2013). Against this backdrop, the objective of the project was to analyse how land acquisitions affect local food security outcomes in two districts in Mozambique where large-scale agribusiness operate.

1.3. Study objectives

The general objective of the study was to investigate the empirical evidence of the food security effects of large-scale agricultural investments in two districts of Mozambique. The study was structured around two specific objectives set out below.

Specific objective 1: To compare the prevalence and level of household food security between employed, non-engaged and counterfactual household samples in these two areas.

Specific objective 2: To compare the seven food security indicators among employed, non-engaged and counterfactual households and use the Principle Component Analysis to verify the findings.

1.4. Research Hypotheses

This research investigated the effects of large-scale agricultural investments and whether differences existed between household food security in two different districts of Mozambique, and focused on the following hypotheses:

- Hypotheses 1: Differences exist in the prevalence and level of household food security among employed, non-engaged and counterfactual households. It was expected that

counterfactual households would have a better status of household food security. According to (GRAIN, 2015), households that are not subjected to lost access to land due to displacement would not be negatively affected as they have means on which to produce their food. The agricultural investments would not have to fit a modernistic development trajectory characterised by large scale monoculture for export production which could extensively change the local food system thereby negatively affecting household food security and diversity of foods consumed by individuals (Borras & Franco, 2012).

- Hypotheses 2: Differences between the seven food security indicators among the employed, non-engaged and counterfactual household groups will exist and the Principle Component Analysis will verify this. It was expected that food security indicators would be consistent and converge, for example if households have poor dietary quality then expectations in resilience to shocks would also be low. The study expects that the counterfactual household groups will have indicators that are more food secure than employed and non-engaged households. The indicators selected present information on household food security that had been obtained by individuals, According to (GRAIN, 2015), households that are not subjected to lost access to land due to displacement would not be negatively affected as they have means on which to produce their food. In the traditional food systems, before investment takes place, the population engaged in agriculture would be high with food production mostly small-scale and requiring low external inputs (Dekeyser, 2019).

1. 5. Outline of the dissertation

The dissertation constitutes of five chapters. In the first and introductory chapter, the background of the study, statement of the problem and objectives of the study have been presented. Chapter two reviews the literature related to large-scale agricultural investments, the land situation in Mozambique, food security evaluation methods and empirical studies. Chapter three provides the methodology. Chapter four presents the research results and discussion inclusive of the Principle Component Analysis and finally, chapter five concludes the study and provides the summary, conclusions and recommendations.

Chapter Two: Literature Review

2.1. Introduction

Chapter two reviews the literature related to large-scale agricultural investments, food security in various contexts, how it is measured and its relationship to large-scale agricultural investments. Due to the location of the study, the land situation in Mozambique is reviewed and the gender component is included.

Large-scale agricultural investments date back to the emergence of commodity trade in products such as rubber, sugarcane and tea (Kugelman, et al., 2013). In earlier periods, most of the investors in Africa, Asia and Latin America were from Europe or the United States of America (laFrancesca, 2013). The rate at which the investment in large-scale agricultural acquisition increased after the 2007/2008 world economic crisis led to a new global interest and debates being published in the media, foreign policies and NGO reports with the effects on food security at the household level not being known.

Food security is understood in terms of livelihoods that are sufficient, robust and sustainable enough to supply adequate food to a household (Devereux & Maxwell, 2001). As per the commonly accepted notion by the 1996 World Food Summit, "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 lifestyle" (FAO, 1996). A number of dimensions are embedded in this definition including access to adequate and acceptable quantities of food, availability to food for sustaining livelihoods and human wellbeing, utilisation of available nutrients within the food and stability of food supply in a climate of political peace.

The complexity of food security eludes measurement through a single indicator. The different food security indictors should not be used interchangeably for example, the household dietary diversity indicator that depicts the diversity or range of food groups should not be substituted with the asset ownership index, which shows the resilience as this could mislead the estimated number of food insecure households and individuals. Despite the important implications that large-scale agricultural investments have for food security at the advocacy and policy levels, few studies have examined these effects (Mawoko, et al., 2018). The studies in existence present research methodologies that surround the controversy of large scale-agricultural

investments and their impacts on development benefits, socio-economic outcomes and the environment in the broad sense (Anseeuw, et al., 2013) (Borras, et al., 2013) (Cotula, 2009) (Deininger, et al., 2015) and little analytic attention has been paid to household food security (Mawoko, et al., 2018).

One of the drivers of large-scale agricultural investments is the exporting of food to food-insecure states that lack the production resources for food, which include land and water (De Schutter, 2011). This could lead to the exploitation of resources for the individuals in the native counties leaving the local communities hungry and food insecure. (De Schutter, 2011) (GRAIN, 2015).

Halving hunger and malnutrition by 2015 was a target of the Millennium Development Goals (MDG), a goal that 72 of 129 countries reached. Further evidence of the global prioritisation to reduce hunger and malnutrition is identified in goal two of the Sustainable Development Goals (SDG), which seeks to "end hunger, achieve food security, improve nutrition and promote sustainable agriculture by 2030" (FAO, 2015; United Nations (UN), 2016). Although the global levels of hunger and malnutrition have been declining over the years, a number of factors have undermined efforts to end hunger and malnutrition worldwide. This includes the persistence of inequalities such as discrimination in access of women and marginalised ethnicities to education, healthcare and resources (Von Grebmer, et al., 2017).

Food security and ensuring that the people in the world have adequate food is becoming an increasing challenge for the global community (Mozumdar, 2012). Approximately 821 million people around the world are undernourished and face severe food insecurity, which appears to be increasing in almost all sub regions of Africa and South America (FAO, 2018). Conflict, adverse climate events and the negative economic conditions affect food insecurity in some developing countries. The socio-economic, agro-ecology, history and political environment are indicators that demand attention when livelihoods and food security are called into question (Zhou, 2019). Achieving food security is imperative but doing so is a complex. According to Sen (1981), food security was viewed as a household purchasing power that could be affected by income and other resources, market integration, price policies and market conditions. Agricultural land is the pinnacle to the social and economic status of households in many African countries and the effects on food security may be influenced by large-scale agricultural investments.

Large-scale agricultural investments have been defined as the acquisition or long-term lease of large areas of land by investors for multiple purposes, which may be categorised into three main components (Borras, et al., 2013) (De Schutter, 2011):

- Agricultural production to produce food, often for export, animal feed and energy
- Environmental importance to allow for the adaptation and mitigation of climate change through carbon offsets by planting trees
- Water grabbing, a process whereby, investors are able to take control of, or reallocate to their own benefits, water resources already used by local communities on which their livelihoods are based which plays a crucial role in agricultural production

Numerous civil society organisations caution against the potentially devastating social and environmental impacts of commercial agriculture expansion as land tenure in African countries is usually conducted through traditional or customary arrangements that do not always protect statutory law (Schoneveld, 2017). It may be argued that large-scale agricultural investment could be increasingly exposing people to involuntary land expropriation (German, et al., 2016).

2.2. Overview of global food security

FAO data demonstrates that enough food is produced globally to meet the demands of those on earth. However, one in every nine people, are chronically undernourished and are unable to access sufficient food (FAO, 2018). The statistics indicate that the numbers of people facing hunger and malnutrition are increasing with nearly 821 people in 2017 from 804 million in 2016 (FAO, 2018). Over recent decades, trends in general food production have been positive (FAO, 2018).The past six decades have seen more substantial economic growth, positive progress in agricultural productivity, increases in per capita food availability and numerous efforts to address hunger with the global levels of hunger and malnutrition declining over the years (Stringer, 2016). Countries that have been associated with high food availability generally have lower levels of undernourishment (FAO, 2018).

A number of countries equate food security to food self-sufficiency, even though evidence has shown that hunger coexists with abundant food supplies at the regional, national and international level, as was the case in Ethiopia during the 1972-1975 famine that led to 50-200

thousand people starving to death (Stringer, 2016). Sen demonstrated the importance of access to food by individuals as the greatest constraint to food security (Devereux & Maxwell, 2001).

Food security remains a priority in Africa where adverse conditions such as harsh droughts and crop failures as a result of the changing climate have led to a high degree of food insecurity and malnutrition (FAO, 2018). This affecting 70 percent of the rural population that depend on agriculture (FAO, 2017). Food security is closely related to agricultural production for households that produce their own food and the many challenges facing the agricultural food systems (Aabø & Kring, 2012). A number of factors including deep and persistent inequalities such as discrimination in access of women and marginalised ethnicities to education, healthcare and resources have undermined efforts to end hunger and malnutrition worldwide, emerging strongly among populations that are already vulnerable and disadvantaged (Von Grebmer, et al., 2017).

2.3. Measuring food security

Food security is a multidimensional concept and a single indicator cannot be used to measure it (Wineman, 2014). Food security indicators fall under three broad measures namely consumption, anthropometrics and experiences (Hendriks, et al., 2016). These measures address the quality (dietary diversity and micronutrient sufficiency), food safety, food preferences, and changing behaviour in consumption over time (Maxwell, et al., 2014). The consumption measures involve the disappearance and the recall method (Hendriks, et al., 2016). The disappearance method considers how much a household produces or purchases in a given time period whereas the recall method considers what an individual ate over the last day to calculate the caloric intake. These methods are said to be flawed, as they are silent to the sustainability of food security and that not all members of the household are taken into consideration, it is also dependent on memory (Hendriks, et al., 2016).

Anthropometric measures involve the calculation of the body mass index, waist circumference and proportion of body fats. Food security status is then expressed in a number of forms including stunting and wasting. The anthropometric approach is problematic as the nutritional status is determined by a number of factors to which food security is a single contribution (Maxwell, et al., 2014). The perception measure has been used by many countries to measure food security and involves the modification of particular indicators (Hendriks, et al., 2016).

Food security indicators have developed over the past decade from age-adjusted per-capita caloric intake considered as the standard, to measuring access to food at the household level and anthropometric measures at the individual level. Many food security indicators are now made easier to use in the field contexts, indicating food access without the complicated in-depth measures relative to biological requirements and food availability of trade and production information are categorised as dietary diversity and food frequency (Maxwell, et al., 2014).

According to Hendriks *et al* (2016), household food security is dependent on two things namely the economic status and social networks. Firstly, the economic status of a household, which refers to the income received and assets available in a particular household; and Secondly, the social networks affiliated with the household that relates to the community life and the ability to receive assistance in times of need. It has been observed that households diversify their income in anticipation of future food shortages. In areas where people depend on "purchased" foods, income is a key variable in determining food security. To cope with food insecurity household activities include increased production of food such as subsistence farming, increased labour force participation rates, substitution of diets with cheaper foods, reducing unnecessary expenditure, the sale of assets, the reduction of food intake and buying food on credit (Devereux & Maxwell, 2001) (Stevenson, 2011) (Hendriks, et al., 2016). The highlighted coping strategy information provides understanding of how households are able to be resilient and food secure when adapting to various situations. The coping strategy applied plays an important role in measuring the food security status of a household.

2.4. Trends in large-scale agricultural investments in Africa

The acquisition of large amounts of land is not new in developing countries, however, the speed at which land acquisition is happening warrants attention (Anseeuw, et al., 2013). According to the Land Matrix, a significant increase in large-scale agricultural investments has been noted in Africa since the year 2000, accounting for 642 deals (Anseeuw, et al., 2016). The renewed interest in the agricultural sector was met with great optimism by numerous African governments as the investment was attractive to support agricultural modernisation and rural poverty alleviation (Schoneveld, 2017). These acquisitions may take the form of purchases or long-term (99 year) leases or concessions of more than 200 hectares by an investor for the purpose of agricultural production (food, feed or biofuel production), timber, carbon trading, mineral extraction, conservation or tourism (The Land Matrix, 2016).

The 2007 and 2008 food price spike, together with perceived information that several countries were endowed with large amounts of seemingly unclaimed or under-utilised land triggered an increased interest in investment on agricultural land (Anseeuw, et al., 2011) (Hall, 2011) (Deininger, et al., 2015). Other contributing drivers that led to the sustained increase of the land investments after the 2007 and 2008 food crisis include the need by insecure food importing countries to improve their food security situation, obtaining energy and manufacturing resources and generating profit from private investments (Deininger, et al., 2015) (Cotula & Blackmore, 2014).

The investors are not necessarily always foreign and could include host country governments, ruling classes and entrepreneurs (Anseeuw, et al., 2016). Initially, investors are perceived by local community members and government officials in regions with poor living conditions as developers, raising expectations of remuneration and benefits (Anseeuw, et al., 2016).

According to the case studies published by the Land Matrix (2016), the majority of investors come from outside the African continent. Western countries hold the largest portion of land investments from Africa (The Land Matrix, 2016). Historical ties lay the foundation of many investments. For example, French investors are more prevalent in West and Central Africa, Portuguese investors focus mainly on Angola and Mozambique and Belgian investors dominate in the Democratic Republic of Congo (The Land Matrix, 2016).

In countries such as Senegal, Mozambique and Ethiopia, there has been open opposition to this phenomena as the deals threaten the livelihoods of the native farming households through the creation of super or mega-farms that could lead to a formation of a monopsony where there is one buyer in the market (Hall, 2011) (Collier & Dercon, 2009). This has undesirable benefits for the community and leads to exploitation and degradation of land (Hall, 2011) (Collier & Dercon, 2009).

In countries such as Zambia and Malawi, large agricultural investments have reportedly created employment and allowed for access to new technology, infrastructure and credit (Deininger, et al., 2015) (Cotula & Oya, 2014). Schoneveld (2017) synthesised results from research conducted on 38 investment projects in Ethiopia, Ghana, Niger, and Zambia. They showed that large-scale farmland investments were accompanied by displacement, dispossession and environmental degradation. The findings indicted that, despite the profound differences in country and contexts, most of the investments emanated from the alienation and expropriation of important livelihood resources. Local communities lost access to either forest, pasture or

farmland. The farmland was previously used for extensive smallholder agricultural production systems inclusive of flood retreat agriculture and agro pastoral production. It was also found, in the example of Ghana, where value chain development did not incorporate smallholders in out-grower or tenant farming schemes that compensation was provided for loss of individualised landholdings and not loss of access to common property resources. This includes resources such as forests, pasture water and areas of social significance with rarely observed market spill over clearly highlighted (Schoneveld, 2017). Overall, the assessment showed high socio-economic costs with limited development.

While academic and popular media express concern over the possible negative effects of large-scale agricultural investments in developing countries (Anseeuw, et al., 2011), little empirical evidence exists on the impact of these investments on the food security of local communities.

2.5. The impacts of large-scale land acquisitions

In Africa, large-scale land acquisitions drive specific land-use changes, which can shift food crops for self-consumption to cash crops, food crops to biofuels, or convert non-food lands such as forests to food production or biofuels (Borras & Franco, 2012). Large-scale agricultural investments differ based on the farm model - whether the investment involves independent farmers, cooperatives or agribusinesses. Some argue that large-scale agricultural investments can bring development to local communities and rural areas through access to capital, technology and knowledge know-how which would contribute to economic growth. Others argue that this would lead to conflict between investors and local communities as they would be left displaced without adequate compensation.

2.6. Mozambique in the food security context

The agricultural sector in Mozambique contributes 26 percent to the national gross domestic product (Di Matteo & Schoneveld, 2016). Approximately 75 percent of the population depend on agriculture (Di Matteo & Schoneveld, 2016). More than 99 percent of households involved in the agriculture are smallholders, with the average family owning 1, 8 ha of land (Di Matteo & Schoneveld, 2016).

In Mozambique, land is owned by the state. Individuals do not own and so cannot sell land. The 1997 Comprehensive Land Law was enacted in an effort to halt speculative land grabs that were leading to increased landlessness among the poor (van den Brink, 2008). The 1997 Comprehensive Land Law recognises and protects customary rights, in the interest of both local communities and investors. The law established the transferable right to use inheritable land subject to certain restrictions. The DUAT (*Direito do USO e Aproveitamento da Terra* translated as the right to use and benefit from the land), sets out the conditions that communities and individuals have with regard to the right to use and benefit from the land. While a DUAT does not confer full ownership, it is a secure, renewable and long-term user right that covers periods of up to 50 years. The law gives communities and local people the right to use and benefit from the land. It provides security to investors and allows the state full authority to allocate land concessions for investment (van den Brink, 2008) (Kathranda, 2014) (Monteiro, 2016).

Deininger *et al's*. (2015) analysis of national survey data from Mozambique's Trabalho do Inqueriito Agricola from 2012 and 2014 found that stronger spill over benefits were possible if the agribusinesses engaged in the processing of agricultural commodities rather than only in the production of agricultural crops. The spill over benefits included access to water and improved use of inputs by the surrounding community. Farmers in these areas were also more likely to adopt soil conservation technologies. However, Deininger *et al's*. (2015) study of quantifying the spill over effects from large farm establishments in Mozambique showed that larger local farms were more likely to benefit than smaller farmers were. Small and medium sized farmers within a 50km radius of the large-scale investment seemed more likely to adopt new farming practices and access fertilisers and pesticides more readily (Deininger, et al., 2015).

2.7. The gender component of food security

According to UNECA (1972), 60-80 % of the labour force in food production was comprised of women in the early 70s, however this has changed in the current age with women accounting for 43% percent of the agricultural labour force in developing countries (Bhandari, 2017). With limited access to land ownership, women comprise a large portion of the rural farmers and food cultivators in agriculture (Bhandari, 2017). Women with the same productive assets as men

have the ability to increase produce yields by 20-30 percent raising output in developing countries by 2.5-4 percent for agriculture (Doss, et al., 2011). These statistics indicate that if women are given adequate land for agricultural production, food produce will increase thereby increasing food security (Doss, et al., 2011). Uplifting the status that women have more access to land could lead to a reduction in the number of global undernourished people by 95-100 million people (Bhandari, 2017). Women as the majority labour force of smallholder farmers in African land are directly subjected to any changes in land policy regarding large-scale agricultural investments and in effect food security.

Taking note that land in Mozambique at the community level is claimed as customary property by the descendants of families that have authority such as chiefs, hereditary land rights are passed on to patrilineal or matrilineal descendants. Married women may own patrilineal land rights however this is impermanent (laFrancesca, 2013). The role of women in various households usually includes the type of food produced and cultivated (Doss, et al., 2011). Studies indicate that women re-invest excess food or profit into the household for children's education, food and well-being (Doss, et al., 2011). Large-scale agricultural investments affect the access of women to land. Additional attention in terms of the gender perspective is critical and necessary when analysing the food security effects at the household level for women headed households. Women farmers should have their cultural, economic and social rights regarded.

Chapter Three: Methodology

3.1. Introduction

This chapter introduces information on the sampling procedure, sites selected, the data tools and the measures used to obtain the level of food security in the households. The study used secondary data collected as part of a broader project called AFGROLAND. Mozambique was one of the three countries selected for analysis. The study area in Mozambique was selected as a result of various large-scale agricultural investments in the Nacala corridor (GRAIN, 2015). This is one of the major growth corridors under development in the country. The districts of Monapo (in the Nampula province) and Gurué (in the Zambezia province) were purposefully selected due to the presence of large-scale agricultural investments (Reys, 2016). The other sites selected were Muela in the Gurué district and Canacué in the Monapo district (Figures 1, 2 and 3).

3.2. Site Selection

Using the Nacala corridor as the starting area of focus, sites were selected as a result of various large-scale agricultural investments. The Monapo district was chosen as an interesting case study as a previous "agro-industrial" district during the colonial time with land occupied by various plantations in the first place (Reys, 2016). Today it shows nine companies, actively engaged in production and processing of diverse crops from vegetables, to cashew, banana, and cotton, among others. The Gurué district was chosen as it identified to have interesting investment activities. This resulted in the identification of three sites in areas prone to be in close proximity to large-scale agricultural investments namely, Gurué, Monapo, and Ruacé (Figure1).

Figure 1: The three sites that were selected for the study in Mozambique
Source: Reys (2016)

The first investment area identified for the Gurué district was Manlé (Figure 2). Manlé is a rural area located near a tea plantation "Cha Magoma". Two other tea plantations, as well as eucalyptus, agriculture, timber, forestry (ATFC) and macadamia plantations are found less than 10 km from the community. The counterfactual selected for Manlé was Muela as there were no large-scale agricultural investments or plantations nearby.

A second investment area, Ruacé was selected in the Gurué district (Figure 2). Ruacé is a town located near a soy plantation "Hoyo". It is reported that since 2010, about one thousand households were displaced by this investment (Reys, 2016). Another soya plantation, Rei Do Agro, is located approximately 11 km away. This plantation was established in 2014, but its development has been quite slow and has since stopped in May 2017. Their counterfactual area could be identified for Ruacé (Figure 2) (Reys, 2016).

In the Monapo district, Ramiene was selected as an investment area (Figure 3). This small town is located adjacent to the sisal plantation "Ramiena". The counterfactual area for the Monapo district was Canacué. This little rural town was not located near a large-scale plantation.

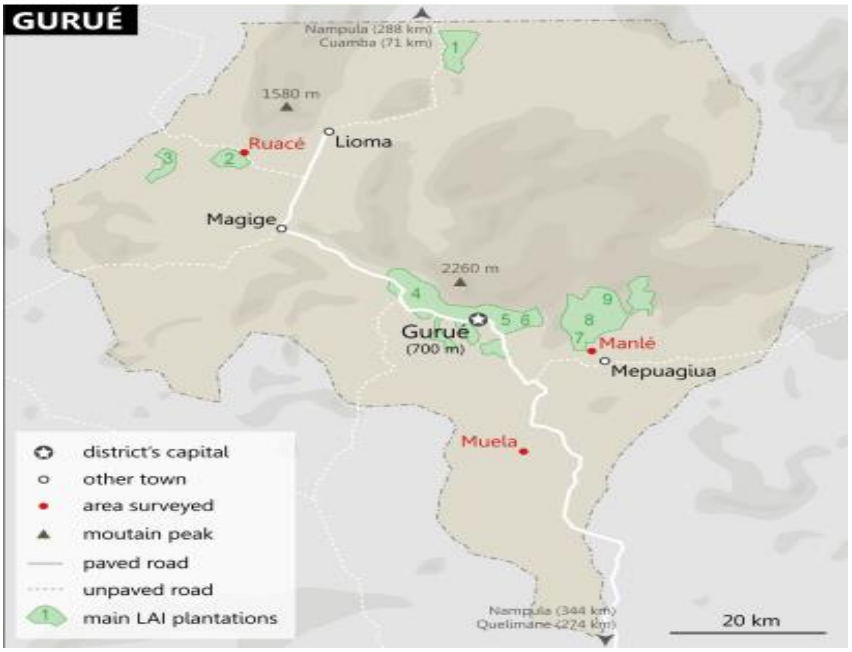


Figure 2: Map of Gurué illustrating areas where data was collected (Manlé, Ruacé, and Muela).

Source: Reys (2016)

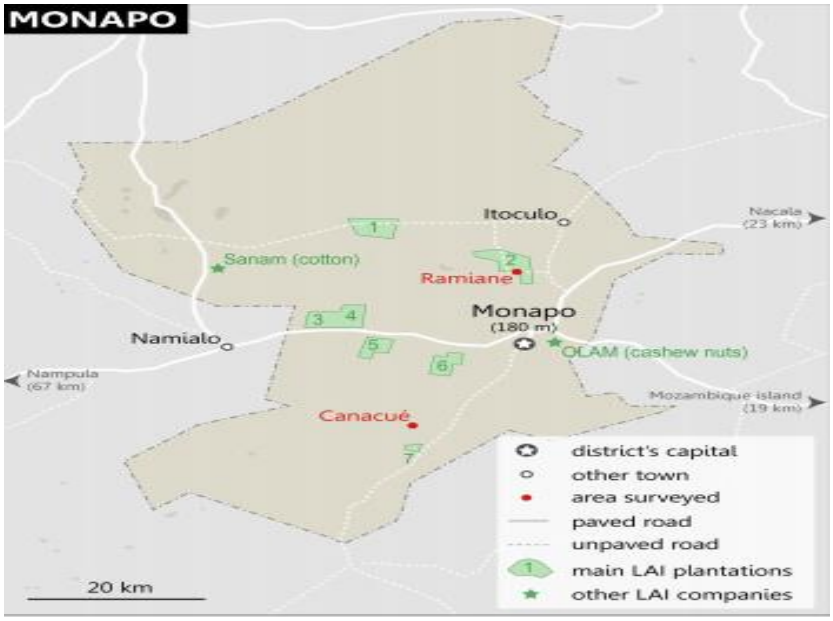


Figure 3: Map of Monapo illustrating districts where data was collected (Ramiane, Canacué).
Source: Reys (2016)

3.3. Sample Selection

The sampling of households within these areas was carried out using a stratified random sampling technique. The total number of households per area was determined from aerial maps. A sample of randomly selected households was pre-selected at the first stage of sampling (300 each from Manlé (20% of the total population), Muela (40%) and Canacué (40%), with the exception of the 10 first interviewed in Manlé and the first 15 households interviewed in Canacué). These respondents were present when the survey team introduced themselves to the local leader in each area. In Ruacé, three strata were identified and from Ramiena, two strata were identified. Samples of 300 households per strata were selected for these areas as given by the AFGROLAND Project. Roughly, a third of the households per strata were randomly selected for interviews. Surveys were conducted in Monapo and Gurué in September and October 2016 respectively (Reys, 2016).

A summary of the survey that was implemented in the different areas of study dynamics of Mozambique is illustrated in Table 1. A total of 504 questionnaires were valid for the analysis.

Table 1: Survey details

	The area selected for the survey: Total Households represented	**Rate selection**	**Target number of questionnaires**	**Total questionnaires completed**
Manlé – Gurué	300	20%	60	39
Muela – Gurué	300	40%	120	110
Ruacé – Monapo	900 (in 3 different areas)	15%	135	128
Ramiane – Monapo	600 (in 2 different areas)	15%	90	89
Canacué - Monapo (Counterfactual Monapo)	300	40%	120	118
Total	**-**		**525**	**504**

(*Reys, 2016)*

3.4. Household classification

The households were classified into different categories as shown in Table 2:

(i) Households where at least one member was employed by the company/ agribusiness (termed employed households),

(ii) Households in the zone of the company/ agribusiness but where household members were neither employed nor contracted to the companies (termed non-engaged households) and

(iii) households from counterfactual households where a large majority, and sometimes the totality, of the households, are not working with a contract in an outgrowing scheme with an agribusiness and where none of their members worked as an employee for an agribusiness (termed counterfactual households).

Table 2*:* Household sample by categories

		Number of households included in the sample area			
Category of sample households	**District**	Monapo	Gurué	Gurué	Total
	Name of town	Ramiane & Canacué	Muela & Manlé	Ruacé	
Employed		60 (29%)	37 (21%)	24 (19%)	121
Non-engaged		29 (14%)	22 (13%)	104 (81%)	155
Counterfactual		118 (57%)	110 (65%)	-	228
Total		207	169	128	504

Source: Reys, 2016

3.5. Data tools

Questionnaires (Appendix 1) were employed across households in the regions that had both large-scale agricultural investments (factual) as well as regions that had no large-scale agricultural investments (counterfactual). The latter region played the role of a counterfactual to help analyse whether or not there is a difference at the household level in the status of food security. The questionnaire used was designed by a team of land investment specialists, agricultural economists and food security experts with both quantitative and qualitative components. The data collected included demography of each household, economic activity and sources of income, dwelling information and service delivery, land ownership and assets, household livelihoods agricultural activities and food security information. Electronic tablets were used to collect the data.

The data was collected by 10 enumerators during October 2016, with 2 weeks being spent in each district, Monapo and Gurué for quality checks. These enumerators were selected from the Faculty of Agronomy at the University of Cuamba and were supervised by a researcher, Dr. Aurelien Reys from the AFGROLAND project. The enumerators were from the anticipated study region to enhance trust between the respondents. The enumerators were chosen based on their knowledge of the study area, their ability to speak the local language and their willingness to participate. A two-day training workshop for all enumerators took place to help them in learning how to use the tablets and how to ask questions professionally. Face to face interviews was be conducted using electronic tablets to limit errors.

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

As food security is a multidimensional term, no single perfect measure captures all aspects (Hendriks, et al., 2016). Therefore, seven internationally recognised food security indicators were selected, namely:

(i) Household Dietary Diversity Score (HDDS)
(ii) Food Consumption Score (FCS)
(iii) Women's Dietary Diversity Score (WDDS)
(iv) Coping Strategies Index (CSI)
(v) Months of Adequate Household Food Provision (MAHFP)
(vi) Asset ownership
(vii) Consolidated Approach for Reporting Indicators of Food Security (CARI)

The Stata Statistical Software (2015) and SPSS (2016) were employed for the analysis of the data through the estimated indicators constructed.

3.6. Data treatment and analysis

The data were analysed using descriptive and inferential statistical tools. Descriptive statistics were used to describe the socioeconomic and demographic characteristics of households. Descriptive statistics that were used to describe the collected data included the mean, the standard deviation, and the coefficient of variance, which represents the ratio of the standard deviation to the mean, and it is a useful statistic for comparing the degree of variation from one data series to another. The data from the survey were cleaned, checked and analysed for inconsistencies. Comparisons of various elements under investigation were conducted using Microsoft Excel, SPSS and Stata. The precise statistical models to analyse the impact or the effect of the large-scale agricultural investments on household food security was the Propensity Score Matching approach and the Principle Component Analysis applied to the data using Stata (2015).

The Household Dietary Diversity Score (HDDS) is an indicator that captures the number of food groups consumed by households within the previous 24 hours (Food and Nutrition Technical Assistance Project (FANTA), 2006). HDDS is recognised as a measure of diet quality, but not quantity, which is significantly, correlated with caloric adequacy measures (IFPRI, 2006). The HDDS reflected household access to a variety of foods and was used as a proxy for dietary adequacy. Studies have shown that an increase in dietary diversity was related to socioeconomic status, food security and energy availability of sampled households (Hoddinott & Yohannes, 2002). According to the 2006 FAO guideline, the HDDS gathers information on the consumption of 16 food groups and then sums the binary responses from 12 groups to arrive at the score. The data was collected on the consumption of 16 food groups listed below:

- Cereals
- White tubers and roots
- Orange-fleshed veg Vitamin A rich veg and tuber
- Dark Green leafy vegetables
- Other vegetables
- Orange coloured (Vitamin A rich) fruits
- Other fruits
- Organ meat
- Flesh meat
- Eggs
- Fish and other seafood
- Legumes, nuts, and seeds
- Milk and milk products
- Oils and fats
- Sweets
- Spices, condiments, and beverages

The dietary diversity score was calculated as the sum of the 12 scores classified as one if the household answer is “yes” and zero if the answer is “no”. The scores were then grouped into three categories: as the lowest dietary diversity (HDDS ≤ 3), medium dietary diversity (HDDS 4 and 5) and high dietary diversity (HDDS ≥ 6) (FAO, 2006). A more diverse diet (HDDS ≥ 6)

has been linked to higher socioeconomic status and household food security (Kennedy, et al., 2011).

The Food Consumption Score (FCS) is a composite score total that considers dietary diversity, food frequency and the relative nutritional importance of different food groups (World Food Programme (WFP), Vulnerability Analysis and Mapping Branch (VAM), 2008). It reclassifies data on the frequency of consumption of the same food groups as used in the HDDS but uses a seven-day recall period and groups the food groups into nine weighted categories. The weights are set out by (World Food Programme (WFP), Vulnerability Analysis and Mapping Branch (VAM), 2008) as illustrated in Table 3, which include the main staples (cereals), pulses, vegetables, fruits, meat and fish, milk, sugar, oil (oils, fats and butter) and condiments (World Food Programme (WFP), Vulnerability Analysis and Mapping Branch (VAM), 2008). The ninth category, condiments, has mainly the function of separating food products that are consumed in small quantities (including spices, tea, coffee, salt, fish powder, etc.) and is weighted as zero in the calculation. This category is largely consumed however is not considered in the final calculation of the FCS. An advantage of using the FCS indicator is that it allows a comparable analysis between datasets and captures both dietary diversity and food frequency (World Food Programme (WFP), Vulnerability Analysis and Mapping Branch (VAM), 2008). The score was classified into three groups: poor consumption (FCS 0 -21), borderline consumption (FCS 21.5 – 35) and acceptable consumption (FCS greater than 35) as outlined in the WFP, VAM (2008) methodology. A FCS lower than 21 represents poor food consumption; meaning that households are food insecure, whereas FCS between 21.5 and 35 represents borderline food consumption, also classified as food insecure; while a FCS greater than 35 represented acceptable food consumption, inferring that a household was food secure.

Table 3: Weights used to calculate FCS *(World Food Programme (WFP), Vulnerability Analysis and Mapping Branch (VAM), 2008)*

Food Item (based on questionnaires)	Food Group	Weight
Cereals, White roots, and tubers	Main Staples	2
Dried Beans	Pulses	3
Vegetables and Leaves (Orange Flesh Veg, Other Veg)	Vegetables	1
Fruits	Fruits	1
Organ Meat, Meat, Fish and Seafood	Meat and Fish	4
Milk and milk products	Milk	4
Sweets	Sugar	0.5
Oils and Fats	Oil	0.5
Spices	Condiments	0

The Women's Dietary Diversity Score is an index calculated by recording all food items consumed by women aged between 15-49 years of age in the 24 hours prior to the survey and reclassifying these into binary food consumption group responses into nine food groups. a newly developed indictor, called the Minimum Dietary diversity for Women (MDD-W), uses 10 groups as it counts fruits and vegetables as two different groups (FAO, 2016) (IndiKit, 2019). The food groups for the Women's Dietary Diversity Score indicator are divided into:

- Grains, white roots and tubers and plantains
- Pulses (beans, peas, and lentils)
- Nuts and seeds
- Dairy
- Meat, poultry, and fish
- Eggs
- Dark green leafy vegetables
- Other vitamin A-rich fruits and vegetables
- Other vegetables/ fruits

The WDDS categorises the scores into three categories: high dietary diversity (WDDS ≥6), moderate dietary diversity (WDDS 4 and 5) and low dietary diversity (WDDS≤3). The WDDS reflects on micronutrient adequacy, which is one critical dimension of diet quality.

The Months of Adequate Household Food Provisioning (MAHFP) measures household food access over the year (Bilinsky & Swindale, 2010). The households were asked if they had enough food to meet family needs over the past 12 months. The binary responses per month were summed to provide a score between zero and 12 (Food and Nutrition Technical Assistance Project (FANTA) and Food Aid Management (FAM), 2003). The scores were classified into three groups following the methodology set out by (Anderson, et al., 2006). Table 4 presents the classification.

Table 4: Classification of food security indicators

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	High dietary diversity	>6
	2	Medium dietary diversity	4-5
	3	Low dietary diversity	<3
MAHFP	1	Least food insecure	≥10
	2	Moderately food insecure	6 – 10
	3	Most food insecure	3 – 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	Most resilient	≥10
	2	Moderately resilient	6 - 10
	3	Least resilient	3 – 6
CARI	1	Food secure	
	2	Marginally food secure	
	3	Moderately food insecure	
	4	Severely food insecure	

The Coping Strategies Index (CSI) measures food security indirectly by asking questions related to food consumption behaviour (Maxwell & Caldwell, 2008). The CSI was calculated

by multiplying the frequency and severity of behaviours that households engaged in to mitigate food shortages over a seven-day recall period. To calculate the level of the severity of household food insecurity, the reported frequency of the use of the strategies were multiplied by a severity rating derived by Maxwell and Caldwell (2008). The weight reflects the severity of the coping strategy or behaviour, similar levels of severity are assigned a weight to each group, from lowest (least severe) to highest (most severe), the range of one to four usually works well. Following Maxwell's (2008) classification, households were classified into four groups: food secure (value of CSI 0-2), mildly food insecure (CSI 3-12), moderately food insecure (CSI 13-40) and severely food insecure (CSI >40) (Maxwell & Caldwell, 2008).

Asset ownership can be used as a proxy indicator for food insecurity, reflecting the level of household resilience (ability to cope with risk) (Swift, 2006). Studies have shown that a reduction in assets increases vulnerability to poverty and hunger and food insecurity (Chambers, 2006) (Maxwell & Smith, 1992). Many studies have used asset-based indexes to estimate the socioeconomic status of the relative resilience of a household. However, no defined methodology exists (Montgomery, et al., 1999). This study used a simple sum asset technique, which was a simple count of household assets that the household owned, recorded as binary responses. This method of weighting assets does not reflect the value of assets. Following the methodology of Browne *et al*. (2014), households we classified into three groups: more resilient households (higher asset ownership), moderately resilient and least resilient households (low number of assets) (Table 4).

The Consolidated Approach for Reporting Indicators of Food Security (CARI) combines a host of food security indicators into a summary indicator called the Food Security Index (FSI), which represents a population's overall food security status (World Food Programme (WFP), 2014). The different indicators that form part of this console include the Food Consumption Score (which measures the adequacy of a household's consumption) and the Livelihood Coping Strategy, which is broken into two dimensions to include the household economic vulnerability and the asset depletion. The economic vulnerability was measured by the food expenditure share. This indicator was based on the premise that the higher the proportion of income spent on food, the more economically vulnerable a household was (World Food Programme (WFP), 2014). The asset depletion element divides households into three broad categories: stress strategies that include borrowing or using the savings, indicating reduced ability to deal with future shocks; crisis strategies that include selling productive assets which

affect future productivity and emergency situations that include selling land; and situations that are more difficult to reverse. For the purpose of this study, these indicators had to be calculated and converted into a four-point scale as categorised in Table 5 (World Food Programme (WFP), 2014) with the results explained in chapter 4 (Table 13). The CARI combines three indicators, which include the FCS, food expenditure shares and asset depletion that were converted to the four-point scale as follows:

- The FCS that categorises each household into three food consumption groups, poor, borderline, or acceptable, upon conversion to a four-point scale, the "acceptable" household was converted to "food secure" and assigned a score of one, the "borderline" household is converted to "moderately food insecure" and assigned a score of three and the "poor" household is converted to "severely food insecure" and was assigned a score of four (World Food Programme (WFP), 2014).
- The food expenditure share includes spending on both non-purchased and purchased foods within the overall food expenditure share estimate; it considers households with different food access and was calculated by the total food expenditure for the 30-day recall period divided by the total value of total expenditure. The food expenditure share indicator was converted into a four-point scale: food secure (score of 1) if the share was higher than 50%, ; marginally food secure (2) if the share was between 50-65% ; moderately food insecure (3) if the share was between 65-75% and severely food insecure (4) if the share was higher than 75% (World Food Programme (WFP), 2014).
- Asset depletion was estimated by classifying the coping strategies into three categories based on their nature either stress, crisis, and emergency strategies. Stress strategies such as borrowing or spending savings; crisis strategies such as selling productive assets or emergency strategies that would be difficult to reverse or were of a dramatic nature such as selling land (World Food Programme (WFP), 2014).

Table 5: Classification of food security indicators based on the CARI console

CARI	Indicator	Food Secure (1)	Marginally Food Secure (2)	Moderately Food Secure (3)	Severely Food insecure (4)
Food consumption	Food consumption score	Acceptable		Borderline	Poor
Coping Capacity/ Asset depletion	Coping strategy Index	None	Employed stress strategies	Employed crisis strategies	Employed emergency strategies
Coping Capacity/ economic vulnerability	Food Expenditure Share	<50%	50-65%	65-75%	>=75%

Spearman's correlation was used to examine the non-parametric relations between food security indicators (HDDS, FCS, MAHFP, CSI and Assets). The CARI console was used for comparative analysis.

3.7. Quantitative evaluation techniques

Once the demographic statistics and the indicators are calculated and estimated, further data analysis to study the probability of two outcomes either factual (employed or non-engaged) or counterfactual zone would be conducted. Propensity Score Matching (PSM) is usually used to understand if differences exist between households in the counterfactual or control area and those in the treatment area, which is defined as the area that was manipulated by the experimenter. The nature of the data collected from the various areas in Mozambique ruled out the use of the propensity score matching technique as data were collected from different areas as opposed to data being collected from one area and then being categorized as treated or controlled data. It is for these reasons the study will focus on the principle components analysis.

Instead, the Principle Component Analysis was used to verify the relationships of the indicators PCA is a dimension-reduction tool that can be used to analyse and reduce a large set of data

variables to a small set that maintains relevant information (Teh, 2010). The re-expressed multivariate data has fewer dimensions. This reduced data system is represented by principle components that are linear combinations of eigenvectors and variables (Johnson & Wichern, 2002).

Principle Component Analysis is a non-parametric analysis and the outcomes are not based on any hypothesis or probability distribution (Johnson & Wichern, 2002). The only assumption of PCA is that all the data are a linear combination of certain basis vectors (Shlens, 2014). The PCA does not eliminate partial important information and is thus not misleading, it is able to maximise the variability of data while minimising the dimensionality of the data set, which means that it is able to extract interesting information from the large data. Factor analysis and PCA are similar methods used for the reduction of multivariate data; the difference between them is that factor analysis assumes the existence of a few common factors driving the variation in the data while PCA does not make such assumptions.

The pattern matrix was analysed to identify and compare patterns given the various food security indicators which contributed to the food security status of households in a category. To ensure that data in the table is readable, blanks were inserted for loadings below 0.3 or above -0.3, the reason being they are not justifiable and should be removed as it is considered a "poor" loading (Katchova, 2013). The principle component loading against the original variables were simulated and represent the correlation between the component and the original variable. The first factor accounts for the maximum percentage of the variance, while the second and subsequent factors account for the remaining variance (Rietveld & Van Hout, 1993). The Kaiser-Meyer-Olkin (KMO) measures the sampling adequacy, a number above 0.5 is good and means that the study is justified in using PCA (Field, 2000). The KMO was calculated for each data subset and the findings indicate that households in both counterfactual Monapo and Gurué, employed Monapo and employed Ruacé were qualified to undergo PCA.

3.8. Limitations

In most of the research that has been conducted, data limitations prevent the interpretation of certain outcomes in the short run (Cotula, 2009). The apparent effects of these large-scale agricultural investments may only be determined after necessary and adequate time is given

(Deininger, et al., 2015). The scope of the study is limited to the selected areas of Mozambique. The households that were selected were based on the incidence of large-scale agricultural investments in the area. The counterfactual area that was chosen is based on the absence of large-scale agricultural investments. The limitation of using a counterfactual is that the relationship between the inputs and the outcome to be predicted might not be causal, "the absence of large-scale agricultural investments" was the only input required to classify households as counterfactuals. The defined characteristics of the counterfactual area were limited. In order to collect data from these selected areas in Mozambique, two weeks should be spent on each particular site. The head of the household interviewed provides the overall household food security status, whereas a different perspective of food security from a child, for instance, was not be noted. Baseline data was not available to determine if households were worse off than before the investments took place. The study was thus limited by data availability.

3.9. Assumptions

It was assumed that the counterfactual households were in no way affected by the presence of large-scale agricultural investments taking place. It was also assumed that all households in the factual zone had equal opportunities to benefit from employment and that the data collected was accurate and that households responded honestly. The indicators constructed and calculated were results of the data collected and reflect the status of household food security. Lastly, it was assumed that the head of the household reflects the overall food security status of all the individuals in a particular household.

3.10. Reliability and validity

The research was reliable as the measure of quality was done according to already existing food security instruments as per their guidelines, which allows for consistency if the same results are used in the same situation or repeated occasion. Validity seeks to ensure that the concept is accurately measured will make use of data collected from the field.

- Development control- this refers to the development of how the data was collected. The questionnaire was designed by experts and placed on electronic software for ease of entry and minimised errors. The translation from English to Portuguese was conducted by a native Portuguese speaker for ease of understanding by respondents.
- Data collection- the enumerators were trained in data collection and all data was reviewed and quality checked before being analysed by the AFGROLAND analyst and the author.
- Post entry- an audit of the data was conducted for the accuracy

Chapter 4: Results and Discussion

This chapter provides the findings from the analysis.

4.1. Demographic data

The demographic characteristics were analysed for all households in the two districts, which were further subdivided into eight category sample areas and are presented in Table 6. The p-value of the chi-square test for all variables is significant at the 5% level of significance, except for household size (the p-value (0.084) is greater than 0.05). This indicated that except for household size, there were statistically significant differences between the groups all variables.

More than 65% of the households in all groups were married; with a higher proportion of divorced households among the non-engaged households for Monapo and Gurué. The age of the household head showed that on average, as people aged, they were less likely to be employed. Very few household heads were over the age of 50 years.

More than 70% of household heads in all groups were male, with less than 30% of the overall sample representing female-headed households. There were slightly more male-headed households in the employed areas than counterfactual and non-engaged categories. This could mean that women were involved in other home-making activities or engaged in other sectors of employment apart from agriculture. This indicated that more male-headed households were employed. The sex of the household head may affect the status of household food security. According to Klasen *et al*. (2011) female-headed households in developing countries are typically disadvantaged regarding access to land, labour, credit and are discriminated against by cultural norms and often suffer from high dependency burdens, which could result in low status of food security for these female-headed households.

Household size was classified into three groups: small (less than five members in the house), medium (six-ten members) and large (greater than ten members). Table 6 indicates that there was no significant difference in average household size among groups of households. Almost half of all households were small, 15% - 40% were medium and less than 10% were large across all groups. There is no significant correlation between household size and the status of employment.

The data were collected in areas that were considered rural as the primary activity is agriculture, the population density was low and a number of areas of open land with few homes and no buildings were found. The households had no running water. The main source of fuel was wood (Table 6).

Low education levels are noted in that the majority (average of 50%) of household heads in all groups had not completed primary school education. In Monapo, household heads in the counterfactual groups (5%) had higher education (college or university) than those in the employed (2%) and non-engaged (0%) groups. This was different in Gurué where household heads in the employed group (14%) had higher education than employed (5%) and non-engaged groups (5%) and in Ruacé, more household heads in the employed group (17%) had higher education than non-engaged group (15%) (Table 6). The results infer that the level of education did not have a significant difference in employment as other members of the sample had a lower status of education.

The majority of households had low access to land - between one and three hectares. There were no significant differences between the amount of land owned and the status of employment. Access to land influences food production and small-scale farming. A higher proportion of non-engaged (41% in Monapo, 32% in Gurué) households lost access to their land through displacement as a result of plantation expansion, compared to employed (respectively 23% and 16%) households in both Monapo and Gurué respectively. In Ruacé, an even share of both the employed and non-engaged households had lost access to land (45%) (Table 6). The loss of land rights due to people being displaced could be perceived both positively or negatively, negatively in that it prevents households from producing on their own land, and positively, it could provide alternative opportunities and trade-offs such as access to agricultural inputs such as seed, new technologies, and credit through the various initiatives undertaken by investors and the government as seen in the case study by Deininger (2015) which quantifies the spillover effects from large farm establishments in areas 25-50 kilometers from the investments (Deininger, et al., 2015).

The results showed that the majority of households (over 65%) did not own livestock. There were no cattle owned, but many households had chickens.

Table 6: Demographic characteristics results for Mozambique, 2016

Variable	Category	Monapo			Gurué			Ruacé		Chi Square	
		Employed (n=60)	Non-engaged (n=29)	Counterfactual (n=118)	Employed (n=37)	Non-engaged (n=22)	Counterfactual (n=110)	Employed (n=24)	Non-engaged (n=104)		
		%	%	%	%	%	%	%	%	df	p-value
Sex of head	Male	98	76	90	89	73	85	92	90	7	0.015
	Female	2	24	10	11	27	15	8	10		
Household family size	Small (<=5)	67	83	68	59	77	59	71	62	14	0.084
	Medium (6-10)	33	14	31	41	18	41	29	38		
	Large (>10)	0	3	1	0	5	0	0	0		
Land Size	Very Small (<1 ha)	28	28	17	30	23	27	17	33		
	Small (1-3 ha)	60	52	54	51	50	51	54	55		
	Medium (3-15 ha)	12	21	29	19	27	22	25	13		
	Large (>15 ha)	0	0	0	0	0	0	4	0		
Age	Age <30	21	18	27	22	25	30	29	27		
	Age30-39	29	25	29	31	25	22	21	33		
	Age 40-49	29	14	22	19	5	25	17	18		
	Age 50-59	14	21	11	19	40	13	29	12		
	Age >60	7	21	11	8	5	11	4	10		

Variable	Category	Monapo			Gurué			Ruacé		Chi Square	
		Employed (n=60)	Non-engaged (n=29)	Counterfactual (n=118)	Employed (n=37)	Non-engaged (n=22)	Counterfactual (n=110)	Employed (n=24)	Non-engaged (n=104)		
		%	%	%	%	%	%	%	%	df	p-value
Education	No Education	13	21	20	14	18	18	13	10	28	0.002
	Primary School	50	52	55	38	50	50	50	46		
	Secondary School	35	28	19	35	18	27	21	29		
	Tertiary Education	2	0	5	14	9	5	17	15		
Marital Status	Single	0	14	7	3	14	1	4	1	28	0.000
	Married	95	69	85	89	68	90	88	88		
	Divorced	5	14	4	3	14	5	8	5		
	Other (widowed)	0	3	4	5	0	5	0	6		
Source of drinking water	Public tap	78	55	100	3	5	37	71	79	21	0.000
	Well/borehole	15	28	0	86	64	39	25	20		
	Spring/flowing water	7	17	0	11	32	23	4	1		
	No	8	21	3	19	27	16	0	1	7	0.000

Variable	Category	Monapo			Gurué			Ruacé		Chi Square	
		Employed (n=60)	Non-engaged (n=29)	Counterfactual (n=118)	Employed (n=37)	Non-engaged (n=22)	Counterfactual (n=110)	Employed (n=24)	Non-engaged (n=104)		
		%	%	%	%	%	%	%	%	df	p-value
Safe to drink water	Yes	92	79	97	81	73	84	100	99		
Source of Energy	None	0	0	0	8	23	6	0	2	42	0.000
	Wood	72	69	88	73	59	79	88	61		
	Electricity	18	7	0	0	0	1	4	11		
	Solar	0	3	3	5	9	7	0	1		
	Candles	0	0	0	0	5	1	0	3		
	Coal	5	14	3	5	0	0	0	13		
	Other	5	7	5	8	5	5	8	11		
Land Lost	No	77	59	100	84	68	100	54	55	7	0.000
	Yes	23	41	0	16	32	0	46	45		
Livestock ownership	No	77	69	68	46	82	42	75	74	7	0.000
	Yes	23	31	32	54	18	58	25	26		
Migrant	Non-migrant	37	48	66	57	64	55	50	35	14	0.000
	Migrant nearby	15	10	18	16	5	15	8	16		
	Migrant far	48	41	16	27	32	30	42	49		

4.2. Results from the Household Dietary Diversity Score (HDDS)

More than 50% of households in all groups had adequate dietary diversity, which meant they ate six or more food groups out of 12 on a daily basis (Figure 4). These food groups consisted of cereals, white roots and tubers, orange-fleshed vegetables, other vegetables, fish and other seafood, oils and fats. The most consumed food groups were other vegetables, oils and fat and spice.

Milk or milk products were consumed the least, on average once a week in the previous 24 hours by households. The coefficient of variation result of milk and milk products is higher than other food security indicators with the highest value of 6.41. This indicates high variability about the consumption patterns (Table 7). This can be partially explained by the low ownership of livestock – less than 65% of all households owned livestock. Milk is also a highly perishable product and in an area without cold storage or livestock, little dairy consumption is noted.

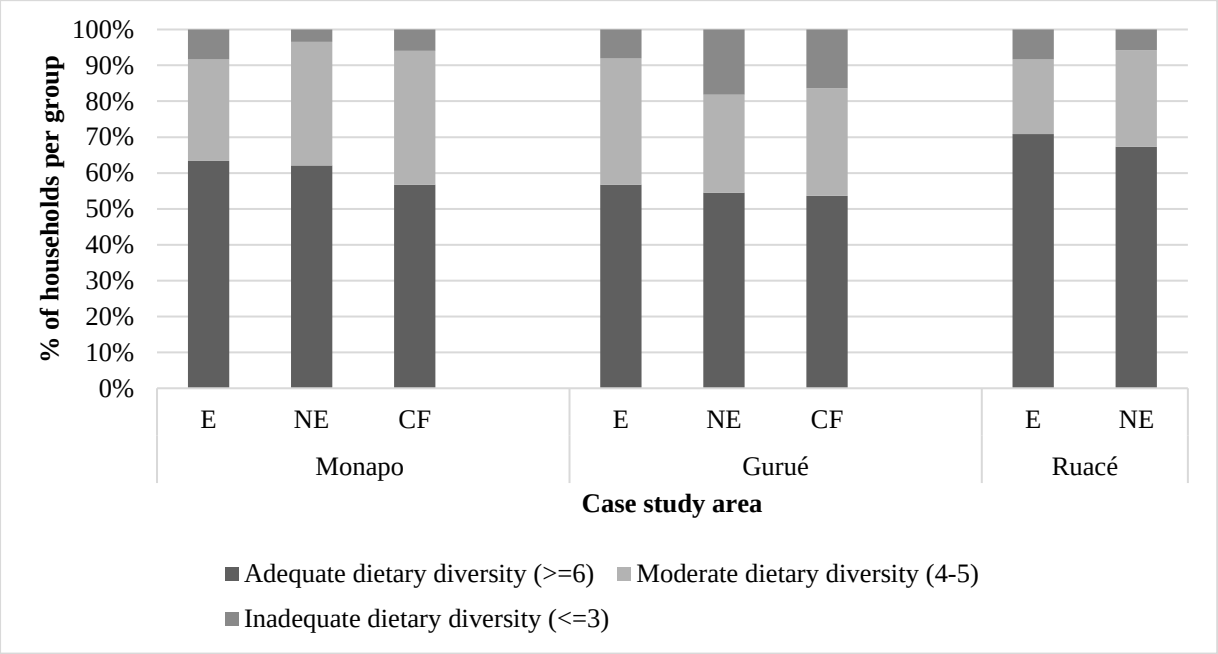
The mean value of each of the food groups consumed by households was calculated. In Monapo, employed households consumed more other vegetables (0.8), meaning that on average 80 % of households in this category consumed "other vegetables", 80% consumed oils and fats and 70% consumed fish and other seafood. The latter findings can be explained as Monapo is closer to the coast and a lot of dried fish and seafood was found in their diets.

These figures were higher than for non-engaged and counterfactual groups, among whom more households consumed more white tubers and roots. In Gurué and Ruacé, households consumed more cereals than any other food group. On average, 80% of households in Gurué and 95% in Ruacé consumed cereals daily. Sixty percent of households in Gurué consumed white tubers and roots, while 80% of households in Ruacé consumed both other vegetables and oils and fats.

Table 7: Summary result of dietary diversity for Mozambique, 2016

Food Group	Coefficient of variance	Monapo						Gurué						Ruacé			
		Employed (n=60)		Non-engaged (n=29)		Counterfactual (n=118)		Employed (n=37)		Non-engaged (n=22)		Counterfactual (n=110)		Employed (n=24)		Non-engaged (n=104)	
		mean	max	mean	max	mean	max	mean	max	mean	max	mean	max	mean	max	mean	max
Cereals	0.63	0.7	1	0.5	1	0.4	1	0.8	1	0.8	1	0.8	1	0.9	1	1.0	1
White tubers and roots	0.86	0.6	1	0.7	1	0.8	1	0.7	1	0.5	1	0.7	1	0.2	1	0.3	1
Orange fleshed veg Vitamin	1.13	0.4	1	0.3	1	0.4	1	0.6	1	0.5	1	0.5	1	0.4	1	0.5	1
Dark Green leafy vegetables	1.31	0.2	1	0.4	1	0.4	1	0.4	1	0.3	1	0.4	1	0.3	1	0.4	1
Other vegetables	0.56	0.8	1	0.8	1	0.8	1	0.8	1	0.7	1	0.6	1	0.8	1	0.8	1
Orange colored (Vitamin A rich) fruits	4.05	0.0	1	0.1	1	0.0	1	0.1	1	0.2	1	0.0	1	0.0	1	0.1	1
Other fruits	3.12	0.1	1	0.1	1	0.0	1	0.2	1	0.3	1	0.1	1	0.0	1	0.1	1
Organ meat	5.06	0.0	1	0.0	0	0.0	1	0.1	1	0.0	1	0.0	1	0.0	0	0.1	1
Flesh meat	2.49	0.1	1	0.0	0	0.1	1	0.2	1	0.2	1	0.1	1	0.2	1	0.2	1
Eggs	3.09	0.1	1	0.0	1	0.1	1	0.2	1	0.0	1	0.2	1	0.0	1	0.0	1
Fish and other seafood	1.10	0.7	1	0.7	1	0.6	1	0.2	1	0.3	1	0.2	1	0.4	1	0.5	1
Legumes, nuts and seeds	1.17	0.3	1	0.5	1	0.2	1	0.6	1	0.5	1	0.6	1	0.4	1	0.4	1
Milk and milk products	6.41	0.0	1	0.0	0	0.0	0	0.1	1	0.0	1	0.0	1	0.0	1	0.0	1
Oils and fats	0.74	0.8	1	0.7	1	0.6	1	0.6	1	0.5	1	0.5	1	0.9	1	0.7	1
Sweets	1.59	0.3	1	0.4	1	0.2	1	0.3	1	0.4	1	0.2	1	0.6	1	0.4	1
Spices, condiments, and beverages	0.28	1.0	1	1.0	1	1.0	1	0.8	1	0.6	1	0.9	1	0.9	1	1.0	1

The chi-square result showed that there was a statistically significant difference between groups at the 5% level of significance (p-value=0.013) for HDDS. A higher portion of employed households had adequate dietary diversity than non-engaged and counterfactual households (Figure 4). Very few households consumed diets of inadequate diversity. However, more households (14% on average) in Gurué consumed diets of lower dietary diversity than in Monapo and Ruacé (5% and 6.5%) were noted. The low dietary diversity for some households may be as a result of the poor crop yields produced as a result of high dependency on rain-fed agriculture and constant mono-cropping without crop rotations in these areas. Another contributing factor may be the soil quality which could have an effect on the yield of various crops for food or animal feed.



Key: E (employed), NE (non-engaged), CF (counterfactual)

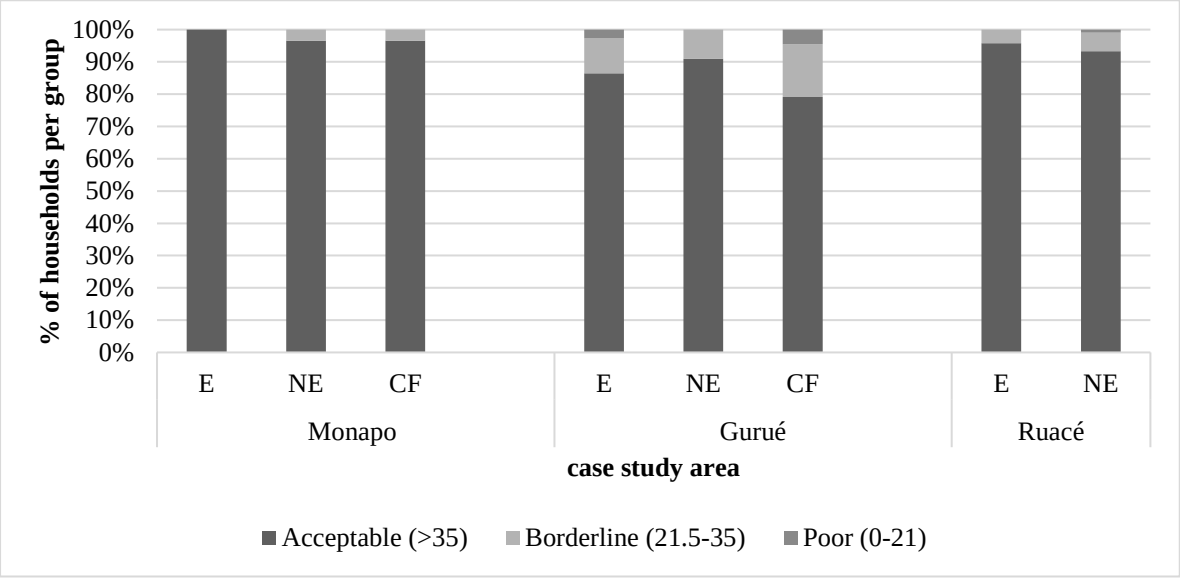
Figure 4: Household dietary diversity score categorised results for Mozambique, 2016.

4.3. Results from the Food Consumptions Score (FCS)

The results of the food consumed in the three areas are presented in Table 8. Staples (cereals and white tubers), vegetables and condiments were the most consumed food groups (with a mean value greater than 6). The lowest mean recorded was zero for milk and milk products

that were not consumed by the households in the preceding seven days. This indicated that most households in the study area consumed the main staples, vegetables and condiments daily. The coefficient of variance result was shown low variability among groups; this is due to a low coefficient of variance for most food groups, except milk (3.73), fruits (1.37) and sugar (1.11).

Figure 5 below categorises the Food Consumption Sore results of the eight groups of households in Mozambique. Approximately 75%of households consumed acceptable diets. The chi-square results showed that there was no statistical significance between groups at the 5% level of significance (p-value=0.140) for FCS, meaning that no differences existed between the groups of comparison or the various households being analyzed.



Key: E (employed), NE (non-engaged), CF (counterfactual)

Figure 5: Food Consumption Score categorised results for Mozambique, 2016.

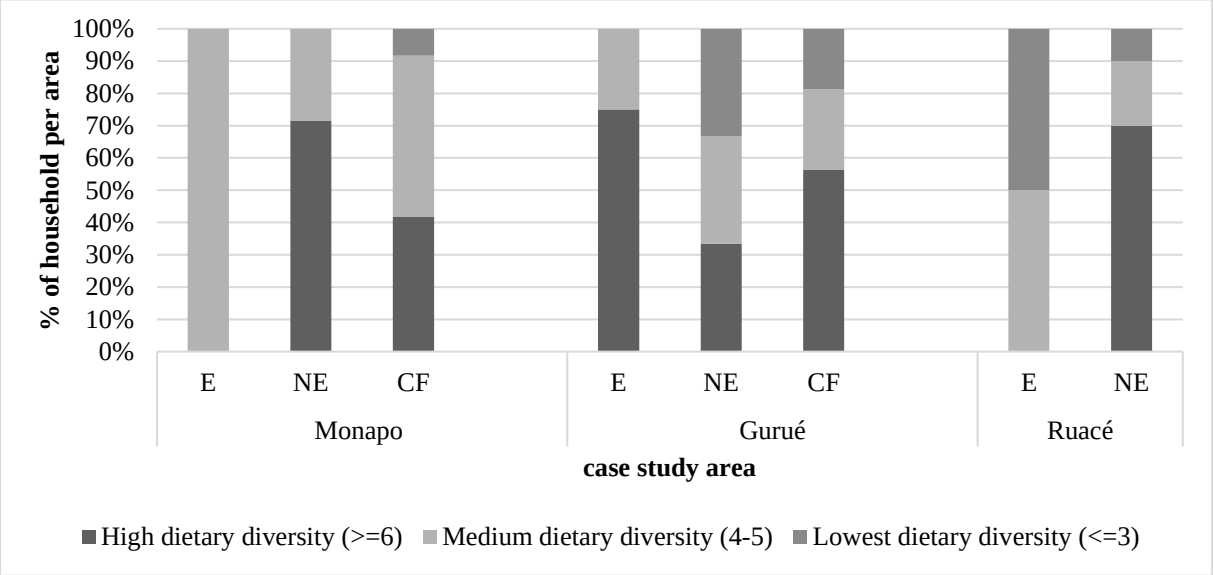
Table 8: Summary result of groups of food consumed for Mozambique, 2017

Food group	Coefficient of variance	Monapo									Gurué									Ruacé					
		Employed (n=60)			Non-engaged (n=29)			Counterfactual (n=118)			Employed (n=37)			Non-engaged (n=22)			Counterfactual (n=110)			Employed (n=24)			Non-engaged (n=104)		
		mean	max	min	mean	max	min	mean	max	min	mean	max	min	mean	max	min	mean	Max	min	mean	max	min	mean	max	min
Main Staples	0.21	6.6	7	2	6.6	7	3	6.4	7	2	6.1	7	0	6.3	7	2	6.3	7	1	6.0	7	3	6.3	7	2
Vegetables	0.17	6.7	7	2	6.1	7	0	6.6	7	0	6.8	7	4	6.8	7	5	6.4	7	0	7.0	7	6	6.8	7	2
Fruits	1.37	0.8	7	0	1.3	7	0	1.0	7	0	2.2	7	0	2.2	7	0	1.6	7	0	1.4	5	0	1.6	7	0
Meat and Fish	0.47	5.6	7	2	5.1	7	2	5.4	7	1	3.8	7	0	4.3	7	0	3.6	7	0	4.7	7	0	4.9	7	0
Pulses	0.54	3.2	7	0	3.3	7	1	2.8	7	0	3.6	7	0	3.5	7	0	3.8	7	0	2.8	6	1	3.4	7	0
Milk	3.73	0.2	4	0	0.1	1	0	0.1	7	0	0.3	2	0	0.4	7	0	0.1	7	0	0.6	7	0	0.4	7	0
Fats and Oils	0.56	5.1	7	0	4.4	7	0	4.4	7	0	3.3	7	0	3.4	7	0	3.0	7	0	5.7	7	0	5.0	7	0
Sugar	1.11	2.4	7	0	2.3	7	0	1.5	7	0	1.9	7	0	1.6	7	0	1.2	7	0	2.2	7	0	2.4	7	0
Condiments	0.21	7.0	7	6	7.0	7	7	7.0	7	3	5.2	7	0	4.5	7	0	6.7	7	0	7.0	7	7	6.9	7	0

4.4. Women's Dietary Diversity Score (WDDS)

Only 13% of the households were female-headed. As with the above two dietary indicators, the WDDS showed that most households consumed starch and vegetables. The results illustrated in Figure 6, showed that the majority of female-headed households enjoyed moderate or medium to high dietary diversity.

In the Monapo and Ruacé areas, a greater proportion of female-headed non-engaged households enjoyed diverse diets compared to households from female-headed employed households. This was different in the case of Gurué, where a higher portion of female-headed employed households enjoyed higher dietary diversity compared to both the female-headed counterfactual and non-engaged households. These findings are not consistent and various outcomes are noted in the different areas when the dietary diversity of female-headed households are analysed.



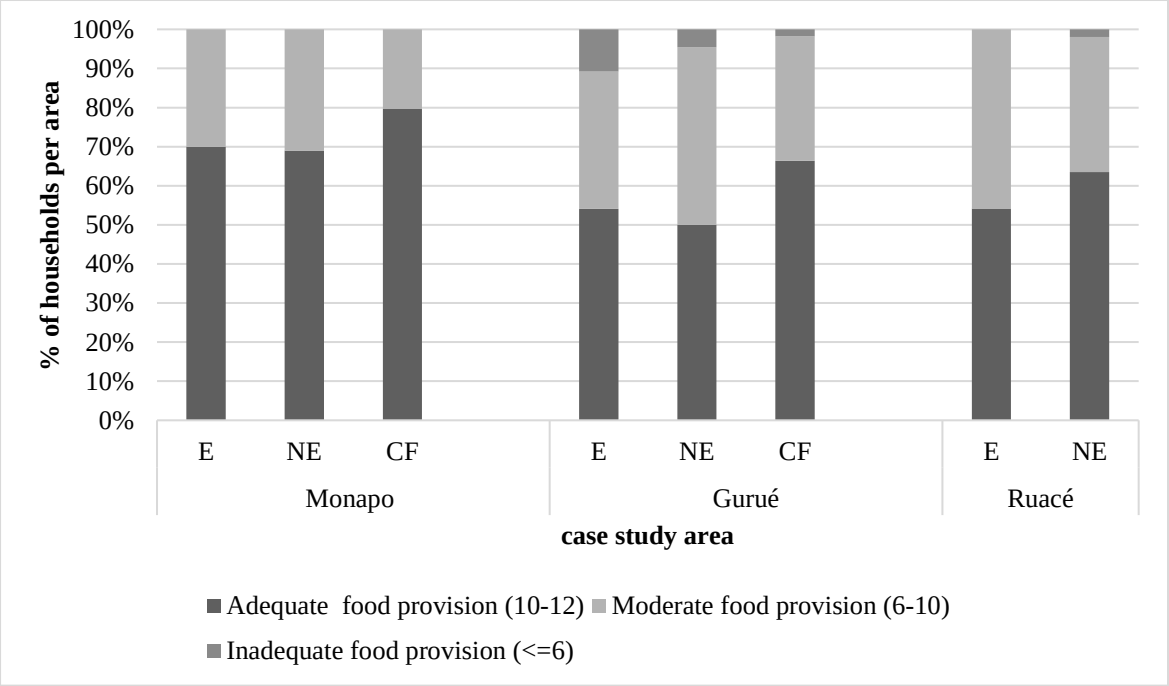
Key: E (employed), NE (non-engaged), CF (counterfactual)

Figure 6: Categorisation of women's dietary diversity score.

4.5. Months of adequate household food provision (MAHFP)

Households typically procured (from production or purchasing) adequate food access for seven months of the year (April, May, June, July, August, September, and October) (Table 9). Maize and sorghum were harvested from March to May and May to June respectively. Wheat was harvested from June to September (FAO, 2018).

These results are in line with the findings that most households had adequate food from April to October. On the contrary, roughly a third of households had inadequate access to food between November and January. Reasons for this include the fact that lower yields of food are produced in these months due to the climatic conditions, it is a dry and hot period with poor yields affecting agricultural; productivity. Figure 7 shows that 63% of households had adequate food provision. Table 9 indicates that the coefficient of variance for the months of May, June, and July is high, above 11, which means that the level of dispersion around the mean is high, this means that the estimation is less precise.



Key: E (employed), NE (non-engaged), CF (counterfactual)

Figure 7: Months of Adequate Household Food Provision categorized results for Mozambique, 2016.

Table 9: Summary results of months of inadequate food for Madagascar, 2017

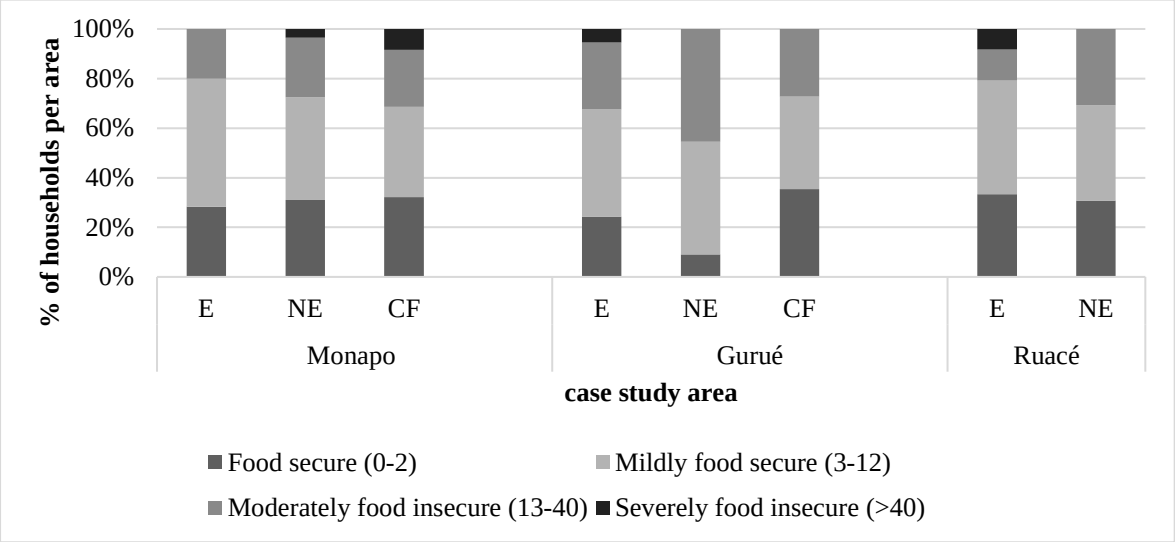
Months	Coefficient of variance	Monapo						Gurué						Ruacé			
		Employed (n=60)		Non-engaged (n=29)		Counterfactual (n=118)		Employed (n=37)		Non-engaged (n=22)		Counterfactual (n=110)		Employed (n=24)		Non-engaged (n=104)	
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Jan	1.12	24	40	14	48	29	25	17	46	14	64	53	48	13	54	59	57
Feb	1.02	37	6	14	48	70	59	12	32	12	55	42	38	10	42	51	49
Mar	1.63	25	4	12	41	56	47	11	30	7	32	11	10	1	4	15	14
Apr	7.42	4	7	0	0	1	1	3	8	1	5	0	0	0	0	0	0
May	12.94	0	0	0	0	0	0	2	5	1	5	0	0	0	0	0	0
Jun	11.19	0	0	0	0	0	0	2	5	1	5	0	0	1	4	0	0
Jul	12.94	0	0	1	3	0	0	1	3	0	0	0	0	1	4	0	0
Aug	7.88	0	0	0	0	0	0	5	14	0	0	0	0	2	8	1	1
Sep	7.04	0	0	0	0	0	0	5	14	1	5	2	2	1	4	1	1
Oct	4.29	0	0	0	0	0	0	6	16	2	9	7	6	2	8	9	9
Nov	2.18	7	1	2	7	5	4	11	30	5	23	28	25	9	38	21	20
Dec	1.68	11	1	4	14	10	8	14	38	6	27	38	35	10	42	39	38

4.6. Coping Strategies Index (CSI)

The coefficient of variation illustrated that there was high variability among the use of coping strategies (highest 3.84). In general, the most commonly adopted coping strategies were to consume less expensive foods (57% of all households), limit the portion of food served (45%), reduce the number of meals (41%) and gather wild food (30%). The chi-square results showed that there was no statistically significant difference between the groups with regard to the coping strategies index (CSI) (at the 5% level of significance, p-value=0.063).

In Monapo, employed households made use of gathering wild food more than non-engaged and counterfactual households. There was no significant difference between groups regarding the adoption of feeding working members of the household over others, implying that all members in the household were relatively equal when it came to food consumption or working members ate at their place of work has no effect on the household member's food consumption.

In Gurué, a larger percentage of households made use of gathering wild food and consuming seed stock for food. There was no significant difference between groups regarding the application of the strategy feeding working members of the household over others. In Ruacé, similarities were noted in the adoption of coping strategies between the employed and non-engaged groups. This may imply that the presence of the agribusiness had no observable effect on the coping strategies applied in the factual zone. As indicated in Figure 8, more severe coping strategies were applied in by the counterfactual households in Monapo (30%) and the non-engaged households in both Gurué (45%) and Ruacé (30%).



Key: E (employed), NE (non-engaged), CF (counterfactual)

Figure 8: Coping Strategy categorized results for Mozambique, 2016.

4.7. Asset ownership

This indicator was calculated for each household and they were scored on the number of assets they owned based on a questionnaire that contained a list of 20 types of assets, including both household and farm assets. The type of asset owned in each of the groups is reported in Table 11 and includes:

- Bed with mattress
- Sofa set
- Table
- Electric stove
- Working radio
- Mobile phone
- Tape/ DVD/CD
- Television
- Motor vehicle
- Refrigerator
- Washing machine
- Plough
- Weeder
- Harrow
- Ox-cart
- Motoculteur
- Manual sprayer
- Water pump

Table 10: Summary result of employed coping strategies for Mozambique, 2017

Coping Strategy	Coefficient of variance	Monapo						Gurué						Ruacé			
		Employed (n=60)		Non-engaged (n=29)		Counterfactual (n=118)		Employed (n=37)		Non-engaged (n=22)		Counterfactual (n=110)		Employed (n=24)		Non-engaged (n=104)	
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Consume less expensive food	2.45	34	57	20	69	70	59	22	59	13	59	51	46	13	54	53	51
Borrow food	1.19	10	17	6	21	31	26	8	22	6	27	32	29	4	17	31	30
Purchase food on credit	3.51	6	10	1	3	13	11	5	14	2	9	15	14	1	4	18	17
Gather wild food	2.38	20	33	7	24	27	23	6	16	9	41	23	21	11	46	34	33
Consume seed stock	1.10	7	12	7	24	24	20	9	24	10	45	30	27	5	21	28	27
Eat elsewhere	3.84	3	5	5	17	9	8	3	8	2	9	12	11	5	21	16	15
Beg	2.86	2	3	2	7	11	9	3	8	1	5	4	4	4	17	5	5
Limit portion of food	1.79	23	38	13	45	62	53	19	51	10	45	46	42	9	38	47	45
Restrict consumption of Adult	1.64	3	5	5	17	19	16	6	16	2	9	16	15	5	21	20	19
Feed working members	2.70	4	7	2	7	9	8	3	8	1	5	7	6	1	4	11	11
Reduce number of meals	1.72	24	40	12	41	53	45	18	49	9	41	41	37	8	33	43	41
Skip eating days	0.91	9	15	4	14	16	14	6	16	3	14	13	12	2	8	19	18

The most common asset owned by households across all groups was of a working radio (40% of households), mobile phones (38%), tables (38%) and sofa sets (36%). Table 12 reports the total sum of assets. The findings are consistent with the results for most of the other food security indicators reported above. On average, employed households had more assets than non-engaged and counterfactual households, except for Ruacé where non-engaged households had a slightly higher mean assets count (3.3 assets per household) than households in the employed area (mean of two assets). On average, non-engaged households had one asset more than employed households did. The coefficient of variance (0.99) showed low variability across the sample households, meaning that there was a very little variation in the sample for this indicator.

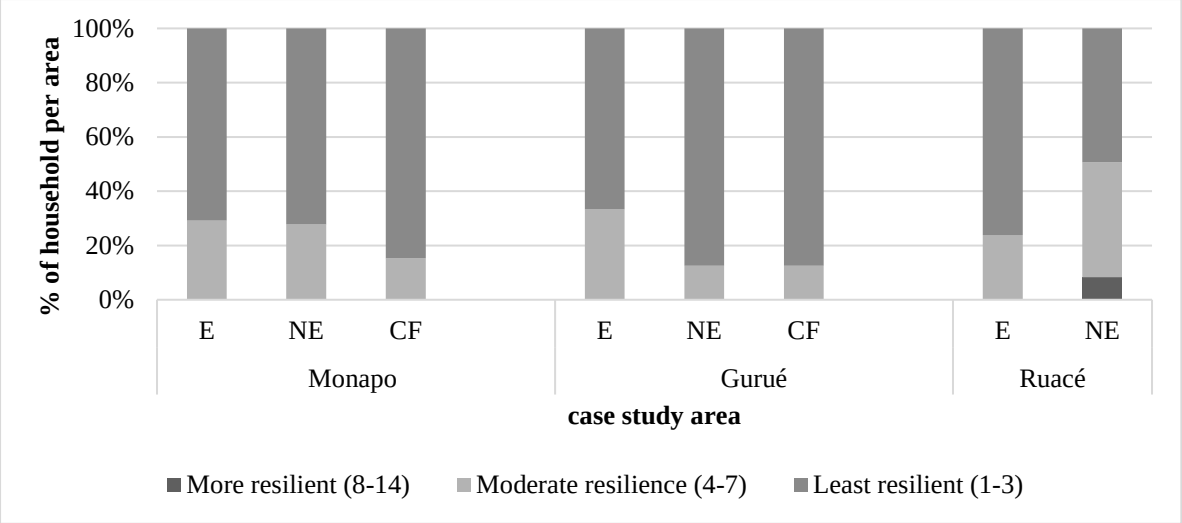
Table 11: Summary of type of asset owned by households in each area for Mozambique, 2016

Asset	Monapo						Gurué						Ruacé			
	Employed (n=60)		Non-engaged (n=29)		Counterfactual (n=118)		Employed (n=37)		Non-engaged (n=22)		Counterfactual (n=110)		Employed (n=24)		Non-engaged (n=104)	
	C	%	C	%	C	%	C	%	C	%	C	%	C	%	C	%
Bed with mattress	28	47	9	31	34	29	14	38	6	27	19	17	11	46	59	57
Sofa set	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	6
Table	28	47	6	21	26	22	21	57	10	45	25	23	9	38	55	53
Electric stove	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
Working radio	16	27	8	28	41	35	24	65	8	36	57	52	8	33	44	42
Mobile phone	26	43	12	41	41	35	13	35	3	14	21	19	13	54	62	60
Tape/ DVD/CD	11	18	3	10	8	7	7	19	3	14	3	3	2	8	34	33
Television	19	32	3	10	2	2	5	14	2	9	1	1	4	17	34	33
Motor vehicle	8	13	1	3	19	16	6	16	5	23	13	12	2	8	25	24
Refrigerator	2	3	0	0	1	1	0	0	0	0	0	0	0	0	14	13
Washing machine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plough	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weeder	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harrow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Ox-cart	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Motoculteur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manual sprayer	0	0	1	3	0	0	0	0	0	0	0	0	0	0	1	1
Water pump	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2

Table 12: Summary results of asset ownership for Mozambique, 2016

Asset			
Coefficient of variance			0.998
Monapo	Employed (n=60)	mean	2.3
		max	7
		min	0
	Non-engaged (n=29)	mean	1.5
		max	6
		min	0
	Counterfactual (n=118)	mean	1.5
		max	6
		min	0
Gurué	Employed (n=37)	mean	2.4
		max	6
		min	0
	Non-engaged (n=22)	mean	1.7
		max	6
		min	0
	Counterfactual (n=110)	mean	1.3
		max	6
		min	0
Ruacé	Employed (n=24)	mean	2
		max	6
		min	0
	Non-engaged (n=104)	mean	3.3
		max	14
		min	0

Assets are an important part of risk management as they can be used to prevent, mitigate and cope with shocks (Babatunde, et al., 2008). When there is a shock, households may sell their assets to be able to access food. In cases where households do not have assets, they may struggle to cope with shocks and are not resilient. Figure 9 illustrates the asset ownership. The majority of the households owned no or few assets (between 0 and 3). Households in the factual zone (employed and non-engaged) owned more assets than counterfactual households. The chi-square result showed that there was a statistically significant difference between groups at the 5% level of significance (p-value=0.000) for assets.



Key: E (employed), NE (non-engaged), CF (counterfactual)

Figure 9: Asset ownership categorized results for Mozambique, 2016.

4.8. CARI console outcomes

The CARI console is an index that makes use of previously calculated food security indicators to draw an overall food security index, for the purpose of this study, the CARI requires the following indicators to be converted to a four-point scale as illustrated in Table 13.

None of the households were severely food insecure and less than 10% of overall households were moderately food insecure (Table 14). More than half of all households were classified as food secure and marginally food secure according to the Food Security Index (FSI). In Monapo, 34.5% of households in the non-engaged category were food secure. This was different in Gurué where 30.6% of households in the counterfactual zone were food secure and in Ruacé where 25% households in the employed category were food secure.

The results of the summative FSI (Table 14) are inconclusive with regard to whether the large-scale investments had a negative or positive effect on the food security status and levels of the households in this study. Ninety percent of all households had high food consumption scores, which made them food secure according to the CARI. Ninety percent had low livelihood coping strategy scores that made them food secure. However, 71% had high food expenditure shares, which classified them as severely food insecure (Table 14). Non-engaged households in Monapo were better off than counterfactual households in Gurué. In Ruacé, employed

households were better off according to the CARI FSI. The findings in the different sites analysed lack consistency.

Table 13: Food security indicators converted into CARI classification

		E	NE	CF	E	NE	CF	E	NE
	Category	**Monapo**			**Gurué**			**Ruacé**	
Indicator	**Food security status**	**Percentage of households (%)**							
Food Consumption Score (4-point scale)	Food secure	87	93	90	92	90	95	96	90
	Marginally food secure	0	0	0	0	0	0	0	0
	Moderately food insecure	10	7	8	5	5	5	4	8
	Severely food insecure	3	0	2	3	5	0	0	2
Food Expenditure Share (4-point scale)	Food secure	9	17	8	9	9	12	8	4
	Marginally food secure	12	0	11	6	9	10	13	6
	Moderately food insecure	15	17	12	3	9	10	4	13
	Severely food insecure	64	66	69	82	73	68	75	77
Livelihood coping strategy (asset depletion 4-point scale)	Food secure	93	97	93	94	100	96	100	98
	Marginally food secure	2	3	2	3	0	0	0	0
	Moderately food insecure	5	0	5	3	0	4	0	2
	Severely food insecure	0	0	0	0	0	0	0	0

Table 14: CARI console for Mozambique, 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 (FCS)	Employed in Monapo	87	0	10	3
		Non-engaged for Monapo	93	0	7	0
		Counterfactual for Monapo	90	0	8	2
		Employed in Gurué	92	0	5	3
		Non-engaged for Gurué	90	0	5	5
		Counterfactual for Gurué	95	0	5	0
		Employed in Ruacé	96	0	4	0
		Non-engaged for Ruacé	90	0	8	2
Coping Capacity (CC)	Food Expenditure Share	Employed in Monapo	9	12	15	64
		Non-engaged for Monapo	17	0	17	66
		Counterfactual for Monapo	8	11	12	69
		Employed in Gurué	9	6	3	82
		Non-engaged for Gurué	9	9	9	73
		Counterfactual for Gurué	12	10	10	68
		Employed in Ruacé	8	13	4	75
		Non-engaged for Ruacé	4	6	13	77
	Livelihood Coping strategy	Employed in Monapo	93	2	5	0
		Non-engaged for Monapo	97	3	0	0
		Counterfactual for Monapo	93	2	5	0
		Employed in Gurué	94	3	3	0
		Non-engaged for Gurué	100	0	0	0
		Counterfactual for Gurué	96	0	4	0
		Employed in Ruacé	100	0	0	0
		Non-engaged for Ruacé	98	0	2	0
Food Security Index (FSI)		Employed in Monapo	29	64	7	0
		Non-engaged for Monapo	34	59	7	0
		Counterfactual for Monapo	27	66	7	0
		Employed in Gurué	11	83	6	0
		Non-engaged for Gurué	27	64	9	0
		Counterfactual for Gurué	30	65	5	0
		Employed in Ruacé	25	71	4	0
		Non-engaged for Ruacé	19	74	7	0

4.9. The relationship between indicator outcomes

Spearman's correlation was used to examine the non-parametric relationship between food security indicators (HDDS, CSI, ASSET, FCS, and MAHFP) using the overall sample of 504 households (Table 15). The WDDS was not included in this analysis due to its small sample

size. The results show that the HDDS, FCS, ASSET and MAHFP all moved in the same direction, except for CSI, which as expected, had an inverse correlation with the other indicators. This meant that the higher a household score for FCS, HDDS, ASSETS, and MAHFP that, according to Table 15, indicates a food secure state, the lower the need for a household to adopt coping strategies.

Table 15: Spearman's rho correlation for Mozambique, 2018

	FCS	HDDS	CSI	ASSET	MAHFP
FCS	1.0000				
HDDS	0.1731*	1.0000			
CSI	-0.0707	-0.0004	1.0000		
ASSET	0.3156*	0.2137*	-0.0043	1.0000	
MAHFP	0.2484*	0.0484	-0.1152*	0.1944*	1.0000

**significant at the 5% level of statistical significance*

4.10. Overall observations of food security indicators analysed

Table 16 presents a summary of the results for the food security indicators. The initial food security findings show that the majority of households enjoyed adequate and acceptable levels in the diversity of diets they consumed. The households did not face serve food insecurity as a result of famine or drought. The HDDS and FCS were used to measure dietary diversity and indicate the quality of the food consumed. Both indicators are consistent in stating that households in the employed categories of the three case studies had a higher food security status. The adequate dietary diversity for employed households in Monapo (63%), Gurué (57%) and Ruacé (71%) was higher than in non-engaged and counterfactual categories. In addition, the acceptable FCS was higher in employed households for Monapo (100%) and Ruacé (96%) and in the non-engaged category for Gurué (91%) households. These results indicate that households in the presence of large agricultural investments enjoyed better dietary quality with no significant difference between those that were employed and those that were not. These results could also be a factor in the production period that occurred prior. If these results were obtained immediately after the harvest period, the food security status would be better as households would have access to food as opposed to during the planting period.

With the WDDS, we perceive that, on average, across all groups, 43% of women-headed households had *adequate* dietary diversity against 41% of women that had *medium* dietary diversity. These results also show that a higher proportion of households were consumed diets of low dietary diversity. In Monapo, a greater portion of women in the non-engaged and counterfactual group enjoyed higher dietary diversity than employed women. The same is true in Ruacé. The case for Gurué differs, where we note that the employment status on women did not seem have an effect on household dietary quality. However, the sample size of female-headed households was less than 15% of the overall group and could hamper our interpretation. A larger sample size of female-headed households would provide more accurate and diverse findings as the sample size would be larger and could account for outliers and fewer margins of error.

The findings of the MAHFP, which is a household perception to food access differs to observations made in the HDDS and FCS as households in the counterfactual categories of both Monapo and Gurué perceived themselves as slightly higher food access to food than the employed and non-engaged categories. In the case of Ruacé, a greater proportion of households in the non-engaged zone had adequate food provision. These findings are inconsistent with HDDS and FCS indicators.

The CSI is the behaviour households take in times of food shortages. The majority of households across all groups were considered food secure or mildly food secure. However, the trends across the three case studies differ. In Monapo a higher proportion of counterfactual households were moderately or severely food insecure, in Gurué a higher proportion of non-engaged and engaged households were moderately or severely food insecure. Whereas, in Ruacé, a higher proportion of non-engaged households were moderately food insecure. This tells us that different areas may have adopted different coping methods. There is no trend noted across categories in which we can deduct the group of households that enjoyed more food security as a result of applying fewer coping strategies.

The asset ownership index was used to measure the resilience of a household. According to this indicator, employed households had more assets than non-engaged and counterfactual households in Monapo and Gurué. This differed in Ruacé, where, a higher proportion of non-engaged households had higher asset levels. These findings are marginal where the average number of assets differed by one or two.

The results above are similar and show that to some extent that households in the factual zones (employed and non-engaged) were more food secure in terms of dietary diversity, food consumption and asset ownership across the three cases studied in Mozambique. The WDDS showed employed households enjoyed more medium to low dietary diversity and MAHFP was slightly higher for counterfactual households. We can deduce that living in the zone of influence did not seem to have major negative effects regarding these indicators for non-engaged households.

Table 16: Summary of food security outcomes for Mozambique, 2016

Indicators	Category number	Category description	Range	Monapo			Gurué			Ruacé	
				Employed (n=60)	Non-engaged (n=29)	Counterfactual (n=118)	Employed (n=37)	Non-engaged (n=22)	Counterfactual (n=110)	Employed (n=24)	Non-engaged (n=104)
Household dietary diversity score (HDDS)	1	Adequate dietary diversity	>=6	63	62	57	57	55	54	71	67
	2	Moderate dietary diversity	4-5	28	34	37	35	27	30	21	27
	3	Inadequate dietary diversity	<=3	8	3	6	8	18	16	8	6
Food consumption score (FCS)	3	Acceptable	>35	100	97	97	86	91	79	96	93
	2	Borderline	21.5 -35	0	3	3	11	9	16	4	6
	1	Poor	0-21	0	0	0	3	0	5	0	1
Women's Dietary Diversity (female-headed households)		High dietary diversity	>=6	0	71	42	75	33	56	0	70
		Medium dietary diversity	4-5	100	29	50	25	33	25	50	20
		Lowest dietary diversity	<3	0	0	8	0	33	19	50	10
Months of adequate household food provisioning (MAHFP)	3	Adequate food provision	10-12	70	69	80	54	50	66	54	63
	2	Moderate food provision	6-10	30	31	20	35	45	32	46	35
	1	Inadequate food provision	1-6	0	0	0	11	5	2	0	2
Coping Strategy Index (CSI)	1	Food secure	0-2	28	31	32	24	9	35	33	31
	2	Mildly food secure	3-12	52	41	36	43	45	37	46	38
	3	Moderately food insecure	13-40	20	24	23	27	45	27	13	31

Indicators	Category number	Category description	Range	Monapo			Gurué			Ruacé	
				Employed (n=60)	Non-engaged (n=29)	Counterfactual (n=118)	Employed (n=37)	Non-engaged (n=22)	Counterfactual (n=110)	Employed (n=24)	Non-engaged (n=104)
	4	Severely food insecure	>40	0	3	8	5	0	0	8	0
Asset Indicator	1	More resilient	8-14	0	0	0	0	0	0	0	7
	2	Moderate resilience	4-7	23	17	10	27	9	8	21	35
	3	Least resilient	1-3	57	45	57	54	64	57	67	40
	4	No resilience	0	20	38	33	19	27	35	13	18

4.11. Principle Component Analysis (PCA)

Principle Component Analysis was used to verify the summary findings. Table 17 presents the outcome of the Principal Component Analysis to investigate these differences further. It shows eight pattern matrices, each matrix representing a household category and its respective site area. Factor loadings indicate the strength of the correlation between the factor (principle component) and the variable (Kline, 1994). If the factor loading is high, the variable contributes more to the PCA outcome (Harman, 1976).

The findings in Table 17 show that PCA generated three uncorrelated variables that accounted for variability in the data associated with all the food security indicators for the different categories. A variance value of zero indicates that all values within a set of numbers are identical, while all variables that are non-zero expected positive numbers. Table 17 shows the PCA pattern results of types of indicators. Of the seven indicators, WDDs was dropped due to its small sample size.

The highest variance is explained by the CSI in the first component for the counterfactual of Monapo. The greatest variance is explained by the CSI and the MAHFP in the second component of the counterfactual Gurué. Households in the employed area of Monapo have the greatest proportion of variance explained by the HDDS in component 2, the CSI in component 1 and the Assets in component 3. The households in the non-engaged area of Ruacé have the greatest proportion of variance explained by the CSI in component 1. The other categories were not anlaysed as the KMO results were lower than 0.5 and indicated that the PCA is not a suitable method of analysis.

The findings in the comparison of the PCA illustrate that the Coping Strategy Index (CSI) had the most explanatory roles in determining the food security status of a household across the groups. The CSI variable is used in the CARI and the Food Security Index (FSI) as the coping capacity which measures the household's resilience to potential shocks and the precautionary strategies adopted by households in times of food shortage.

Table 17: Principle Component Analysis Pattern Matrix

Pattern Matrix	**counterfactual Monapo**			**counterfactual Gurué**			**employed Monapo**			**employed Gurué**			**employed Ruacé**			**non-engaged Monapo**			**non-engaged Gurué**			**non-engaged Ruacé**		
Food security indicator	**Component**			**Component**			**Component**			**Component**			**Component**			**Component**			**Component**			**Component**		
	1	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
FCS	0.46	0.48	-0.40	0.62	0.42		0.59	0.32		0.39	0.50	-0.41	0.56	-0.42	0.22	0.58	0.35	0.27	0.64	0.41	-0.39	0.57	0.31	
HDDS	0.47	0.42	0.40	0.34	-0.68	0.30	0.40	0.61	0.27	0.55	0.68	0.07	0.31	0.76	0.08	0.59	0.34	0.33	-0.32	0.69	0.56	0.36	-0.79	0.12
MAHFP	0.55	-0.32	0.34	0.33	0.72	0.29	0.50	-0.58	0.24	0.52	-0.49	0.27	0.47	-0.49	0.39	-0.43	0.87	0.02	0.63	-0.31	0.70	0.46	0.56	0.29
CSI	0.78	0.59	0.01	-0.36	0.80	0.15	0.72	0.35	0.17	0.39	-0.65	0.20	0.83	0.10		0.62	-0.32	0.21	-0.57	0.30	0.50	0.98	0.01	
Assets	0.50	0.46	0.29	0.51	0.53	0.33	0.42	-0.30	0.69	0.60	0.34	0.20	0.59	-0.31	0.25	0.69	0.17		0.75			0.57	0.32	
Kaiser-Meyer-Olkin (KMO)	0.53			0.55			0.57			0.47			0.41			0.45			0.40			0.68		

The correlation matrix in Table 18 was calculated for the overall data of 504 households, making use of 5 indicators; FCS, HDDS, MAHFP, CSI and Assets to examine the linear relationship between two given variables at a time. The correlation coefficient examines the strength and direction between two variables with a range of -1 to 1. The closer the coefficient is to the value of 1, the stronger the relationship. The results prove that the correlation is not significant and the magnitude of the strength lets us understand if we should be applying PCA. As the overall data is not correlated, it would mean that it is harder to extract various similar components.

Table 18: Correlation Matrix of the household indicators

	FCS	HDDS	MAHFP	CSI	Assets
FCS	1				
HDDS	0.1821	1			
MAHFP	0.2713	0.0274	1		
CSI	-0.0285	-0.0257	-0.0356	1	
Assets	0.3435	0.2397	0.1847	-0.003	1

4.12. Scatter plot of the loadings and score variables

The scores are the linear combinations of the data that are determined by the coefficients for each principal component. The loading plot graphs the coefficients of each variable for the first component versus the coefficients for the second component.

The loading plot graph for all the household categories is illustrated in Appendix 1. Loadings close to -1 or 1 indicate that the variable strongly influences the composition. Loading close to 0 indicates that the variable has a weak influence on the component. In the loading plots, Assets and HDDS have a large positive loading on component 1, whereas CSI has a large negative influence on component 1.

The plot of the score variables illustrated in Figure 10 shows the observations and the rows in the data. This illustrates how they load on the two components. The variables on the graph illustrate the household categories in relation to two components, the overall data is overlapping with the noted outliers mostly represented as category 7 which is attributed to the non-engaged households of Ruacé

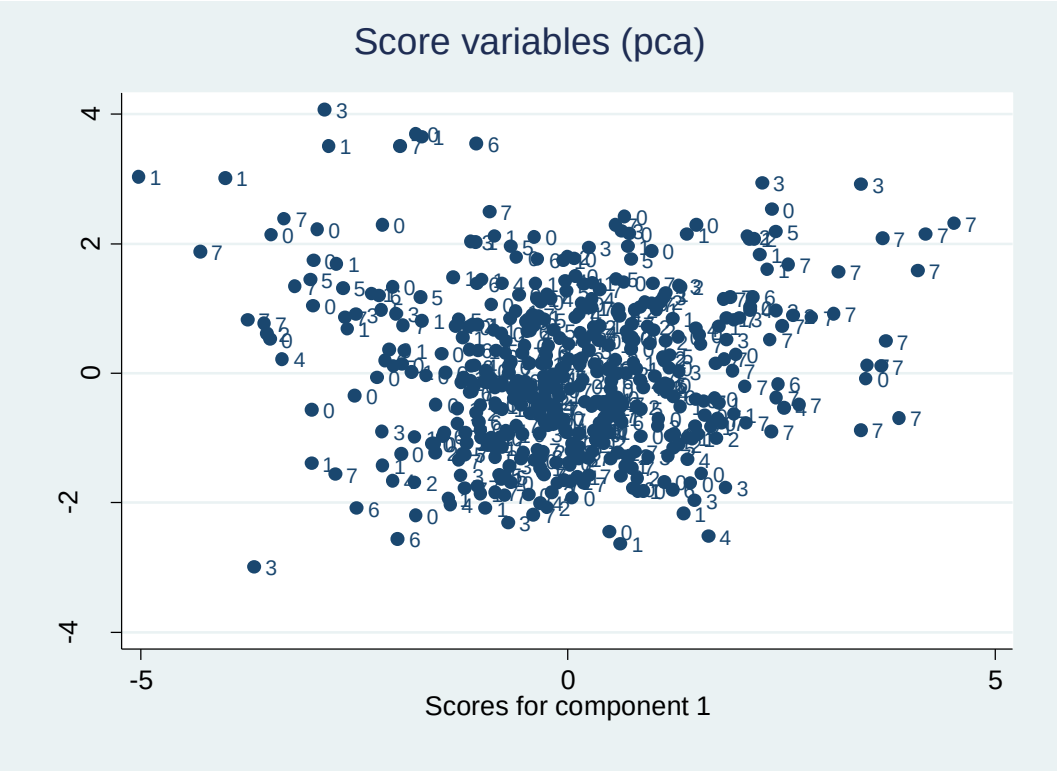


Figure 10: Scatter plot of score variable (PCA)

4.13. Summary

The food security status from the perspective of dietary diversity indicated that more than 50 percent of households in both categories (employed and non-engaged) had adequate dietary diversity, these results are consistent across the district of Monapo and Gurué. A greater proportion of the population in employed households recorded more food secure for FCS, MAHFP, CSI, Asset ownership and the WDDS than non-engaged households. Thus, meaning that more households in the zone of influence near a large-scale agricultural investment were seemingly better off being employed than non-engaged, these findings may be attributed to other factors. Upon further inspection of the Food Security index tool known as the CARI console, it is evident that both households in the employed and non-engaged was classified as marginally food secure. Differences at the level of household food security status did not exist for employed and non-engaged households as they had the same status.

According to the CARI console, it is shown that the majority, greater than 65 percent of households in the counterfactual zone were marginally food secure. This is the same categorization of households in the factual zone (employed or non-engaged). Thus, the households were highly similar across the different food security indicators. Further analysis

is needed to deepen the investigation and explore underlying explanations for these findings. The current outcomes indicate that households that farm in the absence of large-scale agricultural investments could enjoy better dietary quality depending especially on the time of harvest.

The seven food security indicators initially showed that employed households were more food secure than other household categories. The HDDS indicates that households were not severely food insecure and that the majority had adequate dietary diversity, this is noted in the FCS and MAHFP index. The WDDS indicated that employed women had medium dietary diversity as opposed to high dietary diversity. The food expenditure share portion of the CARI console classifies more than 60 percent of households as severely food insecure as more than 75 percent of their household income was used to purchase food. Their behaviour in terms of adaptation is illustrated with the CSI, which classifies the households as mildly food secure or using stress strategies of borrowing or spending savings. The CSI indicated that these households would consume less expensive food and limit their portion of food often. The assets ownership indicator classified the households as moderately resilient. The initial analysis seems that the employed households were better off and living in the zone of influence did not seem to have major negative effects regarding these indicators. The indicators were consistent in their direction when the Spearman's correlation and the correlation matrix was taken into consideration, however, all indicators classified households as food secure or marginally food secure except for the food expenditure which was not one of the seven indicators chosen for the study but rather an element of the food security index which categorised houses as severely food insecure as more than 75 percent of their income was used on food expenditure.

Overall, in the absence of baseline data against which to measure the indicators, it is difficult to say which indicator performs the "best" in terms of correctly and reliably identifying the food insecure households. This leads to further questions of whether to apply multiple indicators in a consolidated index or a single indicator in a particular context to reduce the likelihood of misclassification of the household food security status. In conclusion, analysts should always make use of multiple indicators when analysing food security at the household level so that the correct and necessary interventions are made.

Chapter 5: Summary, Conclusion and Recommendations

5.1. Summary

Since the 2007/2008 world food crisis there has been renewed interest in agriculture and a rush to acquire land to increase agricultural production (Cotula, 2009) (Anseeuw, et al., 2011). The impact of this rush on food security at the local and household level has not really been assessed as evaluations typically focus on short-term case studies level, without considering broader agrarian and socio-economic transformations (Borras, et al., 2013). Against this backdrop, the objective of the project was to analyse how land acquisitions affected local food security outcomes in two areas in Mozambique where large-scale agribusiness operate. Although a third of the households reported that they had lost land as a result of the large-scale agricultural investments and had to be displaced, severe food insecurity was not evident from the results. In fact, more than half of the households were food secure for most of the food security indicators studied. Employed households were better off with regard to dietary quality, food security and resilience. The counterfactual households displayed better food security indexes than non-engaged households in the factual zones. The overwhelming majority of households owned very few assets yet did not apply severe coping strategies such as selling productive assets (animals, tools and land) to address food shortages. The households were generally well adapted to their living situations despite the presence or lack of large-scale agricultural investment. It was not possible to draw a concrete conclusion on whether or not the large-scale agricultural investments had a positive or negative effect on household food security as the direct attribution could be influenced by a number of factors such as climate, infrastructure development and social quality.The dietary diversity of female-headed households needs to be flagged as a problem needing urgent attention. In particular, the female-headed employed households seemed worse off with regard to dietary diversity, which affects their food security status.

5.2. Conclusions

As mentioned in the first chapter, this study investigated two objectives. Objective one set out to determine if differences existed in the prevalence and the level of household food security

between employed, non-engaged and counterfactual households. Objective two set out to compare the seven food security indicators among the household groups and use the Principle Component Analysis to verify the findings.

The study arrived at two conclusions. The first conclusion was that differences did exist between the food security statuses of the groups. As the study did not make use of baseline data and analyse changes over time as a result of the large-scale agricultural investments, it was not possible to attribute relatively lower food insecurity levels to the large-scale agricultural investments. The study can, however, conclude that households in the zone of influence (employed) were better off in terms of dietary diversity and resilience (measured as Coping Strategy Index, Monthly Adequate Household Food Provision and Asset ownership) as compared to households outside the zone of influence (counterfactual households). The first hypothesis that counterfactual households would be better off than employed or non-engaged households was, therefore, rejected. This conclusion however does not provide enough evidence that large-scale agricultural investments have a definitive positive influence on food security. In the case of female-headed households, the findings of this study show that female-headed households tend to display a negative food security status than those that are male-headed in the zone of large-scale agricultural investments influence. More female-headed households had moderate to low levels of dietary diversity in the area of influence in employed and non-engaged areas. Thus, there is a call for equal employment policies where quotas should be in place for women, taking into account their childcare responsibilities and the other time constraining factors such as cooking and collection of firewood as a source of energy.

The second conclusion of this study was that the food security indicators were consistent and converged. Households experienced problems at times or had anxiety about accessing adequate food, but the quality, variety and quantity of their food intake was not substantially reduced as a result of land lost due to displacement or in times of food shortages. This is evident as employed households were better off than non-engaged or counterfactual households. The Principle Component Analysis confirm the findings that showed that all indicators were necessary and there were differences among the indicators, which converge. The second hypothesis that indicators for counterfactual households would be more food secure was, therefore, also rejected.

5.3. Recommendations

Based on the results and conclusion of the study, the following five recommendations are suggested to be considered by various stakeholders. Policymakers should support the development and evaluation of promising new business models that are incentive based to the local community and tackle more sophisticated ways for accountability on behalf of the investors. This is in relation to the literature provided by De Schutter (2011) and Grain (2015) where local communities have their resources exploited as a result of little to no bargaining power against investors. This will be undertaken by having a communication strategy in place, lobbying the interests of the local community and running various campaigns to raise awareness on the issue through the use of champions, mass media, policy briefs, public action or legal remedies. Another recommendation to improve this type of research would be to identify local structures in place that support the community members and analyse to what extent negotiation for land is addressed.

Government organisations such as district level extension working teams, agricultural officers, politicians and political parties running for office at the local level, district councillors, traditional chiefs and clan leaders should have direct dialogue with the local communities before the investment project starts and place sustainable development at the centre of decision-making. This decision will revolve around whether to accept the large-scale agricultural investment project and the community expectation. The government needs to explain the benefits (infrastructure, employment, environmental protection) that will be shared among the local community. Local people that are negatively affected by displacement or expelled as a result of large-scale agricultural investments should be taken under the responsibility of a task force. The task force to be appointed by governments should assess the socio-economic and environmental effects and ensure that investors are held accountable for their deliverables such as employment opportunities, environmental protection, infrastructure development and land safeguards to prevent land speculative investors. They should also provide legal support to ensure that expelled and displaced community members are compensated. Community members should be clearly informed on their human rights, transparency should exist.

NGOs that support the local communities should promote transparency in deal making, raising awareness of the effects and involving the community members in the discussion to promote bottom-up approaches rather than top-down decision making. NGOs should also form a

network of lawyers, activists and researchers that can be mobilised when needed to respond to immediate needs, build capacities to retain skills and knowledge to protect communities especially of women in sustainable livelihood practices.

Investors in agribusiness should be transparent in terms of the types of jobs and other positive or negative project impacts that could be attained for all actors involved. The investors should realistically manage the expectations of local community members in terms of their available capacity and time period available. They should ensure that innovative business models are applied that promote the development of the local community such as out grower schemes and local content requirements. The study recommends investors have long-term engagement with the local interests.

Development practitioners should note that strategic coordination is key, which translates to the long-term effort by different actors to effectively manage a project. This will prevent the duplication of efforts and attain each actors key skill. The engagement with all stakeholders should ensure that the investment project maximises the household food security and contributes to sustainable development. The individuals living in the households should achieve as much benefit as possible to meet their present needs without compromising the ability of future generations to meet their own needs. The development practitioners should create functional systems by having a researcher collect and monitor data of the changes in the status of household food security at timely intervals to improve transparency and information on public scrutiny. The development practitioners should provide advisory services based on similar projects and build capacity from consultation between the investors, government and the local communities to determine their needs and how this could be addressed in the future of such projects so that needs are correctly aligned, public policy related to land tenure rights should also be addressed.

Further research is necessary for monitoring and evaluation purposes by local people and government to tackle food security issues. There is a need for baseline data for continued monitoring to further study the effects of these investments and monitor the food security status of households in such areas. The lack of baseline data inhibits ascribing attribution of the observations directly to the influence of large-scale agricultural investments. Without further information about diets and food acquisition patterns, it is not known if food systems in the factual or land transfer zones were positively affected by the large-scale investments or whether the resultant loss of land rights disrupted the traditional cultivation and food acquisition

patterns. We do not know if, over time, wage incomes and access to cash led to changes in food availability and acquisition patterns. It is crucial for government and investors alike to study the impact of these investments at initial and later stages to monitor the activities of the investors and ensure that a regulated system is in place to prevent exploitation of resources is not taking place.

5.4. Contributions to knowledge

This dissertation contributes detailed food security assessment to inform the food security debate on the impacts of large-scale agricultural investments on households. The research can inform land and food security policymakers, stakeholders, investors, extension workers and development practitioners, civil society and non-government organisations to have a better understanding of the effect of large-scale agricultural investments at the household.

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Appendices

Annex 1: Food security survey questionnaire

Ask about the food consumption of household members	X.1. Did household members eat this food yesterday?	X. 2. How often is this food group usually eaten in the household? Think of the past year, and then fill in the number of times: either per week OR per month OR per year.			X.3. Where was the food obtained from (source)?		
					Self-production	donations/ event Gift/food bank/school feeding	market)
	Yes - tick	Per week	Per month	Per year			
01 = Cereals: maize, rice, wheat, sorghum, millet, and any other foods made from cereals such as porridge, bread and noodles							
02 = White roots and tubers - Potatoes, white sweet potato and cassava							
03 = Orange-flesh vegetables: Pumpkin, carrot, butternut or sweet potato							
04 –Dark green leafy vegetables, including wild/indigenous vegetables							
05 – Other vegetables (tomato, onion, green beans, gem squash, eggplant, including wild/indigenous vegetables							
06 - Orange-coloured fruit (e.g. ripe mango, apricot, spanspek, papaya, dried peach and 100% fruit juice made from these)?							
07 - Other fruit (e.g. oranges, banana, apple, pear etc.), including wild/indigenous vegetables?							
08 - Organ meat (liver, kidney, heart or other organ meats or blood-based foods)							
09 - Meat (e.g. beef, goat, sheep, poultry, pork, insects)							
10 - Eggs from any animal							
11 - Fish and seafood (fresh, tinned or dried and shellfish)							
12 - Dried beans, peas, lentils, nuts, seeds or foods made from these (e.g. peanut butter)?							
13 - Milk and milk products (e.g. yoghurt, maas cheese)							
14 - Oils and fats (e.g. sunflower, rama, lard, butter added to food or used for cooking							
15 - Sweets (e.g. sugar, honey, sweetened juices or fizzy drinks, sugary foods such as chocolate, cookies, cakes)							
16 - Spices (e.g. pepper and salt), condiments (e.g. tomato sauce), coffee, tea, alcoholic							

X.4.	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? 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month) 5 = Always 6 = Not applicable (No adults in household)	[____]
X.5.	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? 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month) 5 = Always 6 = Not applicable (No adults in household)	[____]
X.6.	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. 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month) 5 = Always 6 = Not applicable (No adults in household)	[____]
X.7.	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. 1 = Never 2 = Rarely (1 – 2 times a month) 3 = Sometimes (3 – 10 times a month) 4 = Often (more than 10 times a month) 5 = Always 6 = Not applicable (No adults in household)	[____]
X.8.	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? 1 = Yes 2 = No 3 = Do not know 4 = Not applicable (No children in household)	[____]
X.9 X.10	Did your household run out of money to buy food during the past 12 months? *If "No" Go to Q7.10* Has it happened 5 or more days in the past 30 days?	Yes No [____][____]
X.11 X.12	Did you cut the size of meals during the past 12 months because there was not enough food in the house? *If "No" Go to Q7.11* Has it happened 5 or more days in the past 30 days?	Yes No [____][____]

X.13	Were there months, in the past 12 months, in which you did not have enough food to meet your family's needs?	|__| yes |__| No
X.14	If yes, which were the months (in the past 12 months) in which you did not have enough food to meet your family's needs?	Answer yes or no
	July	A……..

	August	B……..
	September	C……..
	October	D……..
	November	E……..
	December	F……..
	January	G……..
	February	H……..
	March	I……..
	April	J……..
	May	K……
	June	L…….

SECTION HX: COPING STRATEGIES	
Show many days, in the last 7, did the household engage in these mechanisms?	(Use numbers 0 – 7 to answer number of days; Use NA for not applicable)
X.1. Rely on less preferred and less expensive foods?	
X.2. Borrow food, or rely on help from a friend or relative?	
X.3. Purchase food on credit?	
X.4. Gather wild food, hunt, or harvest immature crops?	
X.5. Consume seed stock held for next season?	
X.6. Send household members to eat elsewhere?	
X.7. Send household members to beg?	
X.8. Limit portion size at mealtimes?	
X.9. Restrict consumption by adults in order for small children to eat?	
X.10. Feed working members of HH at the expense of non-working Members?	
X.11. Reduce number of meals eaten in a day?	
X.12. Skip entire days without eating?	

X. Have you adopted any of the following copying mechanisms in the last 30 days?		
	A = No need. B. No, because I exhausted this option and it is not available anymore. C = yes, but rarely (once a week or less), D = yes, regularly (every day or almost)	
X.13	Rely on less preferred and less expensive foods	|__| (code)
X.14	Borrow food from a friend or relative	|__| (code)
X.15	Purchase food on credit	|__| (code)
X.16	Gather wild food or hunt, more than usual	|__| (code)
X.17	Send children to eat with neighbours	|__| (code)
X.18	Send household members to beg	|__| (code)
X.19	Limit portion size at mealtimes	|__| (code)
X.20	Restrict consumption by adults in order for small children to eat	|__| (code)
X.21	Feed working members of HH at the expense of non-working members	|__| (code)
X.22	Reduce number of meals eaten in a day	|__| (code)
X.23	Skip entire days without eating	|__| (code)
X.24	depend on food aid	|__| (code)
X.25	early harvest	|__| (code)
X.26	Sell household's assets (jewels, furniture…)	|__| (code)
X.27	spend all savings	|__| (code)
X.28	consume from trash	|__| (code)
X.29	eat seeds	|__| (code)
X.30	sell under-age livestock	|__| (code)
X.31	sell more livestock than normal	|__| (code)
X.32	sell all livestock	|__| (code)

X.33	Temporary have children leave school for working	
X.34	Have the children leave school for working, permanently	

SECTION HX: CHANGE IN FOOD SECURITY	
X35. Has your overall food situation changed in the past 10 years? 1. Yes …2. No	|__|
X36. How has your food situation changed since 2006 in terms of …?	
- Quantity of meat	
- Quantity of vegetables	-2 -1 0 +1 +2
- Quantity of staples	-2 -1 0 +1 +2
- Quality of meat	-2 -1 0 +1 +2
- Quality of vegetables	-2 -1 0 +1 +2
- Quality of staples	-2 -1 0 +1 +2
- Number of meals a day	-2 -1 0 +1 +2
- Periods of hunger a year	-2 -1 0 +1 +2
- Amount of food purchased	-2 -1 0 +1 +2
- Amount of food self-produced	-2 -1 0 +1 +2

SECTION Hx: EXPENDITURES				
X01	During the last 30 days, how much did your household spent for the following items, in cash, credit and how much did it consumed of the self-production?			
	Fill all cases	Cash (USD)	Credit/borrow (USD)	Estimation of the value of self-production consumed (USD)
01	Cereals:	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
02	White roots and tubers -	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
03	Orange-flesh vegetables:	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
04	Dark green leafy vegetables	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
05	Other vegetables	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
06	Orange-coloured fruit	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
07	Other fruit	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
08	Organ meat)	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
09	Meat	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
10	Eggs from any animal	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
11	Fish and seafood	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
12	Dried beans, peas, lentils,	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
13	Milk and milk products	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
14	Oils and fats	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
15	Sweets	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
16	Spices, condiments, coffee, tea	|__|.|__||__||__|.|__||__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|

17	Soap/detergent	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
18	Restaurant/food out of the house	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
19	Alcohol and tobacco	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
20	House Materials and equipment	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
21	Medicine/regular health expenses	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
22	Rent	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
23	Transport	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
24	Charcoal/gas/wood	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
25	Water	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
26	milling	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|
27	Leisure	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|	|__|.|__||__||__|.|__||__|

X02	During the last X months, how much did your household spend for the following categories?		
		Cash (USD)	Credit/borrow (USD)
01	Health	|__|__|__|.|__||__||__|.|__||__||__|	|__|__|__|.|__||__||__|.|__||__||__|
02	Clothes and shoes	|__|__|__|.|__||__||__|.|__||__||__|	|__|__|__|.|__||__||__|.|__||__||__|
03	Tools and equipment for the land or house	|__|__|__|.|__||__||__|.|__||__||__|	|__|__|__|.|__||__||__|.|__||__||__|
04	Agricultural inputs (seeds, fertiliser, fodder)	|__|__|__|.|__||__||__|.|__||__||__|	|__|__|__|.|__||__||__|.|__||__||__|
06	Sanctions, taxes	|__|__|__|.|__||__||__|.|__||__||__|	|__|__|__|.|__||__||__|.|__||__||__|
07	House Construction or repairs	|__|__|__|,|__||__||__|.|__||__||__|	|__|__|__|.|__||__||__|.|__||__||__|
08	rent	|__|__|__|.|__||__||__|.|__||__||__|	|__|__|__|.|__||__||__|.|__||__||__|
09	Education/school fees	|__|__|__|.|__||__||__|.|__||__||__|	|__|__|__|.|__||__||__|.|__||__||__|
10	Special events (weddings, funerals, celebrations)	|__|__|__|.|__||__||__|.|__||__||__|	|__|__|__|.|__||__||__|.|__||__||__|
11	Repaying debts	|__|__|__|.|__||__||__|.|__||__||__|	|__|__|__|.|__||__||__|.|__||__||__|