
Achieving food security amongst Ghanaian smallholder farmers:

The valuable role of inclusive agribusiness.



Master thesis by Klaske de Vries



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The valuable role of inclusive agribusiness.

Master Thesis

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Front page photo: Women selling lunch in Pokrom, Akuapim South Municipal district, Eastern region, Ghana. Photo credits: Ine ter Berg.

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Summary

In this thesis, the role of inclusive agricultural business on the food security of involved suppliers is explored. The thesis involves a case study of HPW Fresh & Dry Ltd., a Swiss small or medium sized enterprise (SME) in southern Ghana. A mixed-method approach was applied to obtain qualitative and quantitative data by means of a preliminary desk study, nine semi-structured interviews, 117 household surveys, five focus group discussions and participatory observation. Respondents were randomly selected from a suppliers-list. The analytical tools that are used include a one-way Anova tests for continues variables and chi-square tests for nominal and ordinal variables, performed with IBM SPSS statistics version 23. Post Hoc Scheffe tests were performed to assess statistically differences between pairs of means. Bivariate analyses were performed to study the strength of relations between various variables. The inclusiveness of the HPW Fresh & Dry Ltd. business model was analyzed using six criteria for an IBM as proposed by the Food and Agriculture Organization (FAO). It was found that the business model complies with all six criteria, the one to a greater extent than the other. Income security, knowledge transfers and scalability of the business model contribute most to food security: food is best available and accessible right after the first harvest, when payments have been effected. A value chain analysis (VCA) was applied to detect involved actors' struggles and strategies to overcome these struggles. While food availability and accessibility issues are experienced during the dry season, food utilization i.e. diversity in dietary intake is inadequate outside of the scarcity period as well. A 24h food diary recall method was used to calculate Food Variety Scores (FVS) and Dietary Diversity Scores (DDS). FVS is low: eleven out of 45 available food items were consumed on average, with minimum and maximum of six and sixteen food items, respectively. DDS scores were high with five out of six food groups on average, with minimum and maximum of three and six food groups, respectively. These outcomes palliate the lack of dietary intake as respondents largely rely on three typical meals: fufu, banku and rice with stew. These are energy-rich dishes and consist of largely of carbohydrates (cassava, maize and rice), accompanied with very small amounts of (dried) fish and a soup or stew. Diversity in dietary intake hence is where suppliers stand to gain. The extent to which this is a task of inclusive agribusiness, is debatable.

Preface

It is a pleasure to present to you my thesis on inclusive agribusiness and local food security. This thesis is the final product of a combination of one month desk research, two months of fieldwork in Ghana and two months of data analysis and thesis writing in the Netherlands. The research findings contribute to the Follow the Food program - a collaboration of Utrecht University, Mary's University, Solidaridad and Fair & Sustainable Advisory Services – which studies how foreign investments in African agribusiness impact food security at the local level.

I remember myself telling a friend after my fieldwork trip to Vietnam in spring last year, how I would certainly not go on a fieldtrip for my thesis again. During the past years, I have realized how lucky we, *Dutchies*, are to live in this amazing country where every small piece is thought through and well-organized. I also remember how my mind started to change after meeting dr. Bram van Helvoirt during the LANDac Annual International Land Conference last year, when we were talking about the Follow the Food programme of which he was the coordinator at that time. I figured that this was an opportunity too good to let pass by, although I was a little sceptic about Ghana. I was not sure about myself relating with those Ghanaians, of whom I found several to be very rude during my internship at KLM Royal Dutch Airlines. This feeling lasted until I was about to take a taxi at Kotoka International Airport, Accra where the first words from a 'real' Ghanaian were: "Welcome to Ghana, miss!". I remember how I left my feelings of distrust and skepticism behind with every mile we drove to Somewhere Nice Hostel, where one of the best periods of my life was about to start. None of my prejudices were about to be true, it was rather the contrary: I had never ever seen so many happy and friendly people on such a small piece of world – yes, Accra is very very crowded. To make a long story short: my experiences in Ghana were above expectations. Therefore, particular gratitude goes to the Maik Blaser and all Ghanaian farmers and their families I spoke with. Your openness, optimism, and positivism was more inspiring than you can imagine. *Mi daase paa* for your cooperation and hospitality!

Many thanks also go to Dinah and Gias, my two research assistants. It would have been impossible to finish my thesis in time without your great work, dedication and knowledge on the topic, communities and research areas.

Then, dr. Guus van Westen, my supervisor during the past six months: thank you for your insightful comments and encouragement during my fieldwork and thesis-writing period, but also for your questions which incited me to think twice, or in several cases even thrice.

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I can also not go without saying a big thank you to Max. Somewhere Nice indeed was somewhere nice where it felt like coming home after finishing my trips to the field. And of course, Milly, Leticia and Linda: thank you for making me the best breakfasts in the world, *eye de papa!*

And last but not least: Ine, my study mate from the master program and colleague during the fieldwork period. I couldn't have wished for someone more down-to-earth but patient and accurate before, during and after our fieldwork. Thank you for all the talks and laughs during those lovely two months I spent in this crazy but amazing country.

Klaske de Vries

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List of abbreviations

CSPWD	Cape Saint Paul Wilt Disease
CR	Central region
CSR	Corporate Social Responsibility
DDS	Dietary Diversity Score
ER	Eastern region
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign Direct Investment
FVS	Food Variety Score
GR	Greater Accra region
HH	Household head
HPW	Hans Peter Werder
IBM	Inclusive Business Model
MBBS	Mango Bacterial Spot
MSE	Micro or Small Enterprises
MOFA	Ministry of Farming and Agriculture
RNI	Recommended Nutrient Intake
SME	Small or Medium-sized Enterprise
SDG	Sustainable Development Goals
VCA	Value Chain Analysis
VC	Value Chain
VR	Volta region

1. Introduction

1.1 Background

Eradicating poverty and hunger and improving nutrition remain the main challenges for development workers and are translated into the first and second Sustainable Development Goals (SDG) of the United Nations (UN):

Goal 1: End poverty in all its forms everywhere.

Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.



Figure 1: Sustainable Development Goals (UN, n.d.)

The relation between these two challenges and SDGs is close: food and agriculture can eradicate poverty and hunger, and in fact “the entire set of SDGs” (FAO, 2016: 6). “Recognition of this fact has brought agriculture back onto the international development agenda” (Seville, Buxton & Vorley, 2011: 2). Long term strategies for feeding the growing global population which is projected to be nine billion in 2050, include the linking “of smallholders with well-functioning local or global markets” (ibid.). Developing countries have a high potential for agricultural growth, however, lack of know-how and (state of the yard) technology may hamper this potential. This gap can be filled by capital inflows and knowledge and technology transfers enabled by agricultural foreign direct investment (FDI).

In 2015, investment figures jumped with 38% to a total of \$1.76 trillion, which is highest since the global economic crisis of 2008. Europe is, with outward flows of \$576 billion in 2015 (an increase of 85% compared to 2014) the largest investing region and makes up 59,9% of the total investments from developed nations. With a total outflow of \$113 billion in 2015, the Netherlands is regarded the top investing country within Europe.

FDI inflows towards Africa decreased with 7% compared to 2014 figures, to a total of \$54 billion, mainly caused by low commodity prices (UNCTAD, 2016). The primary sector in Africa (including agriculture and extractive industries) is with 28 % of FDI far less popular compared to the service sector (51%). On the African continent, Ghana is one of the top five host countries (see figure 3) where over \$3 million of FDI net inflows made up 8,4% of the GDP in 2015 (World Bank,

2016a and b). In Ghana, “FDI in the agriculture sector is critical, and an important tool in the fight against poverty” (Djokoto, 2012: 21), as the country has a lot of potential but does not have the capacity and resources to “stimulate and develop the agricultural sector” (ibid.). A total of 85 agricultural FDI projects were recorded in Greater Accra region (GR) in 2012. This is far more compared to 37 projects in Eastern region (ER), 24 in Volta region (VR) and 22 in Central region (CR) (see figure 2). The popularity of investing in the greater Accra region can be explained by the nearness of the Tema port and suggests that “the farther a region is from the national capital, the fewer the projects its attracts” (Djokoto, 2012: 23).

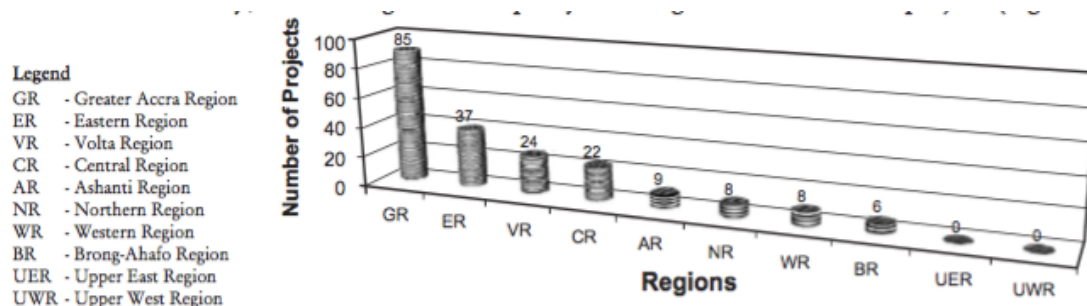


Figure 2: Regional distribution of registered agricultural FDI projects (1994-2010) (Djokoto, 2012)

1.2 Problem statement

In Ghana, poverty and food insecurity rates are highest in the northern regions. Here, no FDI projects were found to be active (Djokoto, 2012). This raises the question whether employment created by agricultural FDI projects in the southern part of the country positively correlates with the living conditions of the local communities. Indeed, combining “the strengths of the investor (capital, technology and expertise in management and marketing) with those of local farmers (labour, land, traditional know-how and knowledge of the local conditions)” (FAO, 2014: 13) is very likely to result in successful food-related outcomes at the local and global level. This potential for economic and social development however is prone to malfunctions and may have negative impacts on host communities. In order to prevent this from happening, “the process through which the investment project is negotiated, designed and planned [should be] transparent, inclusive, participatory, democratic and documented” (FAO, 2014: 16) and the investment contracts between the project partners should be “well-specified and have enforceable terms” (ibid.). These requirements are characteristics of an inclusive business model (IBM): An inclusive business (IB) involves local communities in the value chain (VC) and hence contributes to the creation of sustainable living conditions for vulnerable people. Differentiating between inclusive and non-IBMs however is not straightforward. Hence, and in the light of the SDG’s that aim to address “the root causes of poverty and the universal need for development that works for all people” (UN Ghana, n.d: para. 2), studying the inclusivity of the business model and all actors, elements and processes involved in the VC is essential to explore the various ways in which inclusive agribusiness can contribute to food security *for all*: now and for future generations.

DEVELOPING ECONOMIES

AFRICA

FDI flows, top 5 host economies, 2015 (Value and change)

2015 Inflows

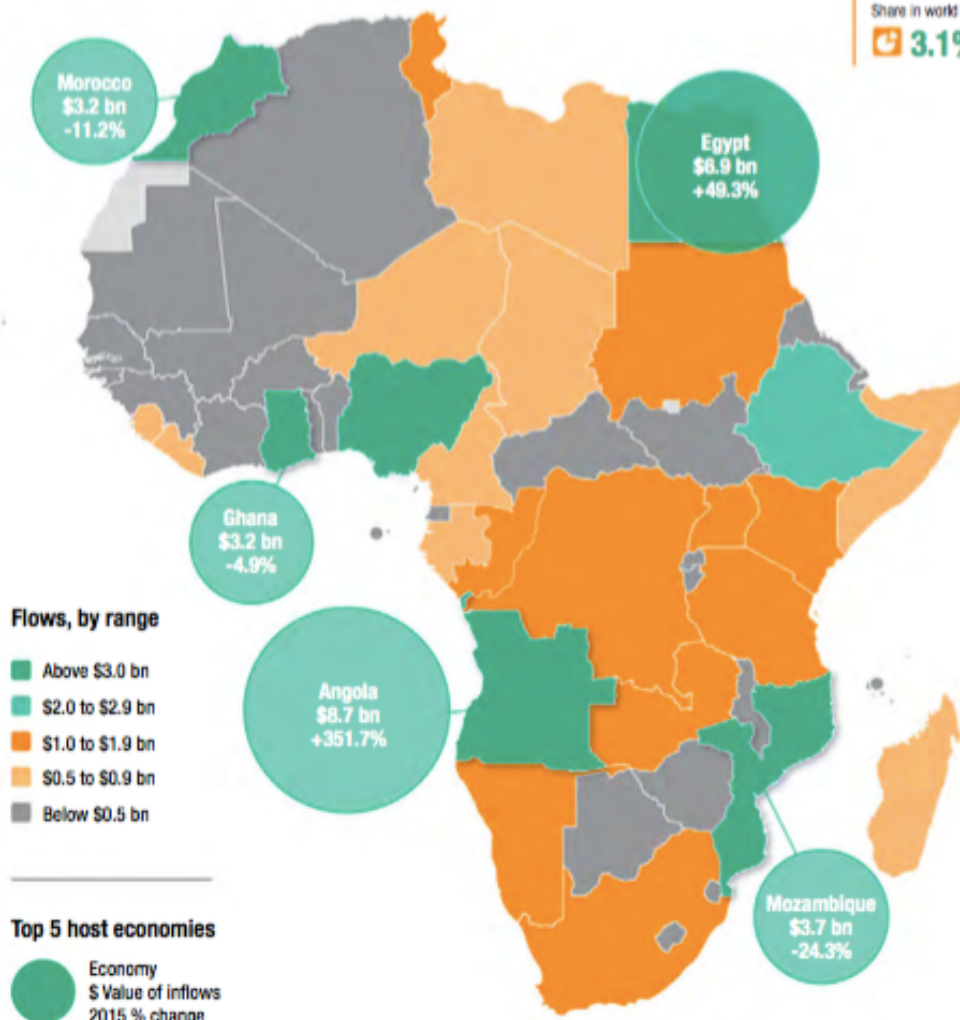
\$ 54.1 bn

2015 Decrease

-7.2%

Share in world

3.1%



Outflows: top 5 home economies

(Billions of dollars, and 2015 growth)

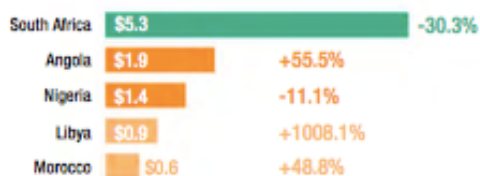
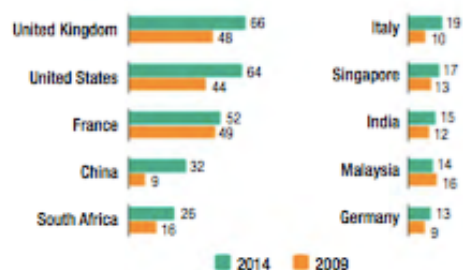


Figure A. Top 10 investor economies, by FDI stock, 2009 and 2014 (Billions of dollars)



Source: UNCTAD.

Note: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations. Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined. Final status of the Abyei area is not yet determined.

Figure 3: Africa: FDI flows, top 5 host economies, 2015 (UNCTAD, 2016)

1.3 Research objectives and main question

To study how inclusive agribusiness can contribute to enhancing global food security without negatively affecting local communities, it is important to learn from various investors with various IBMs. This thesis is a case study and studies the food security of suppliers of HPW Fresh and Dry Ltd., a Swiss company in Adeiso in the central region of Ghana. HPW Fresh & Dry Ltd. buys pineapples, coconuts, papaya and mangoes from smallholder farmers and processes this into dried fruit for the European export market. This research was conducted to fulfil the following research objectives:

- 1) To explore the characteristics of the inclusive business model applied by HPW Fresh & Dry Ltd.;
- 2) To detect the struggles and strategies to overcome these struggles amongst actors involved in the business model by means of a value chain analysis;
- 3) To demonstrate how these struggles and strategies translate into food security of the suppliers of HPW Fresh & Dry Ltd.;
- 4) To identify the role of HPW Fresh & Dry Ltd. for (enhancing) food security of their suppliers;
- 5) To contribute to a model of best practices for inclusive business.

The main question guiding this thesis is formulated as follows:

What is the food security situation of smallholders in southern Ghana and how can inclusive agribusiness contribute to their situation?

This question is divided into the following sub questions:

1. To what extent is the business model applied by HPW Fresh & Dry Ltd. an inclusive business model?
 - a. Who are the main stakeholders involved in the IBM and what are their roles and relations with each other?
 - b. Under which conditions are local smallholders included in the business model?
 - c. On what terms is the business model beneficial local smallholders?
2. How are the value chains organized?
 - a) What struggles are experienced by stakeholders involved in the value chains?
 - b) What strategies are applied or required to improve efficiency and profitability for both HPW fresh & Dry Ltd. and their suppliers?
3. How food secure are HPW Fresh & Dry Ltd. suppliers?
 - a) Which factors influence their food security situation?
 - b) Which strategies are applied by the suppliers to improve food security?
 - c) What is needed to further improve their situation?

This thesis will continue with a discussion of existing literature, to establish a theoretical framework which will function as the basis for this thesis and enables to select appropriate fieldwork methods. How the data required for this thesis was collected and analyzed is discussed in chapter three. In the empirical chapters (four, five and six), data is presented following the structure of the sub questions and in the conclusion (chapter seven), the main findings are repeated which eases answering and reflecting upon the main research question in the discussion (chapter eight).

2. Theoretical framework

Prior to the fieldwork period, a desk study was conducted in which existing literature on agricultural foreign direct investments (FDI), inclusiveness and food security was accessed and reviewed. The most important findings are discussed in the theoretical framework, in which various concepts and theories that will be used throughout this thesis are contextualized and defined as well. This chapter will start with a brief introduction on Ghana, followed by a review on its food security situation. Then, arguments in favor of and against FDI for social and economic development are discussed, which is followed by a review of the potential of inclusive agribusiness on enhancing local food security.

2.1 Characteristics of Ghana

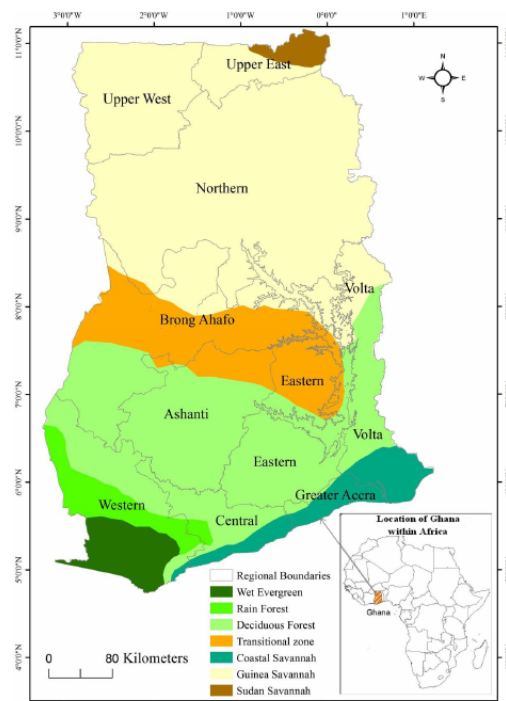
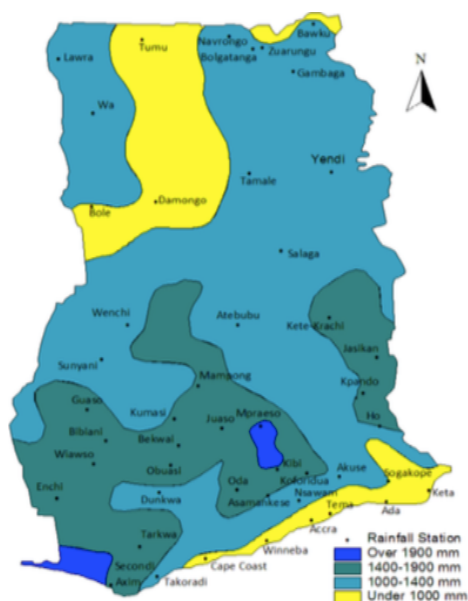
Ghana is a lower-middle-income country in West Africa, bordering Côte d'Ivoire in the west, Burkina Faso in the north and Togo in the east. The southern part of Ghana, including its capital Accra borders the Gulf of Guinea. Ghana's total area is 238,539 km² of which 11,000 km² (5%) is water and 155,000 km² (65%) is agricultural area. Total population was 27,41 million in 2015, of which 46% lives in rural areas. The majority of the Ghanaians (49%) belongs to the Akans (Twi and Fante) ethnic group, 17% is Mole-Dagbon, 13% is Ewe and 8% is Ga/Daangme. Christianity is the most prevalent religion (63%), followed by the Islam (16%) and indigenous beliefs (21%) (FAO & FIVIMS, 2009). Ghana has a tropical climate. The Harmattan (starting around Christmas and lasting until the end of January) brings hot and dry air from the Sahara into the northern part of Ghana, while the monsoon (May and June) brings cool and wet air from the ocean into southern Ghana. As a result, the south experiences two rainy seasons (April to June and September to November), whilst the north experiences one rainy season (from August to September). Rainfall is highest in the far south-eastern region and parts of Ashanti. Here, mean annual rainfall exceeds 1900mm a year. Annual rainfall in 50% of the country is between 1000 and 1400mm (Logah, Obuobie, Ofori & Kankam-Yeboah, 2013) (see map 2). These climatic conditions largely determine Ghana's seven ecological zones (see map 1), which on their turn determine the type of crops that are best cultivated in each region.

In the forest zone¹, tree crops are significant with cocoa, oil palm, coffee and rubber being of particular importance. The food crops in this area are mainly inter-cropped mixtures of maize, plantain, cocoyam and cassava. The middle belt² is characterized by mixed or sole cropping of maize, legumes, cocoyam or yam, with tobacco and cotton being the predominant cash crops. Cotton and tobacco are also important in the northern sector³, where the food crops are mainly sorghum, maize, millet, cowpeas, groundnuts and yam. Rice is important in all the zones. (Oppong-Anane, 2006: 5).

¹ The southern provinces Western, Central, Greater Accra, Ashanti, the south of Eastern and Volta.

² Central provinces Brong Ahafo and the north of Eastern.

³ Northern, Upper West and Upper East.



Physical AVAILABILITY of food	Food availability addresses the "supply side" of food security and is determined by the level of food production, stock levels and net trade.
Economic and physical ACCESS to food	An adequate supply of food at the national or international level does not in itself guarantee household level food security. Concerns about insufficient food access have resulted in a greater policy focus on incomes, expenditure, markets and prices in achieving food security objectives.
Food UTILIZATION	Utilization is commonly understood as the way the body makes the most of various nutrients in the food. Sufficient energy and nutrient intake by individuals is the result of good care and feeding practices, food preparation, diversity of the diet and intra-household distribution of food. Combined with good biological utilization of food consumed, this determines the <i>nutritional status</i> of individuals.
STABILITY of the other three dimensions over time	Even if your food intake is adequate today, you are still considered to be food insecure if you have inadequate access to food on a periodic basis, risking a deterioration of your nutritional status. Adverse weather conditions, political instability, or economic factors (unemployment, rising food prices) may have an impact on your food security status.

Figure 4: Four food security objectives to be fulfilled simultaneously (FAO, 2008)

Latest figures on food security in Ghana stem from 2010-2012 when 1,4 million people (5,6%) were found to be undernourished, although this number "hides striking regional differences" (WFP, 2009: 13). While food is available in Ghana, "it is not accessible to all. Or else food is not utilized well" (FAO & FIVIMS, 2009: 28). The typical food consumption does meet the populations' energy requirements (ibid.), but consists largely of starchy roots such as cassava and (coco)yam and cereals like maize and rice (65-70% of their dietary intake comes from these products), supplemented with fruits (plantain) and (dried)fish. Furthermore, variety in dietary intake is low and products like protein and lipids tend to be under consumed (ibid.).

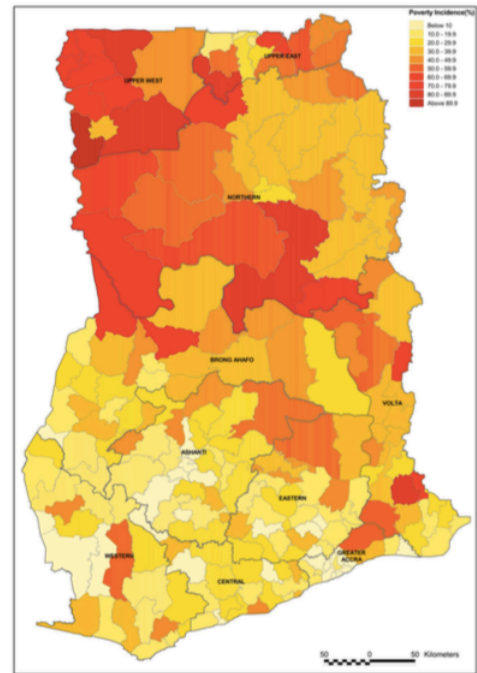
Populations in northern regions are most prone to food insecurity⁴. In this area, people are poor and incapable of combating contextual factors at the macro-level such as the 2008 soaring food prices and "adverse weather conditions, such as floods and droughts" (WFP, 2009: 13). Factors at the household level such as lack of education, "[h]igh dependency on agricultural livelihood activities as primary income source, [...] [l]ack of access to output markets" (ibid.: 16), and poverty further increase food insecurity of northern populations (see map 3). In addition, "unstable production, insufficient purchasing power and problems of physical access due to a lack of road infrastructure in the northern part of the country" (FAO & FIVIMS, 2009: 3) are jeopardizing food security of local populations. Moreover, current food insecurity situation has increased in two of the three northern provinces (Northern region and Upper West), compared to the situation in 2012 situation.

Women in particular are vulnerable to food insecurity, because of "their lower empowerment status, unequal intrahousehold food distribution, and the willingness of women to forego meals in favor of children during times of scarcity" (Malapit & Quisumbing, 2015: 56). Another factor increasing their vulnerability to food insecurity is the lack of ownership of agricultural plots by women (85% of the plots was owned exclusively by the individual male) (Deere *et al.*, 2012).

⁴ Food insecurity prevalence: Upper East: 20,3%, Upper West 18,3% and Brong Ahofa 15,5% of the population.

Regions	Food Insecure		Vulnerable to food insecurity	
	No. of people	% pop	No. of people	% pop
Western Rural	12,000	1%	93,000	6%
Central Rural	39,000	3%	56,000	5%
Greater Accra Rural	7,000	1%	14,000	3%
Volta Rural	44,000	3%	88,000	7%
Eastern Rural	58,000	4%	116,000	8%
Ashanti Rural	162,000	7%	218,000	10%
Brong Ahafo Rural	47,000	3%	152,000	11%
Northern Rural	152,000	10%	275,000	17%
Upper East Rural	126,000	15%	163,000	20%
Upper West Rural	175,000	34%	69,000	13%
Urban (Accra)	69,000	2%	158,000	4%
Urban (Other)	297,000	4%	572,000	8%
Total	1,200,000	5%	2,007,000	9%

Figure 5: Prevalence of food insecurity and



Map 3: Incidence of poverty in Ghana (Ghana Statistical Service, 2015).

2.3 The potential of agricultural Foreign Direct Investment for alleviating food security

The multiplicity of existing literature about food insecurity of women and children in northern Ghana seems to squeeze out the existence of food security issues in southern regions (see figure 7 and map 3). “Undernutrition is a substantial problem throughout Ghana, but is more common in rural areas. The problem of undernutrition tends to be greatest in the Central, Eastern, Northern, Upper East, and Upper West regions” (FANTA, 2013: para. 14). Indeed, the regions where Djokoto (2012) found agricultural investments to be the least occurring.

FDI involves a long-term relationship between an investor and a host country, in which the investor has some kind of control or influence on the activities that are executed by the enterprise in the host country (UNCTAD, 2016; Djokoto, 2012). The potential of agricultural FDI for enhancing local food security is largely discussed by proponents and opponents (Slimane, Huchet-Bourdon & Zitouna, 2016). Opponents base their opinions on the dependency theory: FDI is not more than a profit-making method by extracting natural resources and cheap labor, and increases the economically and politically dependency of developing countries on investors from wealthy countries (Jenkins & Scanland, 2001; Wimberley, 1991). Prices and goods are manipulated for tax avoidance, and profit is transported directly to the country of origin. In addition, dependency theorists argue that local politics and economic conditions are influenced “by controlling the means of production [which has] adverse effects on growth and the distribution of income” (Slimane *et al.*, 2016: 53). External factors such as globally fluctuating commodity prices, trade and growth figures and climate change may increase the vulnerability of host populations (*ibid.*), in particular of smallholders who may lose their land or cattle (Gerlach & Liu, 2010; Schoneveld, German & Nutakor, 2011). And rather than increasing job opportunities, opponents consider the increased use of machinery as a treat for livelihood securities as human performed labor is no longer required (Hallam, 2011).

Proponents on the other hand base their opinions on the modernization theory: FDI provides internal and external sources of economic growth which may develop the host country in the economic sense and help to become international integrated.

Internal sources come from domestic investment, growth and education by creating industrialization and cultural modernization, and finally provide social welfare [...]. External sources come from FDIs, which bring technology, organizational capability, management skills and marketing know-how. FDI inflows provide easy access to international markets and diffuse new skills and knowledge in the host economy [...]. The technology transfer and know-how lead to productivity gains and improved efficiency of allocation of resources. (Slimane *et al.*, 2016: 53).

Agricultural growth - in quantity and quality (Hallam, 2011) – and hunger reduction may be direct effects of agricultural FDI (World Bank, 2008; FAO, IFAD & WFP, 2015). Job creation may enhance living conditions of the host population (Dollar & Kraay, 2001; Dugasquier & Osakwe, 2006), in particular in developing countries (Skoet, Stamoulis & Deus, 2004) and when outputs are produced locally, with locally produced inputs (Djokoto, 2012). Technology transfers improve farming skills and know how, and enhance the quality and quantity of the locally cultivated food crops (Dries & Swinnen, 2004). Improved quality of food products on its turn is beneficiary for health conditions of local communities on the long run (Hallam, 2011).

2.4 Inclusive business for sustainable social and economic development

Webber & Labaste (2010) found that “raising the productivity and increasing the efficiency of agricultural value chains are basic to the success of SSA rural economies and to the growth of incomes of their rural populations”. However, the inclusion of smallholders in “formal value chains [is] not a silver bullet for pro-poor development. To have a significant and durable impact on poverty reduction, and to reach producers with fewer assets, value chain interventions must be integrated with upgrading and wider livelihood strategies” (Seville, Buxton & Vorley, 2011: 42) (see figure 6).

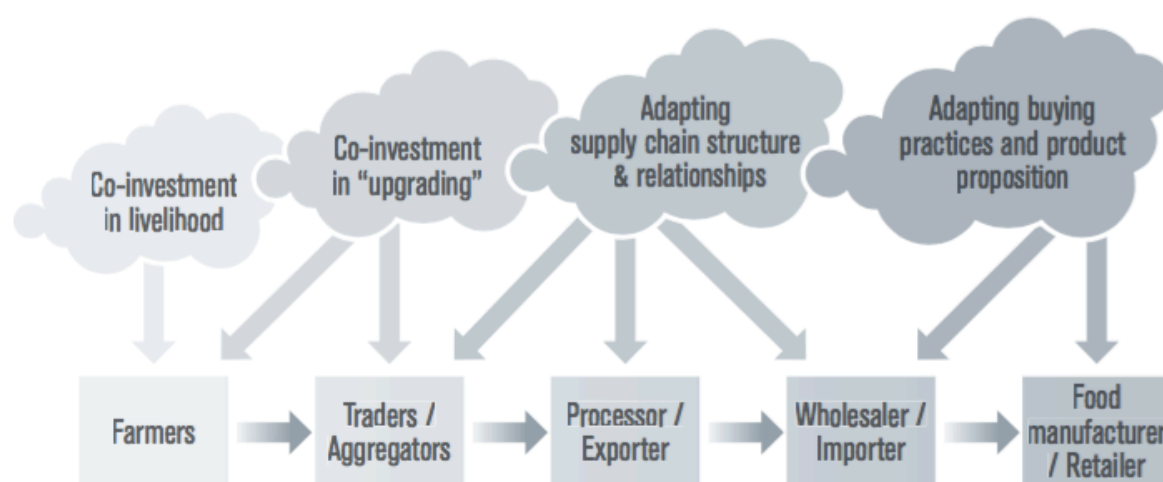


Figure 6: Leverage points in a supply chain (Seville, Buxton & Vorley, 2011).

In addition, several external factors strongly “influence [...] the impact of agricultural FDI on the local community, its’ economic development and the wider economy of the host country” (FAO, 2014: 15) (see table 1).

Table 1: Eight factors influencing the impact of agricultural FDI on local communities, as adapted from FAO (2014).

Good governance	National laws and regulations are crucial to ensure access to land for both the investor and local stakeholders, without the possibility for conflicts to happen.
Local social and economic conditions	Infrastructure and education increase the position of local stakeholders.
Involvement of local stakeholders	Participation of local stakeholders in turn ensures balanced cooperation and positively contribute to the outcomes for the investor.
Formulation and negotiation process	Negotiation processes should be “transparent, inclusive, participatory, democratic and documented” (FAO, 2014: 16)
Contents of investment contracts	Investment contracts need to be well-specified with enforceable terms to establish uncongested relationships between investor and suppliers
Profile of the investor	Intentions, management skills and experiences are critical for a positive investment outcome
Support from third parties	Both parties may be benefit from third parties with relevant experiences, skills and knowledge to facilitate the relationships between investor and suppliers.
Type of production system and crops	The usage of local inputs instead of imported ones for the cultivation of crops is more likely to create backward linkages to the local economy

Hence, the potential of a (foreign) agribusiness for improving local food security depends on, *inter alia*, the inclusiveness of the business model applied by the small or medium-sized enterprise (SME). A business model “is inclusive when it integrates smallholders into markets with the underlying principle that there are mutual benefits for poor farmers and the business community” (FAO, 2015: 4) and should ultimately result “in moving smallholders out of poverty and improving foods security” (ibid.). The aim of an inclusive business model (IBM) is to integrate local people into core business value chains and providing them with roles of producers, suppliers, employees, distributors and customers (SNV, 2016). Thus, ‘inclusiveness’ concerns the linking of commodity-dependent smallholders with small enterprises, into domestic or international markets (FAO, 2015) and various points in the value chains (UNDP, 2008; WBCSD & SNV, 2011; Gradl & Knoblock, 2010; BIF, 2011). Inclusive business (IB) then is a profit seeking method of a SME by expanding the opportunities for the local communities (BIF, 2011) in an environmentally and socially responsible way (WBCSD & SNV, 2011) and the enterprise, local population and the environment will be the beneficiaries (Gradl & Knoblock, 2010).

Drawing the line between inclusive and non-IBMs however is not straightforward (Wach, 2012): in principle, all businesses can contribute to social and economic development of the host population through taxes, employment, market expansion or technology transfer (BIF, 2011). What differentiates IBs from non-IBMs is that IB “goes further, in creating new economic opportunities for people living in poverty, perhaps as workers or as consumers of affordable good and services” (DFID, 2011: 1 as cited in Wach, 2012: 19). Six criteria for IBMs are set up by the FAO (2015) (see figure 7).

Criteria for inclusive business models

An IBM:

- *provides a living wage for vulnerable groups*, such as smallholder groups, small enterprises, women- and youth-run enterprises, while also enabling buyers to profit;
- *uses flexible trading arrangements* that make it easier for smallholders or MSEs to supply a buyer, such as cash on delivery, accepting small consignments, providing reliable and regular orders;
- *supports farmers and small enterprises to establish a stronger negotiation position* through skills development, collective bargaining and access to market information and financial services;
- *builds on the skills and expertise of existing market players*, including traders and processors, and promotes value chain collaboration, transparency in pricing mechanisms, and risk sharing;
- *is scalable in the medium-term* so that the numbers of small actors involved can be increased and/or the type of business model can be replicated in other value chains or parts of the sector;
- *allows for diversified income streams* in the long term to enable the dissemination of upgraded skills to the rest of the sector, avoiding overdependence on any single buyer or market outlet.

Figure 7: Six criteria for inclusive business models (FAO, 2015)

This thesis involves a case study to explore the food security of suppliers of HPW Fresh and Dry Ltd., a Swiss company in Adeiso in the central region of Ghana. HPW Fresh & Dry Ltd. buys pineapples, coconuts, papaya and mangoes from smallholder farmers and processes this into dried fruit for the European export market. Since the start of its' operation, export rates and demand for raw material has increased with 30%. In May 2016, the company has opened a second factory. The scalability of HPW Fresh & Dry Ltd., may “trigger increases in both employment and incomes, and bring broader development results as more and more poor people become integrated into value chains or gain access to certain products and services” (ibid., 2013: 25). Scaling up an inclusive SME can be done in various ways: by innovation and growth, by replication of other successful inclusive SMEs, or by “upgrading and aggregating IB ventures in the informal economy” (Roesler, Hollmann, Naguib, Oppermann, & Rosendahl, 2013) (see figure 8).

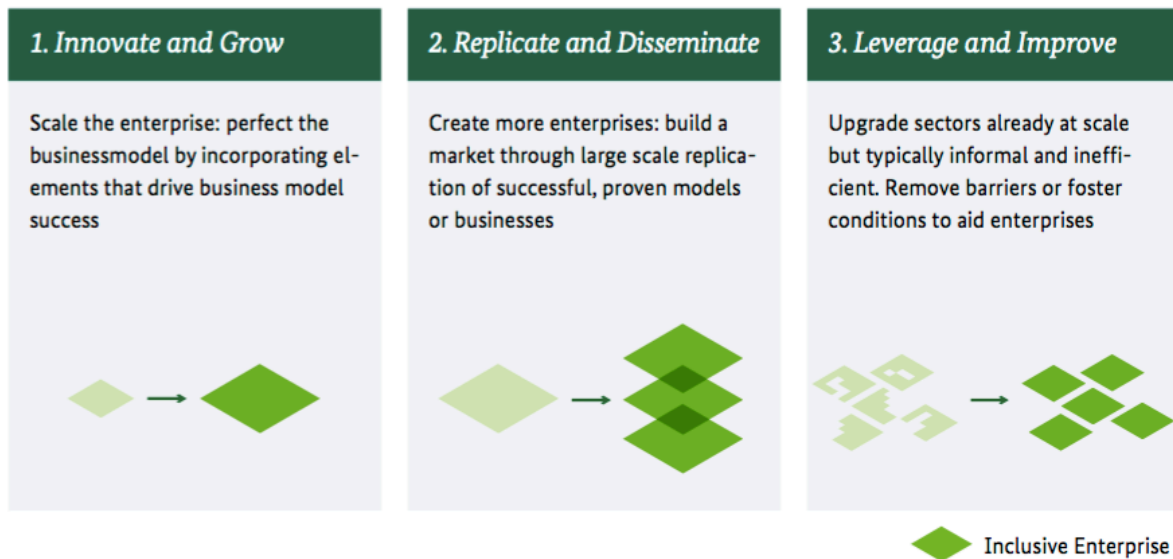


Figure 8: Achieving social impact at scale (Roesler et al., 2013)

In conclusion of the literature that is discussed in the foregoing, (foreign) agribusiness may improve food security in the global sense – basically by enhancing the production of food – but has potential for improving food security of local people in the investment region as well. Technology transfers and enhanced know-how amongst local smallholders may boost productivity levels, which increases income security of those smallholders on the one hand, and income security of people not (yet) involved in the VC because of the requirement for additional labor force. Income is one of the preconditions for access to food. Higher productivity levels may improve food availability at local markets and farming skills enhance product quality and in turn contribute to health and nutritional conditions of local people.

But food security is complex and influenced by several factors: access to food is largely a direct result of livelihood assets⁵, while external factors such as domestic production, imports and (the quality of) educational institutions (FAO & FIVIMS, 2009) determine physical availability and utilization of food. Likewise, agricultural investments are no silver bullets for enhancing food security of local populations: eight external factors may influence the outcomes of agricultural investments: 1) good governance; 2) local social and economic conditions; 3) involvement of local stakeholders; 4) formulation and negotiation process; 5) contents of investment contracts; 6) profile of the investor; 7) support from third parties; and 8) type of production system and crops. An IB attempts to overcome these external factors by integrating smallholders into several points of the VC, to reduce their poverty and improve their food security in a sustainable way (FAO, 2014). Drawing the line between an inclusive and a non-IBM however is not easy, but the six criteria for IBMs may be of help: 1) an IBM should provide a living wage for vulnerable people; 2) use flexible trading arrangements; 3) support farmers to establish stronger negotiation positions; 4) build on skills and expertise of existing market players; 5) be scalable in the medium term so that the business model can easily be adjusted; and 6) allow for diversified income streams in the long term (FAO, 2015).

⁵ A range of personal or household 'strengths', that is required to achieve positive livelihood outcomes.

3. Methodology

This section describes the methods that are used to obtain the data required for meeting the research objectives. It is described how this data is collected and analyzed and how respondents were selected. After providing a schematic overview of the expected relations between the various concepts that are discussed in the theoretical framework, these concepts are translated into measurable variables. Lastly, this section discusses the main research issues with regards to reliability and validity of the methods that are used.

3.1 Methodological approach

This thesis involves a case-study which aims to study the role of the IBM of HPW Fresh & Dry Ltd. on the food security of their suppliers. It was chosen to use a mixed-methods approach as for answering the research questions, quantitative data required complementation from qualitative data and qualitative data required substantiation from quantitative data. Secondary data was collected during a preliminary desk review on FDI, inclusiveness and its' role for food security. Primary data was collected during a two-months fieldwork period (October-November 2016). With regards to food (in)security, this period is relatively neutral in the research area, although food insecurity is on the increase in December which makes food security a relevant topic for the research respondents. Household surveys, semi-structured interviews and focus group discussion with farmers as well as with the spouses of the farmers were performed in the southern part of Ghana and included four regions: Eastern, Western, Central and Greater Accra. Participatory observation involved attending and assisting with the preparation of typical Ghanaian dishes. The objectives of the study were explained to all participants and respondents. Household survey respondents gave their written consent and verbal consent was given by interviewees and focus group participants.

3.2 Data collection

3.2.1 Secondary data

One month before the fieldwork period, a desk review was conducted to create a theoretical overview of existing literature on FDI in Ghana, to get an idea of what is meant with IB and to obtain examples of how IBs may contribute to local food security.

3.2.2 Primary data

Semi-structured interviews

By means of orientation on the scope of foreign investments and food security of smallholders in southern Ghana, five key persons involved or experienced in foreign agribusinesses in Ghana were interviewed. The points that were raised during these interviews helped to focus on and narrow down the topics that needed to be discussed during the focus group meetings. During conducting the focus group discussions and household surveys, formal and informal meetings with various HPW Fresh and Dry Ltd. representatives contributed to the complementation of the up till then collected data. At the end of the fieldwork period, two large-scale farmers (one papaya and one pineapple farmer) were interviewed to explore the differences and similarities between them and small-scale farmers in terms of struggles, opportunities and strategies. Likewise, an event on corporate social responsibility (CSR) for foreign investors in Ghana was attended.

Focus group discussions

At the second stage of the fieldwork, three focus group discussions (see attachment 3) were organized with HPW Fresh & Dry Ltd. suppliers. These discussions aimed to obtain general and specific information on their experiences with being a fruit farmer and supplying to HPW Fresh & Dry Ltd. In addition, three focus group discussions were held with the spouses of HPW Fresh & Dry Ltd.-suppliers, which aimed at mapping their main struggles and strategies with providing their households with their needs in terms of food security. The findings of these discussions enabled to find the right focus for setting up the household surveys.

Household surveys

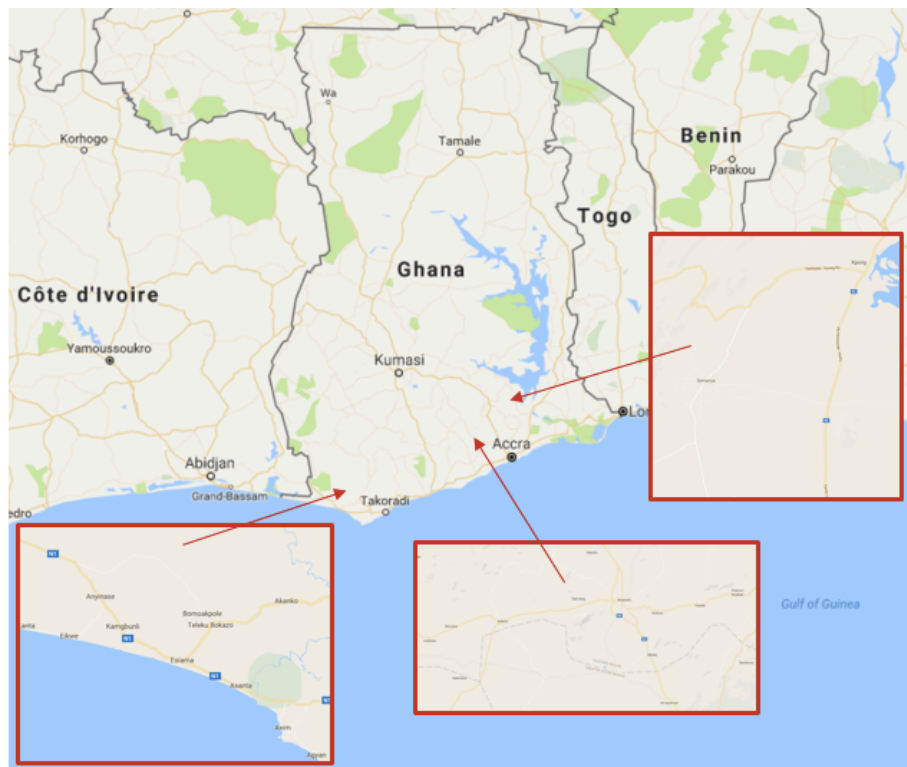
A total of 117 suppliers of HPW Fresh & Dry Ltd. were surveyed. The household surveys (see attachment 2) provided statistical analyzable data on variables such as productivity, farm size, net income from farming, total household income and access to inputs and means that are required for farming. In addition, a specific part of the survey was devoted to obtaining information on food availability, accessibility and utilization. To obtain a detailed overview of dietary consumption of the respondents, the survey involved a qualitative recall of all foods consumed during the previous 24 hours. No distinction was made between weekdays and weekend days as focus group discussions revealed that respondents do not consume specific or different products during the weekend days. Respondents were asked to describe all meals consumed during the previous day, from morning to evening. Next, they were asked whether they had consumed any other items like snacks or drinks, to ensure that all consumed products were specified.

Participatory observation

To ensure that food-related data was correctly interpreted, participatory observation was conducted during the preparation and cooking of four typical Ghanaian dishes: red red, fufu with groundnut soup, waakye, and ampesi. This also provided insight in households' cooking practices, time spent on cooking and various handlings that need to be fulfilled.

3.3 Selection of the research site

The research site (map 4) covers five different districts in four southern provinces of Ghana: coconut farmers are located in Nzema East (Western region), mango farmers are located in Yilo Krobo and Manya Krobo (Eastern region) and pineapple and papaya farmers are located in Akuapim South (Eastern region) and Awutu Senya (Central region). These areas were selected based on suggestions of an HPW Fresh & Dry Ltd. representative as the majority of their suppliers is densely distributed here, which was a major advantage logistically-wise.



Map 4: Research site.

3.4 Sample selection

Respondents were purposively selected from a list of all farmers who are supplying to HPW Fresh & Dry Ltd. This list was provided by the company. From this list, all active suppliers in the selected research areas were selected. In the field, snowball sampling methods complimented the prior sampling method. Smallholder focus group participants were member of a farmers' association and selected by a representative of the farmers' association. Focus group discussions with women were organized by one of the spouses of the farmers who gathered several other spouses of farmers who supply to HPW Fresh and Dry Ltd. As the focus group discussion with coconut farmers involved one male and three female farmers and because of time constraint, it was decided to conduct the discussion on food security with the same participants. For the same (latter) reason, no focus group discussion was held with papaya farmers. The final research sample of the household surveys and focus group discussions is as follows:

Table 2: Research sample.

Cases	Number of household surveys with smallholders	Number of focus group meetings with smallholders	Number of focus group meetings with spouses of smallholders	Participants in group meetings
Pineapple farmers	45	1	1	7, 8
Mango farmers	43	1	1	8, 12
Coconut farmers	17	1	(similar)	4, (similar)
Papaya farmers	12	-	-	-
Total	117	3	3	39

3.5 Data analysis

Quantitative data was analyzed with IMB SPSS Statistics version 23 and Microsoft Excel version 15.30. The analytical tools that are used include one-way Anova tests for continues variables and

chi-square tests for nominal and ordinal variables. Post Hoc Scheffe tests were performed to assess statistically differences between pairs of means. In addition, bivariate analyses were performed to study the strength of relations between two variables. All statistical tests were performed with a confidence level of 95%.

For assessing the inclusiveness of the HPW Fresh & Dry Ltd. business model, six criteria for an IBM as provided by the FAO (2015) were used:

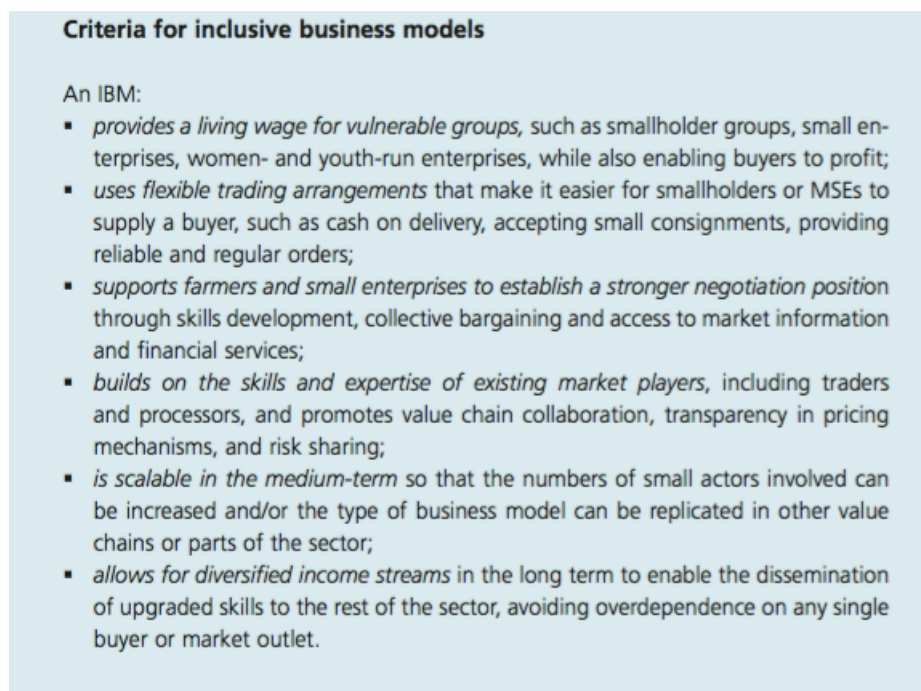


Figure 9: Criteria for inclusive business models (FAO, 2015).

The three pillars of food security – availability, accessibility and utilization – are used to analyze the food security of the respondents. Based on existing literature, it is expected that populations in the research site are not severely food insecure. For various reasons, it is chosen to focus on the nutritional conditions of respondents. First of all, respondents are smallholder farmers involved in a food supply chain. As most smallholders also apply subsistence farming, it is assumed that dietary intake is sufficient and varied. However, the typical Ghanaian diet lacks intake of important nutrients such as iodine, vitamin A and iron (FAO, 2013). And as enhancing dietary intake and nutritional status may increase productivity (Strauss, 1986), it is assumed that obtaining data on dietary intake may reveal important data for the development of recommendations. Dietary intake is analyzed by means of the Food Variety Score (FVS) - the sum of the number of different food items consumed during the past 24 hours - and the Dietary Diversity Score (DDS) - the sum of the food groups to which these food items belong. Both scores reveal the households' economic ability to access a variety of foods (FAO, 2010) and are "a proxy for nutrient adequacy of the diet of individuals" (FAO, 2013: 5). The higher the scores, the higher the socio-economic status and food security of households (ibid.). Bivariate analyses between independent variables and FVS and DDS were performed to gain more insight in different dietary patterns across various population subgroups.

As there is no international consensus on the number of food groups to be used (FAO, 2010), the research of Nti (2008) on "household dietary practices, quality of diets and family nutritional status of rural Ghana" (ibid.: 35) was used as a baseline for the number of food groups and its accompanying product and dishes. Nti found six food groups and 42 food items to be

consumed amongst rural Ghanaians in Manya Krobo District, Eastern region. The group, items and dishes are shown in table 3.

Table 3: Food groups, products and dishes consumed in rural Ghana, based on Nti (2008).

Food group	Products	Dishes
1	Starchy roots and plantain Cassava Yam Cocoyam Sweet potato Plantain	<ul style="list-style-type: none"> ☞ Fufu: pounded mash of cooked cassava with plantain or cocoyam; ☞ Banku: cooked meal of fermented cassava and maize dough; ☞ Ampesi: boiled root, tuber or plantain; ☞ Kokonte: cooked meal of dried cassava flour; ☞ Agbelima: fermented cassava dough;
2	Cereals and cereal products Maize Rice Millet Bread Biscuits	<ul style="list-style-type: none"> ☞ Banku: cooked meal of fermented cassava and maize dough; ☞ Kenkey: cooked balls of fermented maize dough; ☞ Gari: roasted fermented maize meal; ☞ Koko: porridge from millet or corn; ☞ Rice with stew/Jollof rice; ☞ Waakye: rice and beans boiled together; ☞ Omotuo: rice balls;
3	Animal products Meat Fish Poultry Egg Milk Snail	<ul style="list-style-type: none"> ☞ In soups and stews ☞ In hot pepper sauce
4	Legumes Cowpea Soybean Groundnut Bambara Agushie Neri	<ul style="list-style-type: none"> ☞ Waakye: rice and beans boiled together; ☞ In soups and stews; ☞ Groundnuts as snack; ☞ Agushie: melon seeds as snack; ☞ Bambara; ☞ Neri;
5	Fruits and vegetables Orange Mango Pineapple Papaya Banana Watermelon Tomato Onion Leafy vegetables Okra Garden eggs Pepper	<ul style="list-style-type: none"> ☞ In soups and stews; ☞ As snack;
6	Fats and oils Refined vegetable oil Palm oil Palm kernel oil Groundnut oil Coconut oil Margarine Sheabutter Palm fruits	<ul style="list-style-type: none"> ☞ In soups and stews;

3.6 Conceptual framework

Based on the literature discussed in the theoretical framework and the objectives and research questions of this thesis, a conceptual framework is constructed to demonstrate how the various concepts and variables are expected to relate and how these relations guide this study to a certain outcome.

3.6.1 Establishment of the conceptual framework

The model starts with HPW Fresh and Dry Ltd. and the extent to which the business model is inclusive is expected to influence the food security of the respondents. The ability of HPW Fresh and Dry Ltd. to be inclusive is expected to be influenced by external factors such as governmental context, Ghana's political and economic situation, and agro-ecological conditions. Contextual factors are also expected to influence smallholder farmers in several conditions: climate and pest and crop diseases may impede productivity levels of smallholder farmers and require them to develop new strategies. A circular relation is also expected to exist between smallholder farmers, their food security situations and the productivity of HPW Fresh and Dry Ltd.: capacity of the factory of determines income levels of the suppliers, which increases or decreases their struggles and strategies, which in turn leads to a certain degree of food security. A higher food security in turn may lead to enhanced productive levels and hence higher supplies to HPW Fresh and Dry Ltd.

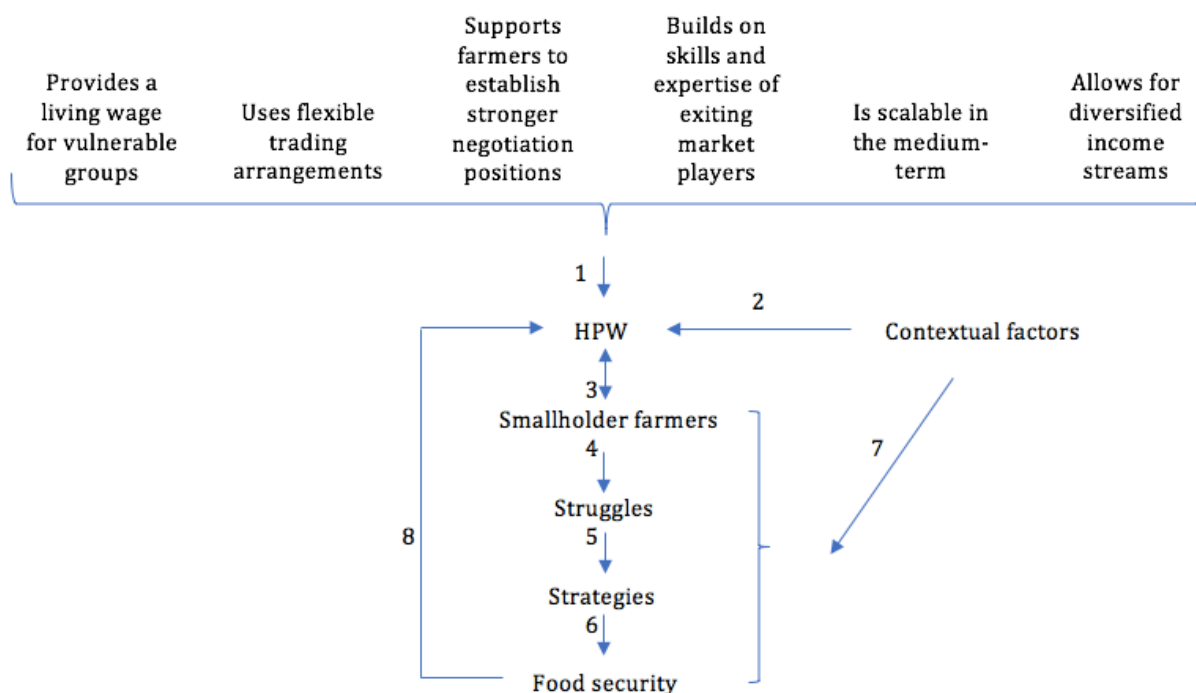


Figure 10: Conceptual model.

3.6.2 Relations within the conceptual model

Arrow 1. Whether and to what extent the business model applied by HPW Fresh & Dry Ltd. is inclusive, depends on the degree to which it complies to the six criteria of an IBM.

Arrow 2. HPW's room for movement in complying with the six criteria is influenced by contextual factors such as Ghana's political and economic situation, agro-ecological conditions and trading opportunities.

Arrow 3. HPW Fresh & Dry Ltd. and smallholders are interrelated: HPW Fresh & Dry Ltd. depends smallholders for supplying raw material according the quality requirements. Various inclusive elements are believed to contribute to enhanced productivity and quality of the products. Smallholders on their turn depend on HPW Fresh & Dry Ltd. for (part of) their income security.

Arrow 4. Cultivating high-value is bound to strict quality and quantity requirements and may involve struggles such as lack of irrigation or farming inputs.

Arrow 5. Farmers apply various strategies to overcome these struggles but may also be helped by inclusive elements to develop strategies for improvement.

Arrow 6. Existing and newly applied strategies will contribute to a households' access to food (income), availability of food (improved productivity due to knowledge transfers, and utilization of food (access to health care and knowledge).

Arrow 7: Contextual factors however are expected to influence smallholders' struggles and strategies. It is furthermore expected that external factors such as seasonality, quality of health care systems and inflation may influence availability, accessibility and utilization of food.

Arrow 8: It is expected that farmers with a higher or improved food security will also have higher productivity levels, which in turn may be absorbed by HPW Fresh & Dry Ltd.

3.7 Operationalization

Now that the most important variables and the relations between those variables are demonstrated by means of a conceptual framework, these variables need to be defined into measurable factors. First of all, the inclusiveness of HPW Fresh and Dry Ltd. is assessed by means of the six criteria proved by the FAO (2015):

Table 4: Operationalization of inclusiveness of the HPW Fresh and Dry Ltd. business model.

Indicator	Operationalization
<i>Provides a living wage for vulnerable groups</i>	<ul style="list-style-type: none"> - net income from main crop - farm size - plot size - ability to meet upper and lower poverty line with net income from main crop - improvement in financial situation - improvement in profit
<i>Uses flexible trading arrangements</i>	<ul style="list-style-type: none"> - number of supplies per year - period of supply
<i>Supports farmers and small enterprises to establish a stronger negotiation position</i>	<ul style="list-style-type: none"> - number of respondents represented in a farmers' association - improvement in production and resource management skills - improvement in group management skills - improvement in basic market skills
<i>Builds on the skills and expertise of existing market players</i>	<ul style="list-style-type: none"> - number of meetings between HPW and suppliers - number of farming trainings
<i>Is scalable in the medium term</i>	<ul style="list-style-type: none"> - HPW capacity growth rate - HPW workforce requirement growth rate - HPW raw material demand growth rate - improvement in productivity of suppliers
<i>Allows for diversified income streams</i>	<ul style="list-style-type: none"> - number of respondents applying livelihood diversification - number of additional income sources - type of income sources - total monthly income

- ability to meet upper and lower poverty line with total monthly income
- number of respondents selling to various buyers

Then, a value chain analysis (VCA) is applied to detect struggles and strategies of the various actors involved in the business model and the external factors influencing these struggles and strategies:

Table 5: Operationalization of smallholder farmers, their struggles, strategies and influences from external factors.

Indicator	Operationalization
<i>Smallholder farmers</i>	<ul style="list-style-type: none"> - age of household head (HH) - gender of HH - level of education of HH - religious background - main occupation of HH - main occupation of spouse - size of household composition - number of children under 12 - number of children above 12
<i>Struggles</i>	<ul style="list-style-type: none"> - access to education and trainings - availability of sanitation and clean water - condition of infrastructure - possessing machineries and farming tools - availability of irrigation - input usage
<i>Strategies</i>	<ul style="list-style-type: none"> - being a member of a farmers' associations - benefits of being a member of a farmers' association - availability of workforce - availability of the land - ownership of the land - strategies for improving living conditions
<i>External factors</i>	<ul style="list-style-type: none"> - availability of education and trainings - rainfall patterns - prevalence of pests and crop diseases - condition of infrastructure

Lastly, food security is analyzed by means of the three pillars of food security as proposed by the FAO (2008). Dietary diversity is determined by the Food Variety Score (FVS) and the Dietary Diversity Score (DDS).

Table 6: Operationalization of food security and nutritional status as livelihood outcome

Indicator	Operationalization
<i>Food availability</i>	<ul style="list-style-type: none"> - consistency in food availability during the year - consumption of food products during peak and lean season - ability to store food
<i>Accessibility</i>	<ul style="list-style-type: none"> - number of crops cultivated for own use; - (type of) products bought at the market; - proximity of market and street vendors; - control over food budget
<i>Utilization</i>	<ul style="list-style-type: none"> - prevalence of diarrhea and cholera; - access to clean water and sanitation - knowledge about health practices

- Food Variety Score (number of different dietary items consumed during the previous 24h)
- Dietary Diversity Score (number of different food groups consumed during the previous 24h)

3.8 Research reliability and validity

Reliability of the research concerns the research results which must be inherently repeatable. Most of the data obtained from the household surveys is analyzed using analytical tools performed with IBM SPSS Statistics. Repetition of these statistical tests would show the same results. It should however be taken into account that coconut farmers just started supplying to HPW Fresh and Dry Ltd. and therefore could not give an accurate indication on various financial matters. The sample also included respondents who did not want to disclose information on similar matters. Others could not recall and had to give an estimation. Furthermore, several outliers were detected and were left out when calculating means. All of these factors have influenced some of the research outcomes. Another important factor to be taken into account is that currently, capacity of HPW Fresh and Dry Ltd. is increasing. It hence is expected that suppliers may supply more in the future, which will definitely alternate answers to the several survey questions. Lastly, the agribusiness is very vulnerable for influences from external factors. It may be expected that such (future) factors will alternate the respondents' answers as well.

With regards to food security, respondents were asked to disclose dietary consumption at the household level. However, several respondents indicated that they had left the house early to work on the farm and get back to their houses in the late afternoon. It is likely that they have purchased and consumed a meal or snack outside of the home which makes dietary intake hard to administrate at the household level, as argued by the FAO (2013). Focus group participants were asked whether the household eats from common bowls, as this would make it more complex to measure individual dietary consumption (Savy *et al.*, 2005). It was found that in most cases, children and parents eat from different bowls. For the above-mentioned reasons, it can be assumed that the data on dietary intake is applicable for an adult in a smallholder farming household. The benefit of measuring dietary intake at individual level is that this is "more strongly linked to the dietary quality and to people's nutritional status" (ibid.: 714).

Validity encompasses the ability of the chosen research methods to measure what it is purported to measure. Selecting the right recall method for collecting data on dietary intake has to be considered carefully. This recall period should be long enough to reflect a 'standard' dietary consumption, but short enough to enable the respondent to memorize all of the items that were consumed during that period and hence minimize the memory bias. It was decided to use a reference period of 24 hours, instead of other reference periods such as the past 3 days, 7 days or previous months. Even though the 24h reference period "does not provide an indication of an individual's habitual diet, [...] it does provide an assessment of the diet at the population level and can be useful to monitor progress or target interventions" (FAO, 2010: 10). In addition, the 24h recall is easier for the respondent and less subject to errors (ibid.). As the data collection progressed, it appeared that most of the respondents had a similar kind of consumption pattern and dietary intake. This increases the likeliness that respondents tend to consume the same meals throughout the week. To eliminate faulty assumption, focus group participants were asked whether different meals were consumed in the weekend days or on festive days. It was found that this is not the case.

Mean, minimum and maximum FVS and DDS were analyzed to make comparisons between sub-populations as there are "no established cut-off points in terms of number of food groups to indicate adequate or inadequate dietary diversity" (FAO, 2010: 26). It however needs

to be taken into account that, by using both scores, the quantity of the consumed food is not measured. The 24h recall method furthermore does not provide any insights in seasonal varieties. Another important factor that should be mentioned is that two respondents lived in Accra at time when fieldwork was carried out. Because of larger markets and retail shops in Accra, their dietary consumption was different and more varied compared to the other respondents.

3.9 Research limitations

The majority of the respondents did not speak (sufficient) English and for that reason two interpreters were hired to conduct the surveys and focus group discussions in the local language. While the interpreters had many years of experience in conducting similar kind of surveys and leading focus group discussions, there is a chance that not all information was (correctly) translated. This issue reduced by asking the interpreters to write a short note on what they had heard and observed during the surveys or discussions at the end of every fieldwork day.

Even though there were no delays during the fieldwork period, more time would have enabled conducting more surveys, focus group discussions and interviews which would have enlarged the reliability of the results. Limited time availability of the interpreters was another major constraint. It would have been particularly interesting to conduct more focus group discussions with women as the various groups appeared to have different opinions, experiences and strategies.

The FAO (2013) argues that food security in rural, agriculture-based communities is best measured “[d]uring the period of greatest food shortage, such as immediately prior to the harvest or immediately after emergencies or natural disasters” (ibid.: 13). In this case, mid-December to the end of February would be the best period to study food security. For practical reasons, it was impossible to conduct fieldwork in that period. Nevertheless, food security was found to be a relevant topic as all respondents were aware of the Harmattan that was coming soon and bringing food security issues. Likewise, food security issues in the research area are less severe compared to northern regions in Ghana. A small part of the respondents indicated to have food available the whole year round. As changing the structure of household surveys and focus group discussions would jeopardize reliability and validity of the research, it was decided to focus on dietary intake and nutritional conditions during the data analyses process.

Another limitation is that I do not have any knowledge on or experiences with assessing anthropometric measurements. In most food security-related studies, factors such as length and weight are measured to determine respondents’ BMI. For this study, I had to rely on my own pair of eyes and commonsense. I observed that the majority of the farmers appear to be healthy, the one rather underweight and the other rather overweight. For this reason, I believe that analyzing dietary intake is an adequate instrument for determining food security and nutritional conditions.

EMPIRICAL CHAPTERS

4. The inclusive business model of HPW Fresh & Dry Ltd.

The first and most important question at this point in the thesis is: can the business model of HPW Fresh & Dry Ltd. be regarded as inclusive? And if yes, how is this demonstrated in practice? It is important to start determining the level of inclusiveness at this point, as these findings will explain and support the struggles, strategies and conditions of the suppliers as presented in chapters five and six. After a short introduction on HPW Fresh & Dry Ltd., this chapter will analyze the inclusiveness of the business model by means of the six criteria for IBMs as provided by the FAO (2015).

4.1 HPW Fresh & Dry Ltd.

HPW AG was established by Hans Peter Werder in 1997 in Switzerland and since then develops, produces and supplies added-value agricultural products for the European market. Baby vegetables originate from Asia, Africa and Switzerland. Fruits like pineapples, mangoes, coconut, bananas and papayas are dried and processed into various products such as fruit bars and coconut oils at the production plant Ghana and exported towards packing companies across Europe.

In 1999, the first fresh pineapples were exported from Ghana to the European market. In 2008, 50% of the pineapples exported from Ghana were handled or bought by HPW which resulted in a peak volume: the company was too small to be sustainable in pineapple trade. In combination with the declining demand for fresh pineapples from Ghana due to the credit crunch, HPW was forced to change its' business strategy and started the construction of a drying facility in Adeiso, Ghana under the flag of HPW Fresh & Dry Ltd. HPW AG and Maik Blaser (the manager director) are the shareholders of HPW Fresh & Dry Ltd.

Here, fresh cut pineapples and mangoes are processed into dried fruits as from 2011. Coconuts followed in 2013 and papayas in 2015. The plant initially employed 180 people from Adeiso and surroundings, a number which rapidly increased as the plant increased their production levels towards 470 tons of dried fruits out of 5700 tons of fresh fruits. In addition, the plant started with the export of dried pineapple without sugar as a new retail product, providing jobs for 370 people. Production levels kept increasing and in 2014 the plant had a constant work force of 400 people and supply of raw material from more than 200 suppliers' organizations equaling about 1000 individual suppliers. With the installation of a production line for fruit bars, fruit pulp could be processed into (pineapple)mango rolls. The yearly turnover was €6.000.000 in 2015 and the plant currently exports 1200 tons of dried fruits out of 14000 tons of fresh fruits, and has a workforce of 1000 people. With the opening of the second factory, HPW Fresh & Dry Ltd. has increased its' production capacity towards 1500 tons of dried fruit products. This goes hand in hand with the growth rates for fresh fruits which has been around 30% in the past years and is expected to continue in similar numbers. Diversifying in products is one of the main strategies for the coming years.

4.2 HPW Fresh & Dry Ltd. and corporate social responsibility

To encourage a positive impact through its' activities, HPW Fresh & Dry Ltd. has set up a corporate social responsibility (CSR) report which aims to embrace responsibility for the company's actions and encourage a positive impact through its activities on the environment, consumers, employees, communities, stakeholders and all other members of the public sphere who may also be considered as stakeholders. In the CSR report, three areas are targeted in particular: the environment, their employees and the society (see tables 7, 8 and 9). Employees in this case refers

to the factory workers and hence it is important to keep in mind that even though smallholder farmers are part of the society, they are no employees and hence not directly targeted through the company's CSR policy.

Table 7: CSR activities - the Environment.

CSR activities aimed for in CSR policy document (vision) - Environment	Active?
Plant native plants.	✓
Use healthy weed- and pest control.	✓
Direct all bio-degradable waste into our fermenters for the generation of bio-gas.	✓
Solar panels to store and generate energy from the sun.	✓
Encourage the use of bio-degradable items such as soap, paper, cups, glass, plastic.	✓
Not engage in indiscriminate felling of trees that will lead to de-forestation.	✓
Not engage in bush burning.	✓
Embark upon yearly tree planting exercises.	✓
Not channel our waste into land or water bodies to cause contamination.	✓
Separate waste into organic, paper, and cardboard, metals and plastic.	✓
Treat organic waste in the bio gas plant and the methane produced used as energy supply.	✓
Sell metals to local scrap dealers for recycling.	✓
Waste water will be treated in bio gas plant and the residual water will be cleaned in sand/cane filter beds to be used for irrigation.	Yes, but insufficiently investment planned for 2017
Explore all possible ways of energy conversation; for example, by keeping electricity consumption to a minimum through the use of energy efficient equipment, machines and appliances.	✓
The greater part of our raw materials comes from agriculture. Our Sourcing Programme encourages Good Agricultural Practices by sourcing from farmers that are GLOBAL-GAP certified.	X
Reduce our greenhouse gas emissions.	✓

Table 8: CSR activities - the employees.

CSR activities aimed for in CSR policy document (vision) - Employees	Active?
Invest in capacity building activities such as trainings and re-trainings, organizational learning and other employee development activities.	✓
Promote a safe and friendly working environment by daily supplying all protective equipment needed.	✓
Provide open channels of communication where employees' opinions can be heard and addressed.	✓
Encourage work-life balance through providing facilities and policies such as flexible working hours, gymnastics, maternity/paternity/compassionate/study leave, etc.	✓
Support employees to celebrate/observe their special occasions such birthdays, weddings, naming, funerals etc.	✓
Establish free guidance and counseling sessions on work and other personal related issues.	Partly
Discourage substance abuse through periodic talks and sensitization on the dangers on drug and substance abuse.	X
Encourage fitness and healthy lifestyles via annual medical examinations, talks and trainings on disease prevention (including HIV/AIDS).	✓
The provision of vocational/recreational activity centers.	X
Provision of a crèche facility for employees' children.	Not yet
Provide educational scholarships for brilliant but needy employees children	✓
Encourage the setting up of a workers' committee to serve as a mouthpiece for the workers whereby their opinions, suggestions and needs can be heard and addressed by management.	✓

Never engage in acts of discrimination against employees or potential employees based on religion, gender, political affiliation, ethnicity etc.	✓
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Table 9: CSR activities - the society.

CSR activities aimed for in CSR policy document (vision) - Society	Active?
Embark upon bi-annual clean-up exercises at selected areas within the community.	X
Make bi-annual donations to less privileged schools, hospitals around the community	✓
Contribute to and support the construction of social amenities such as roads, schools, social centers, etc.	✓
Fund raising activities in support of selected projects or cause for community development.	HPW supports community projects with an annual budget of € 20 000
Hold regular health awareness walks and talks.	Walks no, talks for employees, yes
Partner with the local health center to organize free health screening.	X
Partner with the Ghana Aids Commission to organize annual HIV/AIDS Awareness/Education, Free Guidance/Counseling and Testing for the locality.	X
Discourage the practice of social vices via regular education on the dangers of theft, armed robbery, bribery and the like.	X
Discourage substance abuse through periodic talks and sensitization on the dangers on drug and substance abuse.	X
Partner with the local FM Station as the medium through which the organization will communicate to the community.	X
Provide educational scholarships for brilliant but needy youth in the community.	Only company staff so far
Support the registration of members of the community into the National Health Insurance Scheme.	X

4.3 Inclusiveness of the business model of HPW Fresh & Dry Ltd.

4.3.1 Provides a living wage for vulnerable groups such as smallholders, small enterprises, women-and youth-run enterprises, while also enabling buyers to profit.

Respondents averagely have a net income of ₵21638⁶ per year from selling the main crop (2015) (without outliers). This was highest amongst papaya farmers, followed by coconut farmers, pineapple farmers and lowest amongst mango farmers. Respondents with a larger farm were more likely to have a higher net income from main crop (Pearson: 0,299 with p = 0,003). This is also the case for farmers with a larger plot size (Pearson: 0,299 with p = 0,004).

⁶ \$4921.

Table 10: Net income from selling main crop⁷.

	N ⁸	Minimum	Maximum ⁹	Mean ¹⁰	Outliers
Pineapple	41	¢100	¢62100	¢18172	¢320000 ¢80000 ¢78390
Mango	38	¢1000	¢45600	¢14061	¢60000
Coconut	15	¢1000	¢71550	¢32267	-
Papaya	10	¢2000	¢112500	¢48700	¢2800000 ¢36000000

Ghana maintains two poverty lines:

an upper one below which an individual is considered to be unable to meet all their food and non-food needs, and a lower poverty line below which an individual is considered unable to even meet their food needs. The upper poverty line is set at 1,314 GHS¹¹ per adult per year for 2013, and households below it are simply referred to throughout this paper as living in poverty. The lower poverty line is set at 792 GHS¹² per adult per year, and households below it are referred to throughout as living in extreme poverty. (Cooke, Hague & McKay, 2016: 5).

In the sample, a total of eighteen respondents (15,4%, n = 110) did not meet the upper poverty line and twelve respondents (10,3%, n = 110) did not meet the lower poverty line. Most of these respondents are coconut farmers (17,6% of the coconut farmers does not meet the lower poverty line and 23,5% of the coconut farmers does not meet the upper poverty line).

Table 11: Respondents below and above lower and upper poverty line: income from selling main crop only.

	N	Minimum	Maximum	Mean
Below upper poverty line	18	-1214	-314	-637
Above upper poverty line	92	19	18001686	226569
Below lower poverty line	12	-992	-42	-263
Above lower poverty line	98	41	18002208	213198

Whether a household lives under or below the lower or upper poverty line is strongly related but not statistically significant to plot size (upper poverty line: Phi and Cramer's V: 0,516 with p = 0,503 and lower poverty line: Phi and Cramer's V: 0,464 with p = 0,787).

Financial situation and profit has improved (better or a lot better) for 83,4% and 79,9% of the respondents, respectively since their first supply to HPW Fresh and Dry Ltd. Similar outcomes are expected for coconut farmers as the price per kilogram has raised from ¢0,30 (by Nigerian traders) to ¢1,70 (by HPW)¹³. 12,3% and 15,8% of (all) respondents did not experience any change in financial situation and profit, respectively. 7,3% of the respondents indicate that

⁷ 1 Cedi equals 0,227 USD.

⁸ Without outliers.

⁹ Without outliers.

¹⁰ Without outliers.

¹¹ \$298,95

¹² \$180,20

¹³ Even though coconut farmers indicate that their financial situation has improved (Focus group discussions, November 14, 2016), several survey respondents indicated that they started supplying to HPW since the end of 2015 and hence could not yet indicate whether their financial conditions has changed because of HPW. For this reason, SPSS results of financial situations of coconut farmers may not be 100% accurate.

financial situation has decreased (worse or a lot worse) and 2,6% has experienced decreased profit rates (worse).

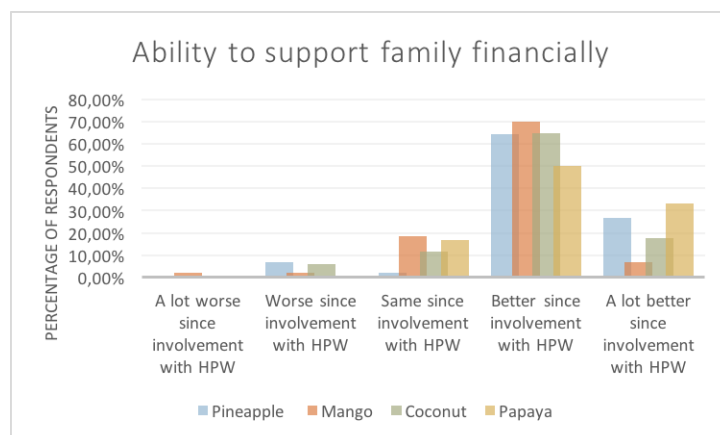


Figure 11: Ability to support family financially.

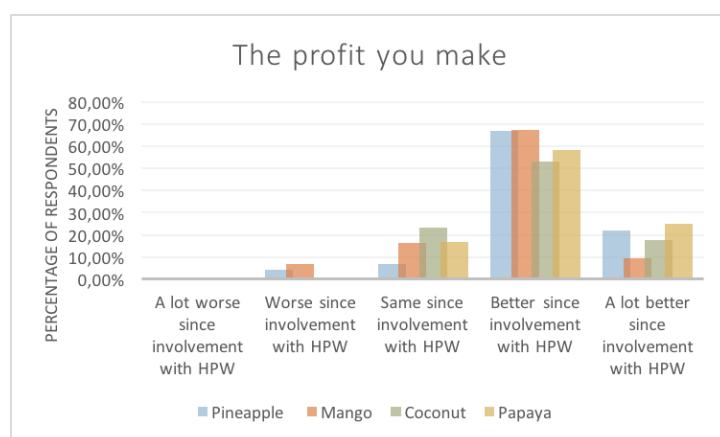


Figure 12: Changes in profit.

4.3.2 Uses flexible trading arrangements that make it easier for smallholders or micro or small enterprises (MSEs) to supply a buyer, such as cash on delivery, accepting small consignments, and providing reliable and regular orders

Farmers are recruited for an unspecified period and depending on HPW's need for raw material. The one condition for suppliers to be contracted is that they should be able to meet HPW's demand and specified quality of the fruits. As part of their agreement, a supply plan is established which is leading for the orders to be placed by HPW Fresh & Dry Ltd. One week prior to the supply, the order is confirmed but this may change due to (im)maturity of the fruits or capacity conditions at the factory. The farmer has the right to cancel or delay the delivery, or to reduce the number of delivered produce in the case that the farmer is prevented, hindered or delayed due to any circumstances beyond its control. HPW Fresh & Dry Ltd. on its turn is not bound to except deliveries that do not comply with the quality standards, or when deliveries exceed or are below the agreed delivery volume. As pineapple production is very difficult to forecast, the volume planning is dynamic and discussed on a weekly basis. Attached to the supply agreement is a specification of the quality requirements for the fruits. Supplies are paid by cheque upon delivery and effected within 14 days after delivery. With an input support program, suppliers may receive inputs in the form of credit. The value of these inputs in Ghana cedi's is deducted from the payment for the supply.

As mango is the product with the highest demands and margins for HPW Fresh & Dry Ltd., the full production capacity is used when mango is in season (from January to February and from May till June). About 8000 tons of mangoes are processed on a yearly basis and bought in Ghana, Ivory Coast and Burkina Faso. 4500 tons of pineapples and 2000 tons of coconuts are supplied by Ghanaian farmers and processed during the rest of the year (from March till mid-May and from mid-August to mid-December).

4.3.3 Supports farmers and small enterprises to establish a stronger negotiation position through skills development, collective bargaining and access to market information and financial services.

HPW Fresh & Dry Ltd. encourages farmers to form associations where their opinions, suggestions and needs can be heard and communicated with the management of HPW Fresh & Dry Ltd. This is an advantage for very small suppliers in particular. About 3/4th of the respondents is a member of a farmers' association. This benefits them most in terms of knowledge exchange and advocacy (see figure 13). Fairtrade liaison officers may act as a third party in the case that any conflict may arise. The sourcing department is in daily contact with suppliers and price-negotiations and technical discussions between farmers' representatives and the management take place twice per year, per crop.

Suppliers of HPW Fresh & Dry Ltd. are trained on improving production capacity and resource management and technological skills. HPW Fresh and Dry Ltd. has planned to start training their suppliers on basic market skills and access to financial services in the near future. 89% of the respondents indicated that their production and resource management skills have increased since they started supplying to HPW Fresh & Dry Ltd. For 64% of the respondents, group management skills have improved, and 61% of the respondents indicate that basic market skills have improved.

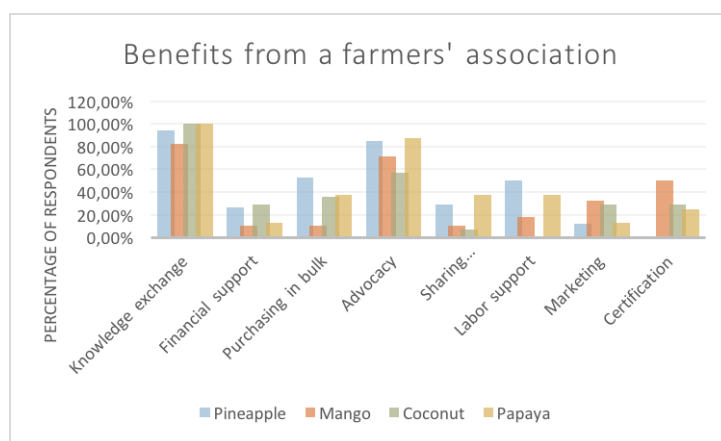


Figure 13: Benefits from being a member of a farmers' association.

4.3.4 Builds on the skills and expertise of existing market players including traders and processors, and promotes value chain collaboration, transparency in pricing mechanisms and risk sharing.

The Ministry of Farming and Agriculture (MOFA) and farmers' associations are important sources for (improving) farming skills. Respondents that are not member of a farmers' association mostly consult friends and relatives for improving their farming skills. Pineapple farmers also mentioned HPW Fresh and Dry Ltd. as an important information and knowledge source. HPW Fresh and Dry Ltd. works with seven local field officers who are in contact with suppliers on a daily basis and assist them with the decision on which fruits should be harvested. An additional agronomist with a focus on farmer support was employed to provide technical trainings twice a year. These

trainings are organized by the sourcing department and based on informal meetings between field officers and farmers, but is also collected by means of questionnaires and surveys. The trainings are open to all farmers, even non-suppliers. In addition, HPW Fresh and Dry Ltd. supplies posters visualizing farming-issues and make training materials available.

4.3.5 Is scalable in the medium term so that the number of small actors involved can be increased and/or the type of business model can be replicated in other value chains or parts of the sector.

At the moment, HPW Fresh & Dry Ltd. works almost exclusively with about 1000 smallholder farmers and roughly 1000 factory-workers from Adeiso and neighboring villages, making HPW Fresh & Dry Ltd. the largest employer in the region. Demand by HPW Fresh and Dry Ltd. for fresh fruits grows with 30% and supply (productivity) of fresh fruits has increased by the suppliers (68,6% of the respondents – better or a lot better) (see figure 14), and with further development and investments this trend is expected to continue. The recently opened second production plant has increased production capacity of HPW Fresh and Dry Ltd. to 1500 tons of dried fruit products. Increased capacity has significantly increased the requirement of workforce at the factory (from 180 in 2011 to 1000 in 2016) and supply of raw material (from 3800 tons in 2012 to 14 000 tons in 2016). It is expected that numbers of suppliers and employees will increase and with the development of new products, suppliers and employees will be involved in different value chains. As mango is the most important product for HPW Fresh & Dry Ltd., field officers will start to look for new (regular) farmers after the coming harvest round (March 2017). In addition, field officers may recruit individual farmers for ad hoc supplies when regular supply is insufficient.

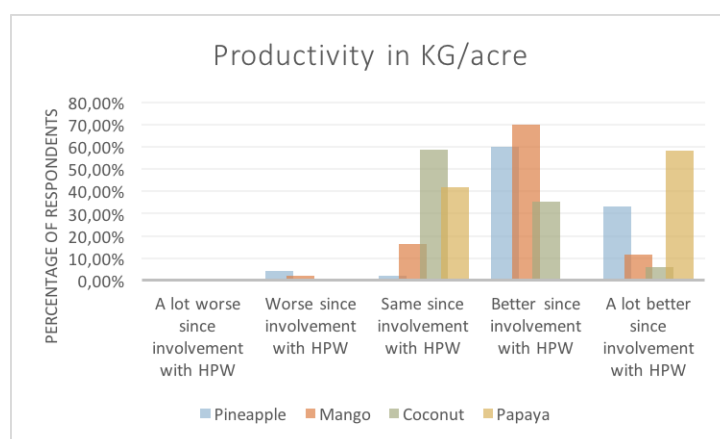


Figure 14: Productivity in kg/acre.

4.3.6 Allows for diversified income streams in the long term, enabling the dissemination of upgraded skills to the rest of the sector and avoiding overdependence on any single buyer or market outlet.

Livelihood diversification i.e. “the exploitation of multiple assets and sources of revenue” (Warren, 2002: 2) is observed amongst 94% of the respondents. The majority of the farmers have either two or three sources of income with minimum and maximum of one and five income sources, respectively. Number of income sources was highest amongst papaya farmers (66,7% with three income sources) and all papaya farmers have at least two income sources. A significant correlation was found between education of household head and income diversification (Pearson: 0,212 with $p = 0,023$) and income diversification correlated very significant with total monthly income (Pearson: 0,383 with $p = 0,000$), suggesting that higher educated farmers are also more likely to have multiple income sources, which in turn increases their total monthly income.

Monthly income is highest amongst papaya farmers, followed by mango farmers, pineapple farmers and total monthly income is lowest amongst coconut farmers (see table 12). Bivariate correlations were performed to find relations between various factors and monthly income (without outliers). No significant relation exists between household size and monthly income (Pearson: -0,143 with $p = 0,142$). Education level of household head on the other hand is likely to positively contribute to with monthly income (Pearson: 0,273 with $p = 0,005$). In addition, respondents with a larger farm also tend to have a higher monthly income (Pearson: 0,276 with $p = 0,004$)

Table 12: Total monthly income¹⁴.

	N ¹⁵	Minimum	Maximum ¹⁶	Mean ¹⁷	Outliers
Pineapple	43	¢250	¢5500	¢1558	¢6200 ¢5700 ¢5500 ¢5000
Mango	42	¢200	¢5600	¢1785	
Coconut	14	¢300	¢1800	¢921	¢6000
Papaya	7	¢1500	¢4500	¢2886	¢12 000 ¢16 5000

When calculating total household income sources, the number of respondents living below the upper poverty line declines to three (two mango and one pineapple farmer - 2,6% of the respondents and $N = 113$) and none of the respondents felt below the lower poverty line ($N = 113$) (see table 13).

Table 13: Respondents below and above lower and upper poverty line: income from all income sources.

	N	Minimum	Maximum	Mean
Below upper poverty line	3	-314	-114	-181
Above upper poverty line	107	86	142686	13196
Below lower poverty line	0	-	-	-
Above lower poverty line	110	208	143208	13353

Here, Pearson's R was statistically significant for the correlation between upper poverty line and number of income sources (Pearson's R: 0,194 with $p = 0,039$) confirming that more income sources indeed reduce the risk of living below the two Ghana poverty levels.

Most additional income sources are selling other crops (62,8% of the respondents). Trading (35,2%) and off-farm activities (37%) are the other important additional income source. Less mentioned additional income sources are retirement, remittances, loans, and animal farming. Moreover, 36% of the respondents indicate that selling to HPW Fresh & Dry Ltd. is part of, but not the major household income source.

HPW Fresh and Dry Ltd. furthermore stimulates farmers to diversify in terms of buyers, which may increase income security as risk of post-harvest losses may be reduced. Farmers are encouraged to do so by supply conditions and support schemes. A small majority of the

¹⁴ 1 Cedi equals 0,227 USD.

¹⁵ Without outliers.

¹⁶ Without outliers.

¹⁷ Without outliers.

respondents (54,4%) indeed has two buyers (HPW and the local market). 28,5% of the respondents has at least three buyers: HPW, the local market and (an)other export- or processing plant(s). 16,5% of the respondent sells to HPW Fresh and Dry Ltd. only and 0,6% sells to HPW Fresh and Dry Ltd. and another processing plant (see table 14 and figure 15). The mean plot size of farmers selling to HPW Fresh and Dry Ltd. only is lower compared to farmers who are selling to one or two other buyers (6,4 acres, 8,7 acres and 13,3 acres¹⁸ respectively) and a larger harvest is likely to be sold to various buyers (Pearson: 0,255 with $p = 0,008$).

Table 14: Selling location of main crop.

	Pineapple		Mango		Coconut		Papaya	
	N	%	N	%	N	%	N	%
HPW	6	13,3	5	11,6	7	41,2	0	0
HPW & Local market	33	73,3	33	76,7	3	17,6	6	50
HPW & other processing plant	1	2,2	0	0	0	0	0	0
HPW, local market & other processing plant	5	11,1	5	11,6	7	41,2	6	50

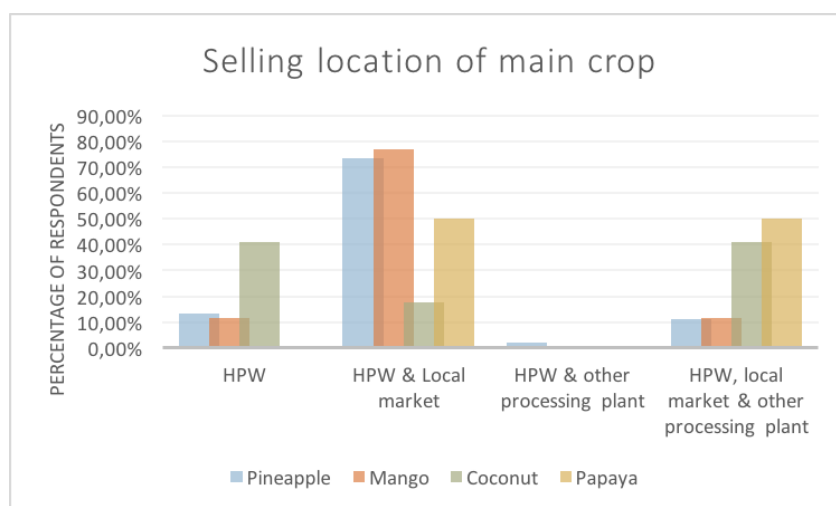


Figure 15: Selling location of main crop.

This chapter has demonstrated that HPW Fresh & Dry Ltd. provides a – sufficient - living wage for almost all of the respondents, which is largely determined by the factory's production capacity. Supplies may be – in contrary to other buyers such as the local market or traders - delivered in bulk which provides smallholders with a lot of money in a short period of time. It was found that papaya farmers have the highest net income from selling their main crop on average, which is mainly a result of factors such as larger plot and farm sizes. As coconut farmers have not been supplying to the company for a long time, they represent the majority of the farmers falling below the upper and lower poverty line. As HPW Fresh & Dry Ltd. buys coconuts for a higher price, compared to the price paid by Nigerian traders, it is likely that coconut farmers will soon experience increases in net income from selling coconuts. As HPW Fresh & Dry Ltd. works almost exclusively with smallholder farmers, it is explainable that almost all farmers apply livelihood diversification by for example cultivating other crops, retailing and off-farm activities. Taken all these income sources together, the number of respondents living below the upper poverty level decline to three and no respondents are found to be living below the lower poverty level. An

¹⁸ 2,58, 3,52, and 5,38 hectares.

important factor with regards to income-related prospects is the recently opened factory of HPW Fresh & Dry Ltd. and the continues development of new products. It is expected that demand for raw material will continue to increase with 30%, which enlarges opportunities for not only already involved actors, but also for people in the region who are not yet involved in the business model.

As this may positively contribute to outcomes in terms of food security, it is important to first explore the various struggles and strategies as experienced by the stakeholders involved in the business model, as it is assumed that these factors may negatively influence the potential of HPW Fresh & Dry Ltd. to contribute to enhanced food security of their suppliers.

Table 15: Background characteristics of respondents.

	Pineapple farmers		Mango farmers		Coconut farmers		Papaya farmers	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Age								
20-29	1	2,2%	1	2,3%	2	11,8%	2	16,7%
30-39	12	26,7%	6	14%	3	17,6%	2	16,7%
40-49	18	40%	8	14%	4	23,5%	3	25%
50-59	10	22,2%	14	32,6%	6	35%	3	25%
60-69	4	8,9%	9	20,9%	2	11,8%	2	16,7%
70-79	-	-	5	11,6%	-	-	-	-
Religious background								
Christian	40	88,9%	42	97,7%	15	88,2%	12	100%
Muslim	3	6,7%	1	2,3%	2	11,8%	-	-
Not religious	2	4,4%	-	-	-	-	-	-
Educational background								
No formal education	3	6,7%	7	16,3%	5	29,4%	1	8,3%
Primary	6	13,3%	6	14%	2	11,8%	-	-
Lower secondary	13	28,9%	11	25,6%	4	23,5%	3	25%
Secondary	9	20%	7	16,3%	4	23,5%	2	16,7%
Higher secondary	8	17,8%	3	7%	-	-	1	8,3%
Technical college	5	11,1%	3	7%	-	-	2	16,7%
University	1	2,2%	5	11,6%	2	11,8%	3	25%
Main occupation								
Farmer	40	88,9%	37	86%	13	76,5%	8	66,7%
Business owner	4	8,9%	2	4,7%	3	17,6%	2	16,7%
Wage laborer	1	2,2%	4	9,3%	1	5,9%	2	16,7%
Main occupation spouse								
Farmer	6	13,3%	13	30,2%	4	23,5%	1	8,3%
Business owner	26	57,8%	20	46,5%	8	47,1%	7	58,3%
Wage laborer	3	6,7%	2	4,7%	-	-	2	16,7%
Unemployed	4	8,9%	1	2,3%	-	-	-	-

Monthly income (€)

<499

500-999

1000-1499

1500-1999

2000-2499

2500-2999

3000-3499

3500-3999

4000-4499

4500-4900

5000-5499

5500-5999

>6000

8	17,8%	8	18,6%	3	17,6%	-	-
8	17,8%	7	16,3%	4	23,5%	-	-
9	20%	5	11,6%	4	23,5%	-	-
4	8,9%	5	11,6%	3	17,6%	2	8,3%
5	11,1%	3	7%	-	-	1	8,3%
-	-	3	7%	-	-	1	8,3%
3	6,7%	5	11,6%	-	-	1	8,3%
2	4,4%	2	4,7%	-	-	-	-
1	2,2%	3	7%	-	-	1	8,3%
1	2,2%	-	-	-	-	1	8,3%
-	-	-	-	-	-	1	8,3%
2	4,4%	1	2,3%	-	-	1	8,3%
2	4,4%	-	-	2	11,8%	2	16,7%

5. Value Chain Analysis of dried pineapple, mango, coconut and papaya

The four crops – pineapple, mango, coconut and papaya are high-value crops with in-country value addition opportunities, such as drying, cleaning and packaging (FAO, 2015). All four fruits are part of the local diet and hence farmers may “retain some production for household consumption and also target local informal markets” (FAO, 2015: xiii). Several inclusive elements that contribute to the living conditions of the suppliers involved in the business model are outlined in the previous chapter. It is assumed that increased income (security) contributes largely to the food security of the suppliers. Before this assumption can be confirmed, it is necessary to detect the stakeholders’ various struggles and strategies to overcome these struggles, along the whole supply chain, as these might influence outcomes in terms of food security.

A schematic overview of the value chain is outlined below:

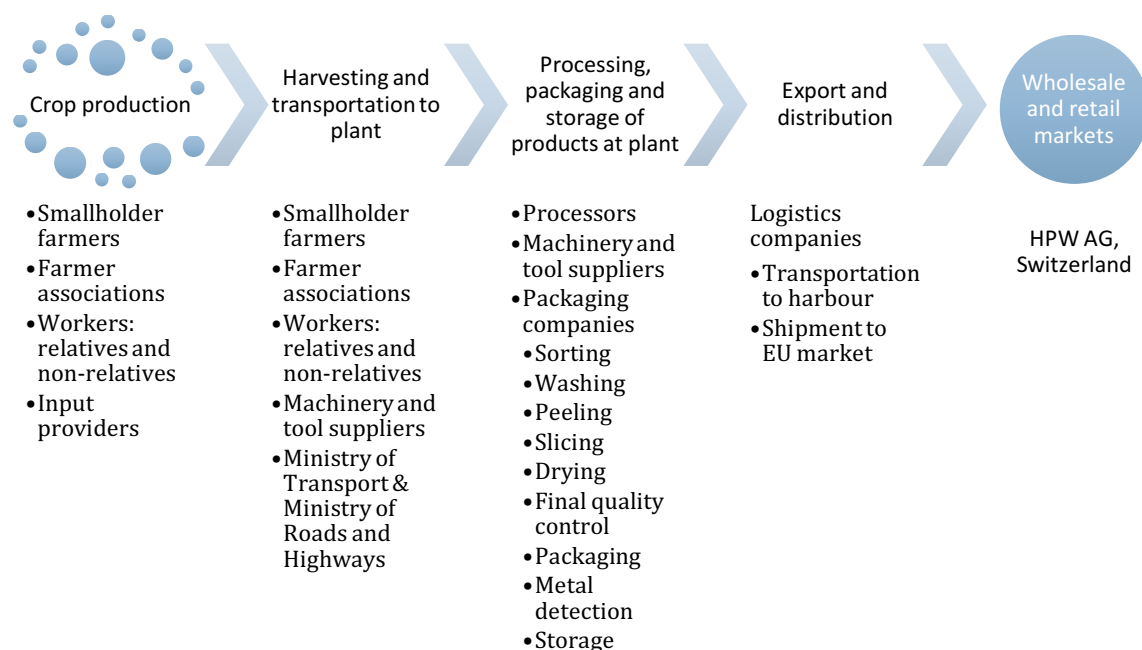


Figure 16: Value chain.

5.1 Crop production

The cultivation of the crops start with smallholders who need arable land, farming inputs and workforce.

5.1.1 Smallholder characteristics

Table 15 provides an overview of the background characteristics of the respondents. The average age is 48 with minimum and maximum of 23 and 78 years old, respectively. The far majority is religious: mostly Christian and a few respondents are Muslim. Most farmers have completed lower- or secondary school, but a relative large part has completed technical college or university. Household size (defined as the number of people sharing meals on a regular basis) is between five and six members. An average household has one or two children under twelve (with minimum and maximum of zero and six children respectively) and two or three children above twelve (with minimum and maximum of 0 and 9 children respectively).

The majority of the respondents (83,8%) considers him/herself farmer. The rest (N = 19) is wage laborer, business owner or other (car dealer, pastor) and does farming next to their main occupation. In most families, spouses, parents or siblings also contribute to the household income. Eighteen respondents (15,4%) do not have a spouse. Only five spouses (4,3%) are unemployed, the rest is business owner (52,1%), farmer (20,5%) or wage laborer (7,7%). In addition, siblings, older children and parents (in law) also contribute to the household income.

5.1.2 The farm

Mango and coconut farmers often hold a title on the family name and have obtained the land by inheritance (48,8% of the mango farmers and 70,6% of the coconut farmers). Amongst pineapple and papaya farmers, renting land is more common (75,5% and 75% respectively). The average farm size of the respondents is 16,7 acres¹⁹, with minimum and maximum acreage of 1,5 and 201 acres²⁰, respectively. Average plot size is 9,2 acres²¹, with minimum and maximum acreages of 1 and 50 acres²², respectively. Average farm size and average plot size is highest amongst papaya farmers (see tables 16 and 17).

Table 16: Farm size in acres.

	N ²³	Minimum	Maximum ²⁴	Mean ²⁵	Outliers
Pineapple	40	2	27,65	8,9	190 60 49 44 37
Mango	41	1,50	36	12,0	46 37
Coconut	16	2	46	18,0	105
Papaya	11	2	201	60,7	329,5

Table 17: Plot size in acres.

	N ²⁶	Minimum	Maximum ²⁷	Mean ²⁸	Outliers
Pineapple	36	1,5	7	3,8	180 50 40 25 15 14 10
Mango	42	1	25,5	9,6	35
Coconut	15	2	36	13,3	105 45
Papaya	10	2	50	20,8	315 200

¹⁹ 6,76 hectares.

²⁰ 0,61 and 81,34 hectares.

²¹ 3,72 hectares.

²² 0,4 and 20,23 hectares.

²³ Without outliers.

²⁴ Without outliers.

²⁵ Without outliers.

²⁶ Without outliers.

²⁷ Without outliers.

²⁸ Without outliers.

5.1.3 Irrigation

Coconuts are cultivated in the far south-western region where rainfall is exceeding 1900 mm per annum. Mangoes, papayas and pineapples are cultivated in more in-land areas where annual rainfall is between 1000-1900 mm. For a proper growth and maximum coconut production, rainfall should be between 1500 and 2500 mm per year (Caulum, 2012). 41,2% of the coconut farmers indicate never to have issues with water shortages. For pineapple production, an annual rainfall between 1000 to 1500 mm is required (Zottorgloh, 2014). 42,2% of the pineapple farmers sometimes experience water shortages. For papaya production however, an annual rainfall between 1200 and 2000 mm is required (MOFA a, n.d) and 41,7% of the papaya farmers indicates to always struggle with water shortage. Mango production requires less rainfall (500-1500 mm per year). Moreover, two to three “months of dry weather is necessary for good flowering and fruit set” (MOFA b, n.d.: para. 5). Nevertheless, climate change has led to rainfall becoming unpredictable which negatively affects mango production. Fruits initially appear to mature slowly but suddenly start to ripe in a fast pace which causes major post-harvest losses.

5.1.4 Pests and crop diseases

Issues with pests and crop diseases are common amongst mango and coconut farmers in particular. The mango bacterial spot (MBBS)²⁹ (see figure 17) and fruit flies cause quality constraints and result in post-harvest losses for mango farmers. Moreover, 20,9% and 37,2% of the mango respondents indicate that crop diseases always or most of the time negatively influence their living conditions, respectively. Coconut farmers face post-harvest losses due to the Cape Saint Paul Wilt Disease (CSPWD)³⁰ (see figure 18). The Ghanaian government has been involved in the development of a resistant coconut variety, which however is not (yet) provided to the respondents.



Figure 17: Mango bacterial black spot.

²⁹ “MBBS affects all aerial parts of the mango plant. [...] Leaf symptoms begin as small water-soaked spots delineated by veins, becoming raised, black, sometimes with a chlorotic halo. [...] Fruit symptoms appear as small water-soaked spots on lenticels. [...] MBBS, and infections can result in drastic yield losses associated with premature fruit drop, reduction of fruit quality, and induction of severe defoliation, especially when storms or hurricanes are involved. (Gagnevin & Pruvost, 2001: 929)

³⁰ The Cape Saint Paul Wilt Disease “a lethal-yellowing type disease of coconut has been in Ghana since 1932. The disease is caused by a phytoplasma and is found in Africa and the Caribbean. The symptoms of the disease are premature nut drop with or without yellowing of fronds and blackening of immature inflorescences. This is followed by progressive yellowing or in some instances browning of the crown from the older leaves upwards. Eventually, the crown turns yellow, dries up and then falls off, leaving a bare trunk” (Nkansah-Poku, Philippe, Quaicoe, Dery & Ransford, 2009: 111)



Figure 18: Cape Saint Paul Wilt Disease (Photo credits: Ine ter Berg).

5.1.5 Farming inputs

Farming inputs are used by all pineapple, mango and papaya respondents. 35% of the coconut farmers however does not use any farming inputs. Coconut farming requires less farming inputs compared to other fruits. In addition, for Fairtrade nuts, an additional fee of 3 USD cents per nut is paid by HPW Fresh and Dry Ltd. An issue for mango farmers is that there are no separate fertilizers for varying soil types. This negatively influences the quality of their fruits. Increasing input costs is also one of the major struggles at production level. The total costs spent on farming inputs depends on, *inter alia*, farm size (Pearson: 0,201 with $p = 0,030$). Indeed, average input costs are highest amongst papaya farmers (€6732) and 13,6% of the variety in total input costs may be explained by the type of main crop (Partial Eta Squared: 0,136). Differences between height in input costs of pineapple and coconut farmers are statistically significant (Post Hoc Scheffe $p = 0,005$). Indeed, input usage is highest amongst pineapple farmers (57,8% of the respondents use five out of six available inputs³¹). A higher diversity in crop cultivation however does not mean that input costs are higher as well (Pearson: 0,090 with $p = 0,336$).

Table 18: Input usage.

	Pineapple	Mango	Coconut	Papaya
Average input costs	€6604	€3023	€199	€6732
Most applied input	Fertilizer	Pesticides and fungicides	Farming equipment	Farming equipment

5.2 Harvesting and transportation to the plant

The chain continues with the harvest of the crops and the transportation of the harvest to the production plant in Adeiso. 86% of the respondents has non-relative workers for harvesting activities. The rest is helped by non-relatives and relatives (spouses, siblings, parents(in law)). A very small minority (2,9% of the respondents – pineapple and mango farmers) has only relatives working at the farm. Farming skills are considered important factors for value addition, and so is the availability and condition of machineries and farming tools. Mango and pineapple focus group participants indicate that they require a tractor for harvesting purposes. As these are too costly, tractors can be rented. Such rental organizations however are not reliable: even though farmers

³¹ Planting materials, fertilizers, pesticides, herbicides and weedicides, fungicides and farming equipment.

have made an appointment in advance, the tractor might be rented out to another farmer. As a result, affordable farming machines are not accessible for 40% of the respondents.

5.2.1 Harvest

A strong positive relation was observed between plot size and harvest in kg (Pearson: 0,457 and $p = 0,000$) and 99% of the variance in harvest numbers is explained by plot size (Partial Eta Squared: 0,990). Indeed, papaya harvest was highest with an average of 89040 kg in 2015 without outliers³². The lowest papaya harvest was still ten times as much as the lowest pineapple and mango harvests.

Table 19: Harvest last year (2015) in kg.

	N ³³	Minimum	Maximum ³⁴	Mean ³⁵	Outliers
Pineapple	40	1000	100000	31727	500000 400000 150000 120000 100000
Mango	41	1000	60000	15536	150000 120000
Coconut	17	4000	75000	37414	-
Papaya	10	10400	150000	89040	42400000 300000000

The majority of the papaya and coconut farmers produce more fruit than can be supplied to HPW Fresh and Dry Ltd. The company maintains a supply quota for pineapples, coconuts and papayas when mango is in season (from January to February and from May till June). For HPW Fresh and Dry Ltd., demands and margins are highest for dried mango, so full production capacity is used during the mango season. The coconut season partly coincides with the mango season, so coconut farmers in particular speak out their desire for HPW Fresh and Dry Ltd. to increase their quotas. Because of these quotas, coconut farmers rely on Nigerian traders for selling the rest of their coconuts. The price per kg paid by Nigerian traders is 17% of what is paid by HPW Fresh and Dry Ltd. The same goes for the other crops: all fruits that cannot or will not be bought by HPW Fresh and Dry Ltd. may be sold at the local market, where prices per kilogram are lower (see table 20).

Table 20: Price per crop per kg by HPW Fresh and Dry Ltd. and local market.

	HPW price/kg	Local market price/kg
<i>Pineapple</i>	€0.75	€0.70 (or €0.20 in major season)
<i>Mango</i>	€1.20	€2.00 (or €0.80 in major season)
<i>Coconut</i>	€1.70	€0.70 (or €0.50 in major season) (€0.30 by Nigerian traders)
<i>Papaya</i>	€0.85	€0.50 (or lower in major season)

Orders are primarily in accordance with the supply agreement as signed by HPW Fresh and Dry Ltd. and the supplier, or field officers may come by to show the farmers which fruits are ready for harvesting. However, several farmers have experienced inconsistencies and delays in purchase orders which may result in reduced quality of the fruits as it ripens fast after harvesting.

³² Outlier 1: 42,360,000 kg; outlier 2: 300,000,000 kg.

³³ Without outliers.

³⁴ Without outliers.

³⁵ Without outliers.

5.2.2 Transportation and infrastructure

Transportation costs of the produce towards the production plant is covered by HPW Fresh and Dry Ltd. For each kilogram of produce, a fee of between 2 and 4 USD cents is paid and included in the final payment. The majority of the farmers however appear not to be aware of this mechanism as they have to arrange and pay for the transportation of the produce themselves. Moreover, half of the pineapple and coconut respondents and a quarter of the mango and papaya farmers consider transportation costs unaffordable. Transportation of the mangoes differs from the other crops. As part of the mango suppliers in more distant areas could not arrange transportation of the fruits towards the factory, it was decided to arrange transportation for them. Later, this mechanism had to be arranged for all mango farmers.

Infrastructure is another issue mentioned by the farmers. Fruits may be boxed in crates or not boxed at all and transported in a small truck, without any refrigerating facilities. It was observed that the conditions of the roads towards the production plant are not optimal³⁶. For this reason, the quality of the fruits may reduce on the way towards the factory. Because of the farthest distance of the location of coconut farmers from the factory, one might expect that this issue is most applicable for coconut farmers, but from doing observations in this area, it was found that the road constructions in this part of the country are better compared to those in other regions in southern Ghana. Indeed, number of farmers indicating to have access to paved roads was highest in the coconut region: 70,6% compared to 66,7% of the papaya farmers, 65,1% of the mango farmers and 46,7% of the pineapple farmers.

5.3 Processing, packaging and storage of products at the production plant

After delivery of the fruits, the products are assessed according to the quality requirements. Those fruits that do not meet these requirements are rejected and not paid for. Farmers do not attend this process and hence some of them argue not to have any insights in which fruits are rejected. The fruits that do meet the quality requirements are washed, sorted, peeled, and sliced. The sliced pieces are placed in the oven where precise electronic control systems regulate its' temperature, humidity and air circulation.

At the processing level, fluctuation in supply with long periods of undersupply (the factory may run below 50% of the capacity) followed by short periods of increased production, makes it difficult to plan labor requirement. Staff availability and labor costs are hence partly determining the production capacity. Staff must be trained for a period of one month and cannot be employed during peak seasons only. In addition, high operational and power costs, low water availability and bad diesel quality is experienced. For this reason, the company has invested in photovoltaic, a water storage construction and a biogas installation. Coconut shells and mango stones are repurposed as fuel for heating the drying ovens and pineapple peels are transformed into biogas.

After drying, the products undergo a final quality control. From there, they are packaged, checked with metal detection and stored in the warehouse in an unbroken cold chain of 5 degrees Celsius. The recently opened second factory consists of new processing machines that contribute to process optimization and increase food safety. The plant holds a BRC certification³⁷ since the start of its' operation in 2011.

³⁶ Even though fieldwork was conducted in the run of the elections, which is also the period in which improvements in infrastructure are executed.

³⁷ "BRC global standards guarantee the standardization of quality, safety and operational criteria and ensure that manufacturers fulfil their legal obligations and provide protection for the end consumer" (BRC global standards, 2016).

5.4 Export and distribution

95% of the final products is exported to the European market. Meeting customer orders on time is challenging because of the unpredictability of the production, which is a result of issues with obtaining sufficient information on cultivation progress. Products are transported in trucks to Tema port and shipped to Europe. Less than 1% is sold at the local market and to large retailers in Accra. The main reason for the latter is that local sales are levied with import duties of 20% and 17,5 VAT, making the products very expensive for local consumers.

5.5 Wholesale and retail market

At HPW AG, Switzerland, all customer support and procurement of European equipment and machineries is arranged.

In conclusion of the foregoing, smallholder farmers, farmers' associations, input and machinery suppliers, factory workers and transportation service providers are the most important actors in the supply chain. Various struggles exist in various phases of the supply chain. This chapter has demonstrated the major struggles of the farmers and those at the process level. What stood out was the threat from fruit flies and crop diseases on the incomes of mango and coconut farmers, because of major post-harvest losses. Another issue is the transportation of the fruits towards the plant: apart from mango farmers, all respondents have to arrange this by themselves. While transportation costs are covered by HPW Fresh & Dry Ltd., the majority of the respondents is not aware about this arrangement and hence considers transportation as an issue. In addition, infrastructure conditions are not conducive for the quality of the fruits, which may increase the number of rejected fruits during the quality control at the factory and hence lowers the income of the farmers. Irregularity in supply of raw material complicates the deployment of factory workers, which on its turn determines production capacity at the factory as people cannot be employed for a few weeks a year. Hence, supply quotas are maintained for various periods during the year. As farmers may harvest more than they may supply to HPW Fresh & Dry Ltd., they have to sell part of the harvest to other buyers, where prices per kg are lower. This obviously lowers their incomes and influences food security, as will be demonstrated in the next chapter.

6. The inclusive business model of HPW Fresh and Dry Ltd. and food security of their suppliers

According to the managing director, “food security is achieved when wholesome food for a living is available and affordable for people” (personal communication, November 2016). He lists the main challenges to overcome local food security issues as follows:

- Education with regards to malnutrition;
- Initiation of an attitudinal change to value agricultural work and farmers more;
- Internal trade liberalization by giving farmers access to the local market without the need to pass through market queens;
- Control of export of subsidized produce from industrialized countries to Ghana to avoid the collapse of local food production industries (as experienced with the chicken production);
- Training of farmers in sustainable and up-to-date cultivation techniques to maintain soil fertility;
- Professionalization of plant breeding to make available varieties adapted to local conditions.

Being a foreign agri-business, supporting local agriculture and job creation is considered the main responsibility of HPW Fresh & Dry Ltd. for improving local food security (personal communication, November 2017). Indeed, data presented in the previous chapters is in line with findings from existing literature arguing that farming trainings and knowledge exchange may boost productivity levels, which increases smallholders' incomes. Income indeed is a precondition for enhancing access to food, as will be elaborated on in this chapter. But income alone is not a ticket to food security, as will be demonstrated in the sections on food availability and food utilization.

6.1 Access to food

6.1.1 Household expenditures

Household income of suppliers is discussed in chapter four. Almost half of the respondents (47%) invests the major part of their income in the farm. For 32,5% of the respondents, education is the second major household expenditure, and food follows as a third major household expenditure for 38,5% of the respondents. For nine farmers (7,7% of the respondents), food is the major household expenditure, which strongly relates to whether and the number of (additional) crops that is cultivated by these respondents (Phi and Cramer's V: 0,342 with $p = 0,018$). The latter suggests that the more crops one cultivates, the less likely he or she will spend most money on food. A similar relation was found between the number of crops cultivated for own consumption exclusively and considering food as main household expenditure (Phi and Cramer's V: 0,327 with $p = 0,014$). Decisions on food expenditures are mainly made by the household head. In less than 10% of the cases, the spouse decides and in less than 5%, the household head decides together with the spouse. This is one of the reasons that several female focus group participants have started their own farm or job so that they can buy food for themselves and their children.

For the majority of the respondents, food may be bought from street vendors within a two-minute distance. More than 25% of the mango farmers however indicate not to have a street vendor in the neighborhood. They buy food at the market, which is accessible within 10 to 30 minutes

traveling. For pineapple, coconut and papaya farmers, a market is usually located at a 10 minutes' distance, irrespectively of the means of transportation that is used.

Table 21: First, second and third major household expenditures - in percentages of respondents.

	Rank 1: Farm	Rank 2: Education	Rank 3: Food
Pineapple	60 %	26,7 %	42,2 %
Mango	44,2 %	37,2 %	39,5 %
Coconut	11,8 %	35,3 %	29,4 %
Papaya	58,3 %	33,3 %	33,3 %

6.1.2 Crop diversification

25 farmers (21,4% of the respondents) cultivate only one crop (the main crop). This is in particular the case for coconut and mango farmers. The rest of the farmers applies crop diversification or mixed cropping. The average number of additional crops is two or three with minimum and maximum of two and six additional crops, respectively. Maize is cultivated by over half of the pineapple, mango and papaya farmers. Cassava is cultivated by over half of the pineapple, coconut and papaya farmers, and plantain is cultivated by over half of the coconut and papaya farmers (see figure 19).

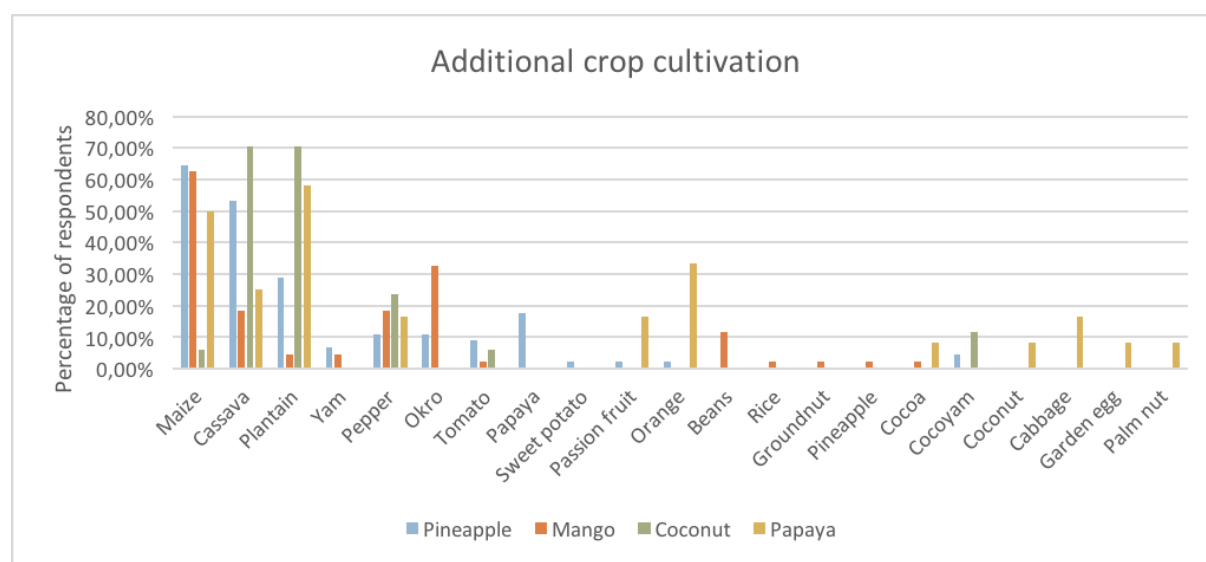


Figure 19: Additional crop cultivation.

6.1.3 Crops cultivated for own consumption

The major part of the harvest of these additional crops is sold at the local market. In most cases, a small part is consumed by the household as well. All farmers who cultivate plantain, yam, sweet potato, cocoyam, pineapple (not as a main crop) and groundnut, consume part of the harvest in the household (see table 22). Moreover, 20% of the respondents cultivates a crop for own consumption exclusively. 10% of the respondents cultivate two crops for own consumption exclusively, and 2% of the respondents cultivate three crops for own consumption exclusively.

Table 22: Additional crop cultivation and % of farmers cultivating this crop for own consumption.

	N of farmers cultivating the crop	% of these farmers consuming (part of) the harvest
Plantain	32	100%
Yam	5	100%
Sweet potato	1	100%
Coco yam	5	100%
Pineapple	1	100%
Groundnut	1	100%
Cassava	46	95,70%
Maize	58	94,80%
Okro	18	88,9
Tomato	6	83,3
Pepper	18	83,30%
Papaya	7	71,40%
Bean	3	66,70%
Rice	1	50%
Passion fruit	2	50%
Cocoa	2	50%
Orange	5	20%
Cabbage	2	0%
Garden egg	1	0%

6.1.4 Origin of food products

Figures 21 to 25 demonstrate that part of the respondents consume self-cultivated tubers, plantain, maize and fruits and vegetables. Products like beans, groundnuts, animal products and oils on the other hand are mostly bought at the market. Some animal products like poultry and eggs may be reared at the farm (about 25% of the respondents).

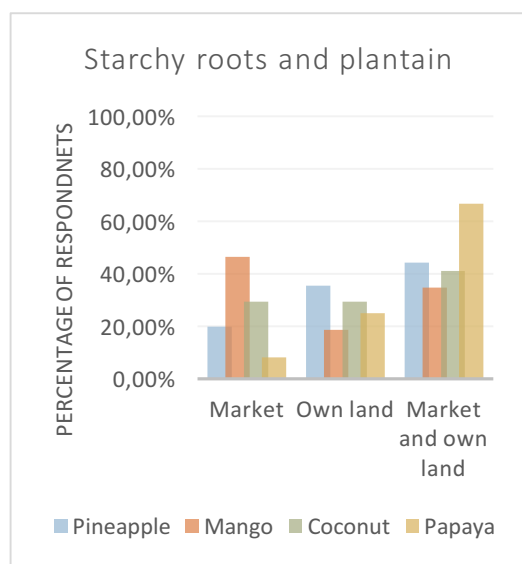


Figure 21: Where do you obtain starchy roots and plantain?

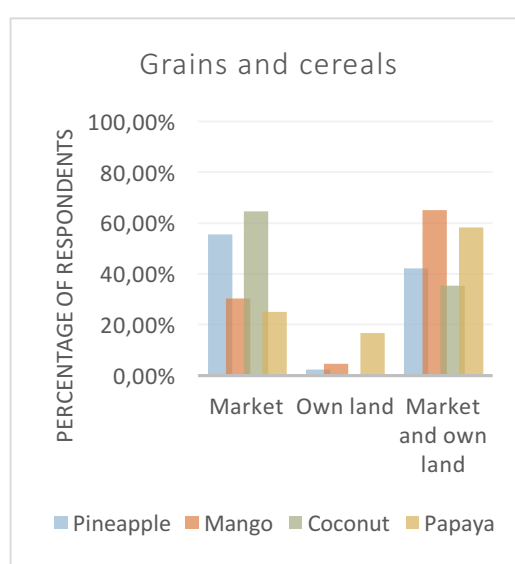


Figure 20: Where do you obtain cereals?

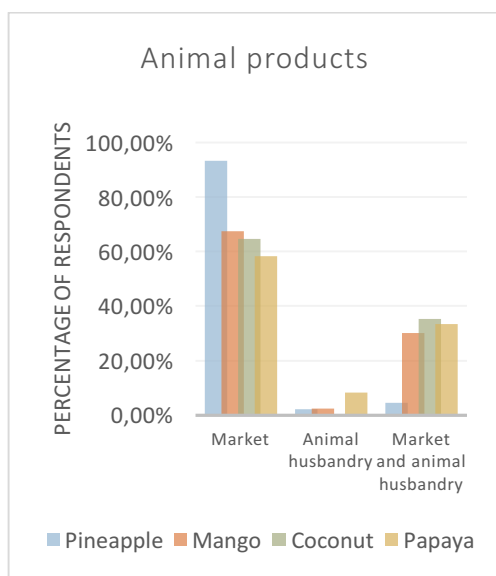


Figure 23: Where do you obtain animal products?

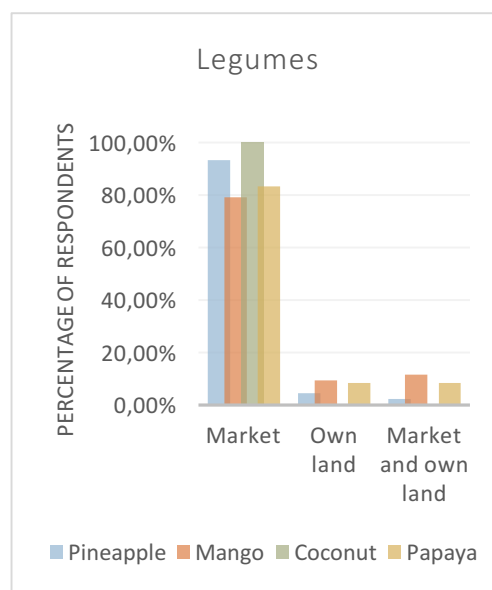


Figure 22: Where do you obtain legumes?

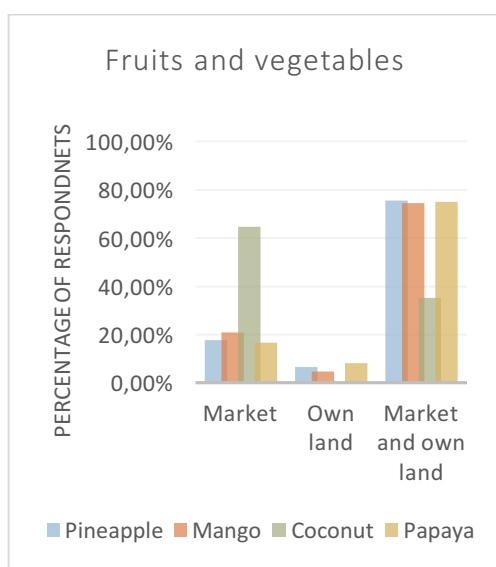


Figure 25: Where do you obtain fruits and vegetables?

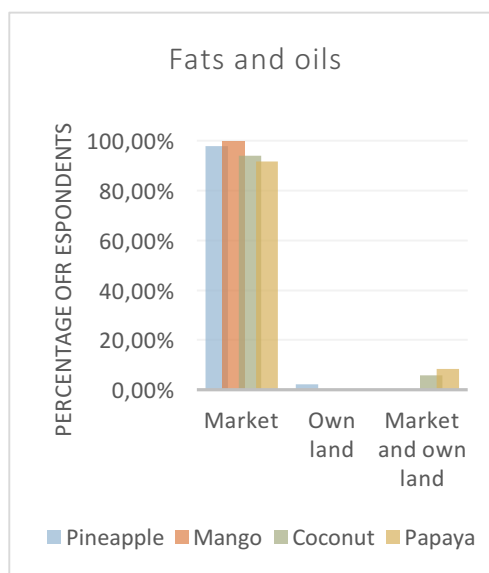


Figure 24: Where do you obtain fats and oils?

Nevertheless, focus group participants unanimously agreed that improvements in financial means have positively contributed to access to food: 'before HPW', many of them experienced income insecurity from farming. Selling crops to the local market went hand in hand with a lot of uncertainty and post-harvest losses were higher. Now, farmers can sell their produce in bulk and with these payments, they can buy more and more diverse food products.

6.2 Food availability

6.2.1 Seasonality

Food availability is associated with seasonality: partly the seasonality of their own main crop and partly seasonality in the broader context – the rainy and dry seasons. Focus group discussions and household surveys revealed that food scarcity starts during the Harmattan (late December to the

end of January) and lasts until the first rainy season (April to June). Food is best available during the rainy season, although too much rain might result in post-harvest losses. Cassava for example gets rotten and fruits go bad. This not only reduces the availability of food at the market, it also reduces the harvest that can be sold and hence affects their income. Climate change is also indicated to influence food availability: “This year, the rainy season delayed so food became really scarce and expensive” (female focus group participant, November 14, 2016). Figures 26 and 27 show when food is best and least available for the respondents. It demonstrates how food availability reduces during the dry season and starts to recover during the rainy season. It however also shows that the period of food availability for mango farmers differs slightly from the other farmers. Focus group discussions revealed that participants consider themselves most food secure right after the first harvest, when they have received the payment from HPW Fresh & Dry Ltd. As the full capacity of the factory is used when mango is in season (from January till June), pineapples, papaya’s and coconuts can be supplied only during the other half of the year. Indeed, figure 27 demonstrates a peak in food availability for pineapple, papaya and coconut farmers around August and September, when they can start supplying to HPW Fresh & Dry Ltd. It furthermore demonstrates how food availability for mango farmers start to increase right at the start of the ‘HPW Fresh & Dry Ltd. mango season’ and starts declining around July.

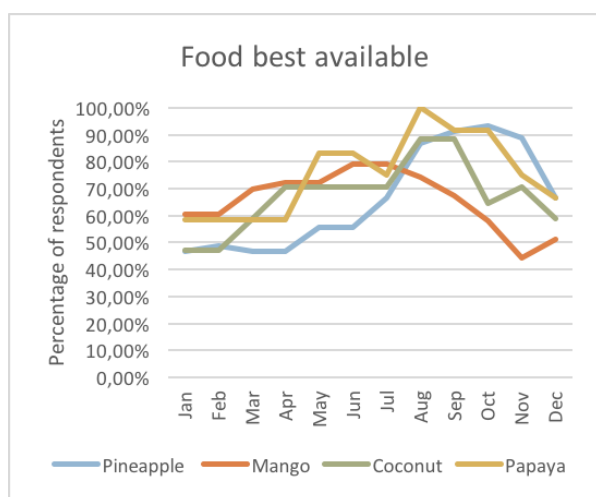


Figure 27: Food availability.

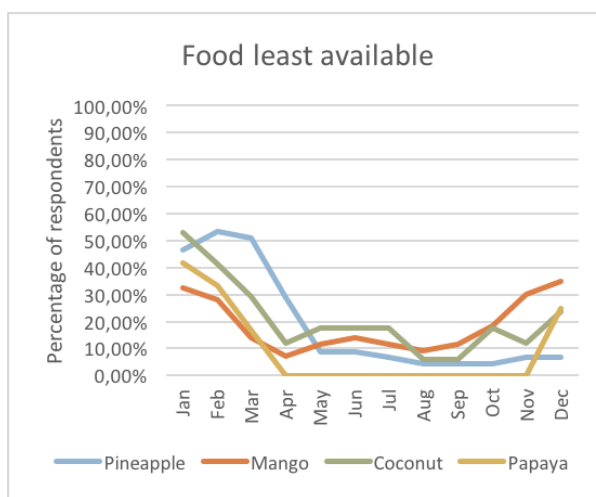


Figure 26: Food scarcity.

6.2.2 Subsistence farming

Apart from seasonality factors, whether a farmer cultivates crops for own consumption also influences availability of food. “I grow some other foods in the coconut farm myself so I do not experience food shortages” (female focus group participant, November 14, 2017). Crops like cassava and maize in particular are important products as these can be stored for a long time and processed into energy rich meals like fufu and banku. A mango female farmer stores cassava and maize during the rainy season and sells this for a higher price during the dry season.

6.2.3 Food consumption during the dry and rainy season

“During the dry season, food is very expensive so we can eat only two meals in a day, in the morning and in the evening. We also experience hunger” (female focus group participant, November 9, 2016). Farmers eat fermented products like banku or kokonte (dried and pounded cassava) for a few weeks in a row, as these products can be stored for a longer time and are

relatively cheap. Rice and gari (dried cassava) are other examples of products that can be stored for a longer time. Another strategy is to eat a lot of maize during the dry period. Even though this is expensive, the major benefit is that maize “increases in size once you cook it, so you don’t need a lot of it but still can feed many people” (female focus group participant, November 4, 2016).

Their diets are a lot more varied during the rainy season: bread with tea in the morning and fufu or rice with stew in the afternoon and evening. But fish, eggs, plantain and yam are also available and largely consumed. A female focus group participant explains: “The food we eat after the first mango harvest (February-March) is much more diverse. In this period, the availability of food is very constant. But during the second mango harvest (June-July), it is more variable. Some farmers can sell their mangoes and others cannot” (female focus group participant, November 9, 2016).

6.3 Food utilization

From what is described above, it can be concluded that the issue of access to food and availability of food is most relevant during the dry season. Even though fieldwork was conducted in November 2016 which falls in between the rainy and dry season, it was observed that typical diets were very low in diversity and mainly consisting of carbohydrates. Therefore, it was decided to analyze their consumption of food products during the past 24 hours.

6.3.1 Food consumption patterns

The majority of the respondents (69%) consumed three meals during the previous 24h. 25% of the respondents consumed two meals. Most meals were consumed in the morning and evening (see figures 28 and 29). Afternoon and evening meals are cooked by the female household head, but as the farm is often at a far distance from their houses, breakfast is regularly bought from street vendors. Parents give their children some money so that they can buy porridge on their way to school, where they can eat it. Meals consumed at home are often eaten from common bowls, or there might be separate bowls for children and adults.

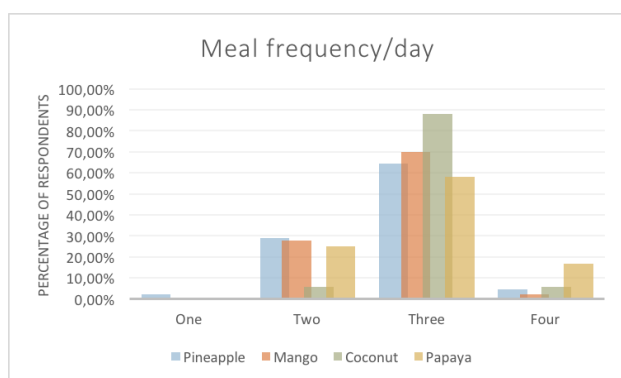


Figure 29: Number of meals consumed (previous 24h).

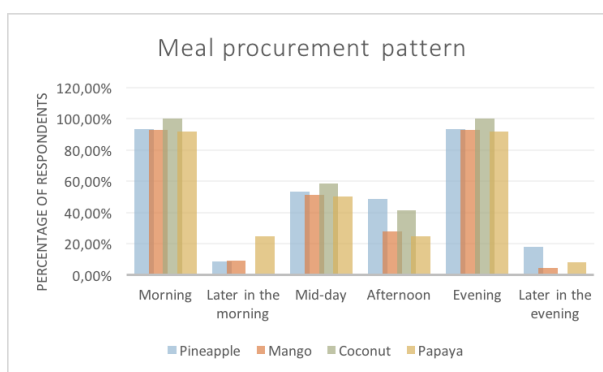


Figure 28: Meal procurement pattern.

An additional snack (a piece of fruit and/or with some groundnuts) was consumed by a third of the respondents, but most amongst pineapple and papaya farmers. One pineapple farmer who had consumed one meal also consumed a snack. A small majority (58,6%) of the farmers who had consumed two meals also consumed a snack. This was 22,2% amongst farmers who had consumed three meals. The number of meals and snacks consumed were also found to correlate significantly (Pearson: -0,361 with $p = 0,000$) suggesting that higher the number of meals, the less likely it is that a snack is consumed as well.

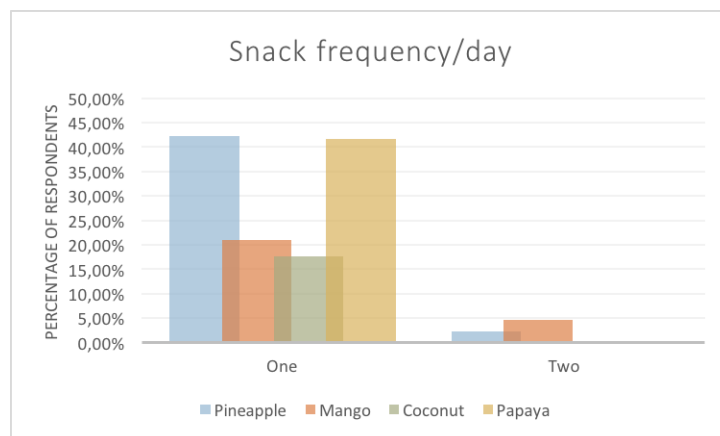


Figure 30: Number of snacks consumed (previous 24h).

Banku, fufu and rice was consumed by most of the respondents (see figure 32), supplemented with soup or stew and (dried) fish. Amongst coconut farmers, rice with stew and fufu is consumed more often than banku. Banku is a cheap dish and made from fermented maize and cassava dough. Indeed, maize was not found to be cultivated often amongst coconut farmers. This is the other way round for mango farmers, where cassava is not cultivated often and banku was found to be consumed more often than fufu and rice with stew. Fufu is more expensive and made from pounded cassava. Fufu with light soup (from tomatoes, onions, garlic, and peppers) with fish or (goat) meat is considered very healthy: “When I have this, I am good for the rest of the day” (female coconut farmer).



Figure 31: Women at the local market selling cassava leaves for kontomire stew. Photo credits: Ine ter Berg.

A female mango farmer explained: “Meals like banku and akpele (similar to banku) are healthy because it is heavy and filling. I eat this a lot during the harvest season because I can do the work without being hungry”. Another female mango farmer mentioned that for her, fufu with palm nut soup is healthy because “when I eat it in the evening and wake up in the night, I feel good, strong and healthy”. Foods that make them happy, such as plantain or rice with stew, are also considered healthy: “it makes me feel happy to see that my children like the food” (female focus group participant, November 4, 2017). Other dishes that are considered healthy are ampesi (boiled yam or plantain with garden eggs stew and fish) and kontomire stew (made from cassava leaves, tomatoes, peppers, onions and garlic). The cassava leaves used in kontomire stew are believed to be blood building. They furthermore are the “cheapest and most readily available sources of important proteins, vitamins, minerals and essential amino acids in Ghana” (Kwenin, Wolli & Dzomeku, 2011: 1300).

Female pineapple focus group participants mention that they know that fish and meat are important sources of protein, but that these products are hard to obtain during the dry period. Some of the farmers consume chicken or goat, but only when these animals are reared at the farm as the meat is too expensive at the market. When they cannot afford fish, meat or poultry, they would add an egg to the dish to make sure they get some protein. However, healthy food is not of

primary concern: they know which dishes are healthy, but ‘eating food’ is more important than ‘eating healthy food’.

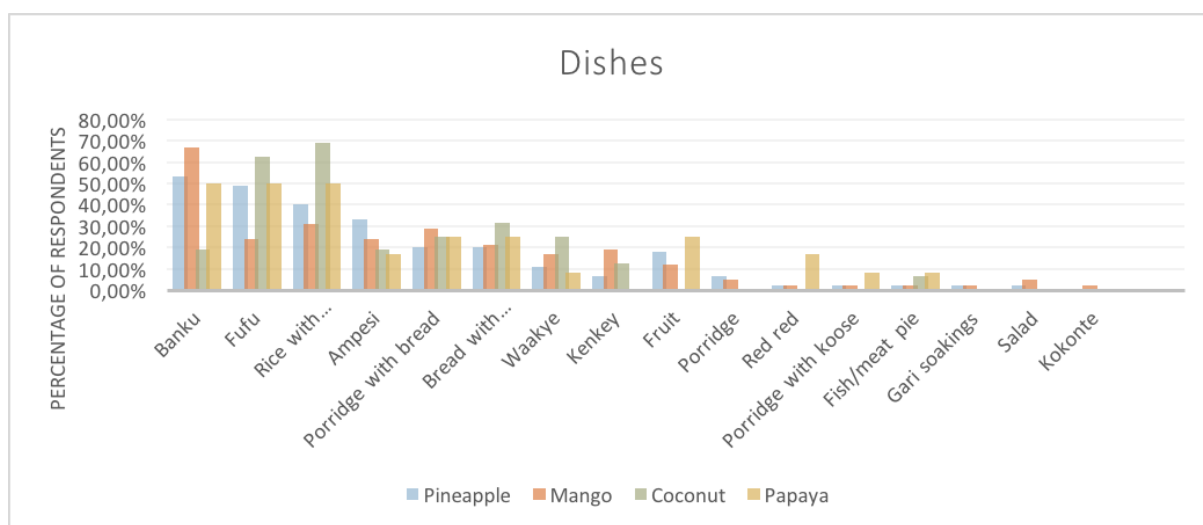


Figure 32: Dishes consumed by percentages of respondents (previous 24h).

6.3.2 Dietary Diversity Score

Respondents on average consume a little over five food groups with minimum and maximum of three and six food groups, respectively (see figure 33). Household composition (size) does not appear to be of influence on a DDS (Pearson: -0,105 with $p = 0,260$). Monthly income on the other hand positively influences DDS (Pearson: 0,208 with $p = 0,032$) which is not the case for income from selling main crop (Pearson: 0,048 with $p = 0,627$). Farm size also appears not to influence DDS (Pearson: 0,119 with $p = 0,200$).

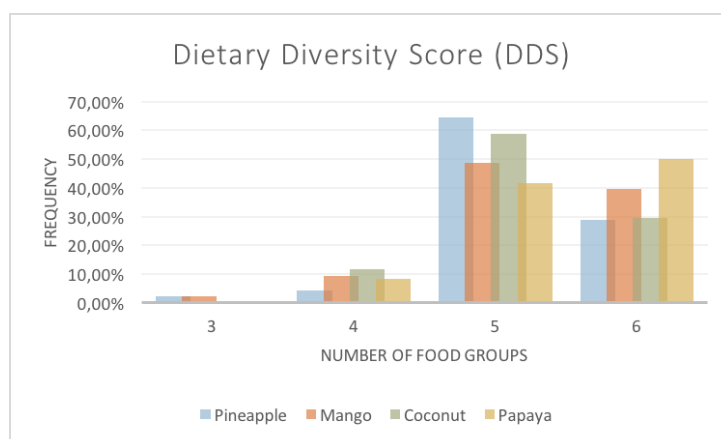


Figure 33: Dietary Diversity Score (previous 24h).

All respondents consumed at least one food item from food group five (fruits and vegetables) during the previous day. Products in food group two, three and six (grains and cereals, animal products and fats and oils) are also consumed amongst almost all respondents. Items from food group four (legumes) are eaten the least (see figure 34 and table 23).

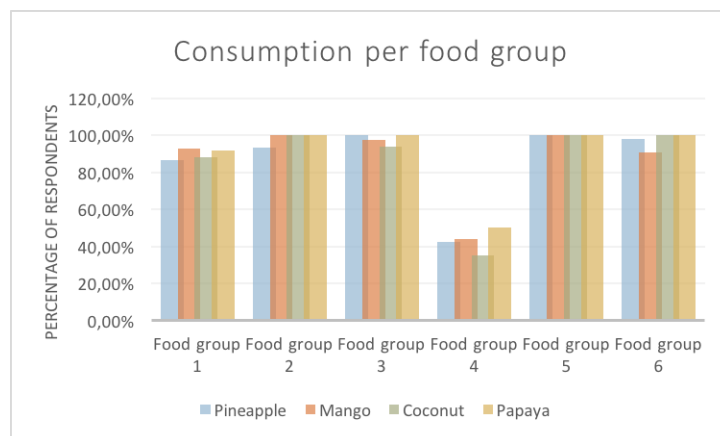


Figure 34: Consumption of food groups in percentages of respondents (previous 24h).

Table 23: Food groups consumed by more than 50% of the respondents.

Pineapple farmers	Mango farmers	Coconut farmers	Papaya farmers
Fruits and vegetables	Fruits and vegetables	Fruits and vegetables	Fruits and vegetables
Animal products	Grains and cereals	Grains and cereals	Grains and cereals
Fats and oils	Animal products	Fats and oils	Fats and oils
Grains and cereals	Starchy roots and plantain	Animal products	Animal products
Starchy roots and plantain	Fats and oil	Starchy roots and plantain	Starchy roots and plantain
			Legumes

Consumption of products from food group three (animal products) correlates significantly with net income from selling main crop (Pearson: 0,295 with $p = 0,002$), suggesting that farmers with higher net incomes from selling main crop are more likely to consume more animal products. A similar correlation was not found between consumption of animal products and monthly income (Pearson: 0,025 with $p = 0,799$). Similar correlations were not found for the other food groups. Negative but not significant relations were found between net income from main crop and consumption of starchy roots and plantain (Pearson: -0,081 with $p = 0,416$) and consumption of fruits and vegetables (Pearson: -0,172 with $p = 0,081$).

6.3.3 Food Variety Score

FVS distribution in the sample was quite small with minimum and maximum consumption of six and sixteen food items, respectively and a mean of 11,2 out of 45 identified food items.

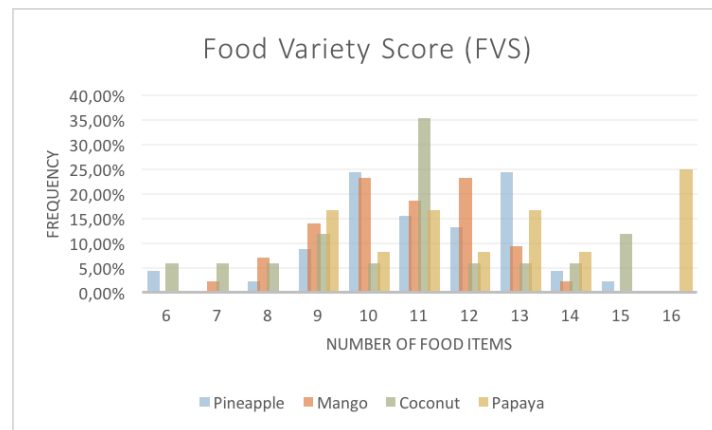


Figure 35: Food Variety Score (previous 24h).

Cassava was consumed most frequent in food group 1 (85,9% of the respondents) although plantain is eaten regularly as well. In food group 2, maize (66%) and rice (65%) was consumed most frequent. Maize was consumed more amongst mango farmers and rice was consumed more amongst coconut farmers. Over half of the respondents ate bread (wheat). Porridge (millet or oats) is not consumed that often. In food group 3, fish was consumed by 95,6% of the respondents. Coconut farmers live in the coastal region where “you can easily buy three varieties of fish for a little money” (male coconut focus group participant, November 14, 2016). Indeed, all coconut respondents had fish during the previous 24h. Coconut farmers also consumed fish more often: 36% of them consumed fish three times a day, which was 16% of the pineapple farmers, 7% of the mango farmers and 0% of the papaya farmers. 57% of the farmers who did not eat fish ate meat instead. Milk (in tea) was consumed by about a quarter of the respondents. Cowpeas (red red/waakye) and groundnuts (in groundnut soup or as a snack) are the most often consumed products in food group 4. As it is the basis for almost all soups and stews, pepper (98%), tomato (96%) and onion (83%) were most frequent consumed products in food group 5. Even though all respondents are fruit farmers, consumption of (these) fruits are very low: about a third of the pineapple farmers ate pineapple and about a third of the papaya farmers ate papaya. As almost all dishes contain vegetable oil, this the most frequent consumed product in food group 6 (83,3% of the respondents). Margarine is used in bread, biscuits and pastries and hence about half of the respondents had consumed this food item. About 30% of the respondents took palm nuts or palm oil.



Figure 36: Women at the market selling cassava dough. Photo credits: Ine ter Berg.

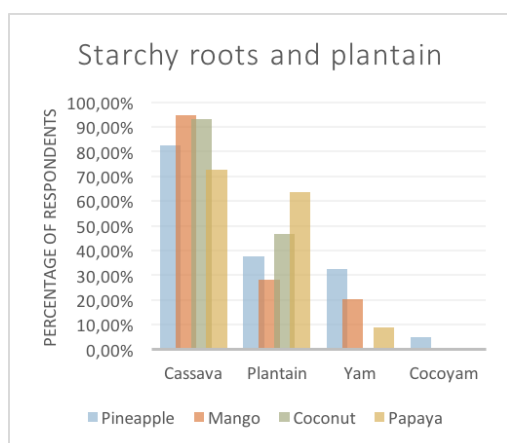


Figure 38: Consumption of starchy roots and plantain, in percentage of respondents (previous 24h).

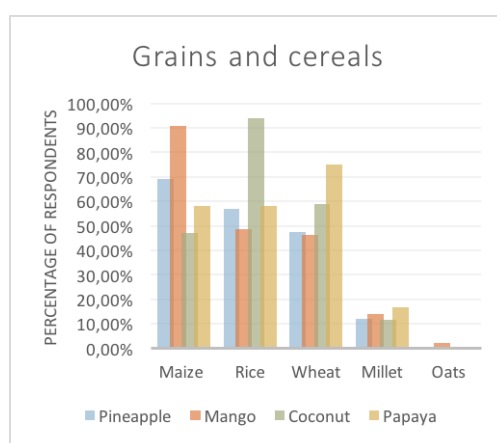


Figure 37: Consumption of cereals, in percentage of respondents (previous 24h).

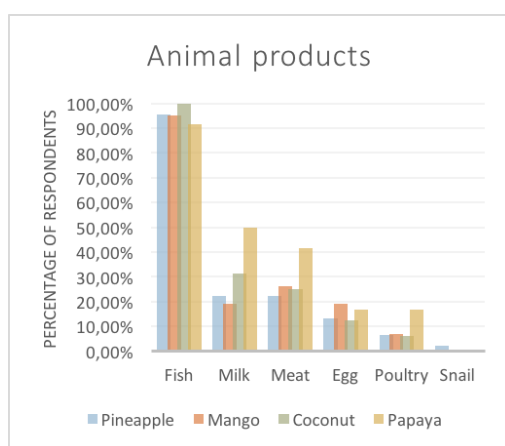


Figure 40: Consumption of animal products, in percentage of respondents (previous 24h).

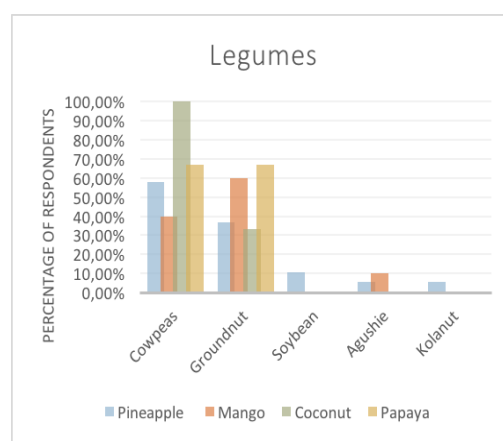


Figure 39: Consumption of legumes, in percentage of respondents (previous 24h).

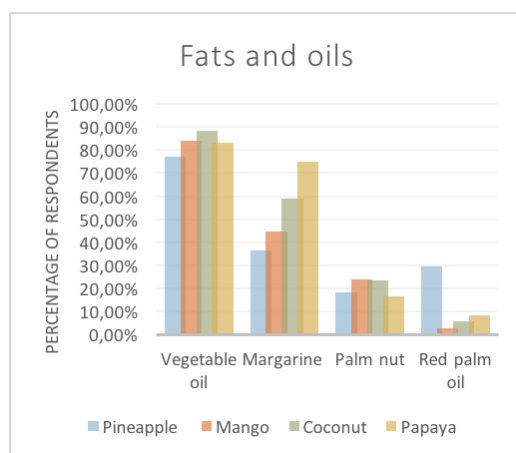


Figure 41: Consumption of fats and oils, in percentage of respondents (previous 24h)

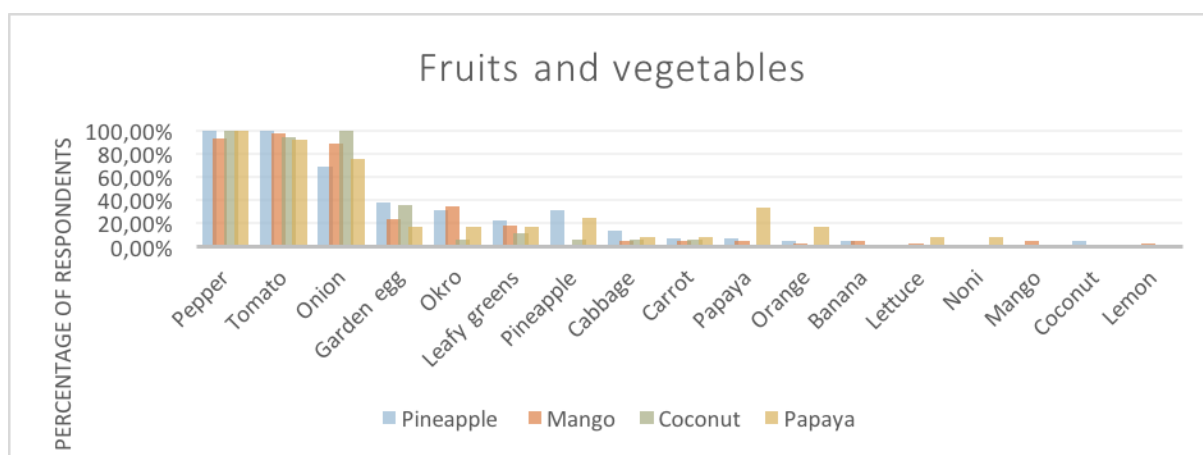


Figure 42: Consumption of fruits and vegetables, in percentage of respondents (previous 24h).

6.3.4 Health and sanitation

Most respondents have been informed about health and cooking practices by their mother (73%), or at school (53%). The media (36%) and health workers (25%) are important factors as well. A strong relation was found between visits from health workers and DDS (Phi and Cramer's V: 0,326 and $p = 0,006$) which was not the case for relatives and DDS (Phi and Cramer's V: 0,114 with $p = 0,486$), media and DDS (Phi and Cramer's V: 0,145 with $p = 0,484$) or school and DDS (Phi and Cramer's V: 0,142 with $p = 0,500$). This suggests that health workers may contribute to dietary diversity of the respondents. Soap is used amongst all respondents and all of respondents have access to water sources for cooking and washing purposes. Tap water is better available for mango farmers: 80-85% compared to 40-50% of the pineapple and coconut farmers. Most papaya farmers obtain their water from a community or household well. A little over half of the respondents (52%) buys purified water for drinking purposes. Health problems are sometimes experiences by a third of the respondents, which is rarely or never the case for 19% and 38% of the respondents, respectively. Procurement of sanitation-related diseases like diarrhea and cholera during the past six months is very low (less than 7% of the respondents).

Hence, respondents are aware about health benefits of various food items and the importance of sufficient sanitation practices. In line with expectations based on existing literature, food security in terms of availability and accessibility is – apart from the dry period – not found to be a severe issue. The contribution of HPW Fresh & Dry Ltd. to the food security is most apparent from the finding that food availability increases at the moment that farmers may supply their produce to HPW Fresh & Dry Ltd. But subsistence farming is essential for reducing their vulnerability for food unavailability throughout the rest of the year. Farming trainings provided by HPW Fresh & Dry Ltd. may positively contribute to the quantity and quality of the subsistence crops, which are partly destined for household consumption. Banku is one of the cheaper dishes and most consumed amongst mango farmers, who found themselves to be farthest from their last obtained income from selling main crop³⁸. While respondents are aware that they should consume varied and nutritious dishes, they are not always able to do so as healthy food is more expensive and unavailable during the dry season. As a result, FVS is low but DDS is high. Variety in food consumption is partly a result of the various crops that can or cannot be cultivated in the area. Maize is not easily cultivated in the south-western region (coconut farmers) and cassava is less cultivated in eastern and central regions (mango and papaya farmers). Nevertheless, it has to be

³⁸ Last harvest round and supply was in July

kept in mind that apart from the higher rainfall pattern in the south-western region, the various research areas are quite similar in terms of ecology and abilities to cultivate various food crops.

7. Conclusion

The main objective of this thesis was to study the food security situation of smallholders involved in an inclusive agricultural business model. The main research question guiding this thesis was: “What is the food security situation of smallholders in southern Ghana and how can inclusive agribusiness contribute to their situation?”. Quantitative and qualitative data for answering this question was obtained with a preliminary desk study, semi-structured interviews, household surveys, focus group discussions and participatory observation. Survey respondents were randomly selected from a list of suppliers provided by HPW Fresh and Dry Ltd. The inclusiveness of the business model of HPW Fresh & Dry Ltd. was assessed along the six criteria for an inclusive business model (IBM) provided by the FAO (2015). A value chain analysis (VCA) was used to reveal important actors, their major struggles and their strategies to overcome these struggles. Several of these struggles and strategies influence the current food security situation of the suppliers. Food security was analyzed by means of the three pillars of food security: food access, food availability and utilization of food. In addition, the Dietary Diversity Score (DDS) and Food Variety Score (FVS) provided insight in the dietary intake of suppliers.

The business model of HPW Fresh & Dry Ltd. meets the six criteria of an IBM; some to a larger extent than others. The inclusion of over thousand smallholders³⁹ with an average farm size of 16,7 acres⁴⁰ and an average plot size of 9,2 acres⁴¹, and about thousand factory workers from neighboring villages is distinctive for an inclusive business, as an inclusive business should provide vulnerable people with a living wage (FAO, 2015). Respondents made an average of ₵21638⁴² last year (2015) (without outliers) from selling the main crop, although individual net income is influenced by various factors. A larger farm- or plot size for example is likely to result in higher net income (Pearson: 0,299 with $p = 0,003$ and Pearson: 0,299 with $p = 0,004$, respectively). However, eighteen farmers (15,4% of the respondents) did not meet the upper poverty line⁴³ and twelve respondents (10,3%) did not meet the lower poverty line⁴⁴ from selling main crop only. The majority of these respondents are coconut farmers who have started supplying to HPW Fresh & Dry Ltd. only recently. Nevertheless, the majority ($\pm 75\%$) of the people living under the upper and lower poverty line indicates that their profit and ability to support their family has increased since they started supplying to HPW Fresh and Dry Ltd. Selling their produce in bulk to HPW Fresh and Dry Ltd. contributes to income security and decreases vulnerability for 78,7% of all respondents. Livelihood diversification i.e. obtaining income from various sources, is another inclusive element and applied by 94% of the respondents. Selling other crops, off-farm activities or trading provides respondents with an average monthly income of ₵1651⁴⁵. Respondents with a higher education level are more likely to diversify in terms of income sources (Pearson: 0,212 with $p = 0,023$) and multiple income sources on their turn increase total monthly income (Pearson: 0,383 and $p = 0,000$). The number of respondents not meeting upper poverty line declines to three (2,6%) when calculating all household income sources. Similar, zero respondents fall below the lower poverty line. The number of income sources correlates to total

³⁹ Even though “the definition of smallholders [differs] between countries and between agro-ecological zones [...], [SSA smallholders may] cultivate 10 ha or more” (Faurès & Santini, 2008: 93).

⁴⁰ 6,76 hectares.

⁴¹ 3,72 hectares.

⁴² \$ 4921

⁴³ ₵1314 per adult per year.

⁴⁴ ₵792 per adult per year.

⁴⁵ \$375,51

monthly income (Pearson: 0,319 and $p = 0,001$) and to upper poverty line (Pearson's R: 0,194 with $p = 0,039$) which suggests that a higher diversity in income sources results in higher monthly income, and reduces the likelihood of living below the two Ghana poverty levels.

Similar is the flexibility of the contracts: a farmer may cancel, delay or reduce the delivery when anything out of his/her own control happens. HPW Fresh and Dry Ltd. in turn may reject deliveries when it does not comply with the quality requirements or when deliveries exceed or are below agreed volume. Fruits that are not taken by HPW Fresh and Dry Ltd. may be sold at the local market, but the prices per kg are lower compared to prices paid by the company. Having multiple buyers is stimulated by HPW Fresh and Dry Ltd. and 82,9% of the respondents indeed has two or more buyers. This enhances their income security and reduces the risk of post-harvest losses. 17 farmers (16,5%) sell to HPW Fresh and Dry Ltd. only. This can be explained as their mean plot size and harvest was lower compared to farmers with two or more buyers (6,4 acres⁴⁶, 8,7 acres⁴⁷ and 13,3 acres⁴⁸ respectively; 24806 kg, 28047 kg and 50038 kg, respectively). A correlation was found between number of buyers and size of the harvest (Pearson: 0,255 with $p = 0,008$) and number of buyers and plot size (Pearson: 0,251 with $p = 0,011$). One major constraint for pineapple, coconut and papaya farmers is that their produce may be supplied only during the mango lean season (March to mid-May and mid-August to mid-December).

HPW Fresh and Dry Ltd. has seven local field officers who visit the suppliers regularly and assist them with the decision on which fruits should be harvested. Farmers' associations may enhance the negotiation position of smallholder farmers and Fairtrade liaison officers may act as a third party in the case that any conflict may arise. Roughly 75% of the respondents is member of an association. Farming trainings provided by HPW Fresh and Dry Ltd. have contributed to an increase in production and resource management skills, group management skills and basic market skills (for 89%, 64%, and 61% of the respondents, respectively).

Hence, smallholder farmers, farmer's association, field officers, input providers and factory workers are important actors in the supply chain which consists of five phases: 1: crop production; 2: harvesting and transportation to the plant; 3: processing, packaging and storage of products at plant; 4: export and distribution; and 5: wholesale and retail markets. Lack of irrigation and unavailability of machineries, pests and crop diseases and increasing costs of framing inputs are obstructing farmers most in ensuring high quality and productivity levels. Transportation of the harvested products is another issue jeopardizing the quality of the fruits: Bad road conditions and small trucks with no refrigerating facilities may reduce the quality of the fruits on the way to the plant. Coconut farmers are located farthest from the factory, but road conditions in this area are better compared to the situation in eastern and central region. Despite of the supply agreement with HPW Fresh and Dry Ltd., farmers experience irregular or delayed orders. Due to this delay, already harvested fruits may become overripe and HPW Fresh and Dry Ltd. will not buy overripe fruits. These products can be sold to the local market, but for lower prices. As a result, many farmers experience financial losses. Also, while local markets are usually accessible within a ten to fifteen minutes' transportation, the local market is located at the farthest distance for mango farmers, and in combination with their arrangement with HPW Fresh & Dry to come and pick up their fruits (instead of transporting them to the factory themselves, as is the case for the other crop farmers), such an impact seems to be largest for mango farmers.

⁴⁶ 2,59 hectares.

⁴⁷ 3,52 hectares.

⁴⁸ 5,38 hectares.

At the processing level, issues like high operational and power costs, low water availability and bad diesel quality are solved with photovoltaic, a water storage construction and biogas from pineapple peels. Coconut shells and mango stones are repurposed as fuel for heating the drying ovens. After the drying process, the products are packaged and stored in the warehouse. Then, logistic companies take care of exporting 95% of the products to the European market. Here, HPW AG in Switzerland is responsible for customer support and arranges wholesale to European supermarkets and grocery stores.

The different supply periods between mango farmers and pineapple, coconut and papaya farmers is translated in different periods of food security as experienced by respondents. Food availability for mango farmers is highest between June and July, while pineapple, coconut and papaya farmers indicate to have more food available between August and September. Food scarcity peaks during the Harmattan (late December to the end of January) and lasts until the first rainy season (April to June). Nevertheless, food availability alone is not an indicator for food security. Access to food was relatively good in all three research areas, as a street vendor or a market can usually be reached within 2-30 minutes' travelling. During the dry season however, food prices increase and respondents cannot afford to eat a lot and diverse. Subsistence farming is an important strategy for relieving food scarcity during the dry period: 92 respondents cultivate at least one crop next to the main crop and 31% cultivates at least one crop exclusively for own consumption. This is usually plantain, maize or cassava. With regards to food utilization, overall food consumption patterns were good: most respondents (69%) consumed three meals during the previous 24h. The usual local diet consists of a (fermented) dough or rice, accompanied with a stew or soup of vegetables and fish. Energy rich meals like banku, fufu and rice were consumed most frequent as these keep them full and enable them to work at the farm without being hungry. Legumes (food group 4) are eaten the least. Respondents are aware of the health benefits of cassava leaves, eggs and fresh fish but eating healthy food is not of primary concern. FVS distribution in the sample was quite low with minimum and maximum consumption of six and sixteen food items, respectively and a mean of 11,2 out of 45 identified food items. In terms of food groups, the DDS ranged from three to six, over six possible food groups (mean DDS = 5.3). All respondents consumed at least one item from food group 5, regardless of their FVS or DDS score. Respondents with a low DDS scores consumed two meals and one or two snacks a day divided over three food groups (fruits and vegetables, grains and cereals and animal products). Starchy roots and plantain and fats and oils are added for respondents with a medium DDS score and respondents with a high DDS score consumed at least one food item from all six food groups.

Crucial in all of the above is the increased income security of suppliers of HPW Fresh and Dry Ltd. Selling their produce in bulk according to a supply plan gives smallholders a certain degree of security, where they base the rest of their activities on: farmers consider themselves (most) food secure right after the first harvest, when their income is highest. And while seasonality is a major external factor determining food availability, 65,3% of the respondents indicates that in general, household food consumption has increased since their first supply to HPW Fresh and Dry Ltd. and diversity in household food consumption has increased for 68,6%. Farming trainings and the input support program are considered important factors for the increasing productivity and hence income levels of the suppliers. Scalability of the company leads to the expectation that farmers may increase their supply levels in the near future. Nevertheless, the role of livelihood diversification and subsistence farming for income- and food security should not be underestimated: income levels increase significantly when counting all household sources. And except for legumes, fats and oils and animal products, many farmers cultivate additional

crops that may be consumed by the household themselves as well, which is an important food source during the dry season in particular.

8. Discussion

As discussed in the theoretical framework and demonstrated in the empirical chapters, giving a clear-cut answer on ‘what’ the role of an inclusive agribusiness on the suppliers’ food security entails, is more complex than pointing out the role of foreign direct investment (FDI) on local food security. This complexity arises because of several factors that may or may not be interconnected. First of all, even though there is a certain consensus on what an inclusive business model (IBM) should entail and how an inclusive business model differs from a non-inclusive business model, different definitions of an IBM exist amongst various “key organizations working in the field of ‘Inclusive Business’ (Wach, 2012: 9). This complicates determining whether and to what extent the business model applied by HPW Fresh and Dry Ltd. is inclusive. The same goes for determining the level of food security of the suppliers and the extent to which the involvement of HPW Fresh and Dry Ltd. has contributed to this level of food security. Using a mixed-method approach with both qualitative and quantitative data collection methods has reduced these issues to a certain extent: interviews and focus group discussions complemented quantitative data obtained from household surveys and qualitative data obtained from focus group discussions and interviews are substantiated by household surveys. Participatory observations furthermore contributed to a just interpretation of the not so self-evident research findings. Nevertheless, a limitation with regards to data collection and analysis is that no counterfactual was included in this thesis. A counterfactual is “essential in order to gain information about the real impacts of a business activity” (Wach, 2012:26, 27). Without a counterfactual, it is impossible to determine the level of respondents’ food security if HPW Fresh and Dry Ltd. would not be inclusive. As this information is essential for the thesis, respondents were asked to compare several current situations with the period in which they did not supply to HPW Fresh and Dry Ltd. and rate this using a Likert scale (1 being a lot worse and 5 being a lot better). This is a challenging method with regards to the validity of the outcomes, for several reasons. First of all, this method relies on the memory of the respondents who might idealize the current situation over the past, or the other way round. This might induce them to answer in favor or against HPW Fresh and Dry Ltd. Second, ‘increased’ food consumption cannot simply be translated into the conclusion that this is *because of* HPW Fresh and Dry Ltd. as there may be numerous other factors influencing this increased food consumption. Here, focus group discussions were required to figure out exactly *why* food consumption has increased and *what* the role of HPW Fresh and Dry Ltd. is. These discussions found that a higher degree of income security provided by the company is the major contributing factor for increased access and availability of food.

This is in line with expectations that were based on existing literature. As argued in existing studies (Dollar & Kraay, 2001; Dugasquier & Osakwe, 2006; Scoet, Stamoulis & Deus, 2004), HPW Fresh and Dry Ltd. brings employment and hence, living wages to the area. Income directly increases accessibility of food for local people involved in the value chain. But jobs can also be created by a ‘normal’ foreign investor, or even a local investor (BIF, 2011). So what is it that HPW Fresh and Dry Ltd. as an inclusive business makes outcomes in terms of food security different compared to the contributions of non-inclusive businesses? According to Paglietti & Sabrie (2013), “[t]he more a business model involves partnerships with smallholders or communities and the more the value is shared among the business partners, the greater is the model’s inclusiveness” (ibid.: 18). With regards to the six criteria for inclusive business models presented by the FAO (2015), several factors were found to stand out. First of all, the farming trainings and the contact with local field officers have reduced the risk at post-harvest losses i.e. financial losses and improved smallholders’ farming skills. As a result, crop productivity and

quality has increased. The scalability, i.e. HPW's ability to grow, enables the company to absorb this increase in supply, which in turn requires increased workforce at the factory. This two-sided mechanism increases their income security and hence is assumed to improve living conditions of both smallholder farmers and local communities in neighboring villages, increasingly. As rural smallholder farmers are more likely to be food insecure compared to medium-sized farming households or urban populations (Hjelm & Dasori, 2012), the inclusion of this vulnerable population in the business model is contributing to their access to food. It is beyond the scope of this research, but it may be assumed that farming trainings and (natural) input provision may enhance the availability and quality of food in the region, as the major part of the smallholders not only cultivates pineapples, mangoes, coconuts or papayas, but instead supplements this with other (locally often consumed) food crops as well (see figure 43). It is clear that these factors primarily target income securities of smallholders and therefore it is assumed that this increases their accessibility to food. Through providing suppliers with a living wage, this is indeed the most obvious contribution of HPW Fresh & Dry Ltd. to the food security situation of their suppliers and was confirmed by the respondents. And even though a non-inclusive business model may be able to provide smallholders with a living wage as well, the close contact between the two parties and the twice-yearly meetings strengthen the position of smallholders for negotiating about the prices of their produce. And integrating and strengthening the position of smallholders with mutual benefits for both parties is the core idea of inclusive business.



Figure 43: Linkages between the inclusive business model and food security.

Yet, seasonality remains an external but determining factor for the food security situation of respondents. All farmers are aware that every year, right after Christmas, Harmattan will come and bring food security issues. The drought makes food scarce and hence, expensive. Farmers have developed numerous strategies to support their families with their needs: subsistence farming provides them with 'at least a little bit to eat' during the dry season. Or storing products with a long shelf life and sell this for a higher price during food scarcity. Livelihood diversification, i.e. obtaining a total household income from multiple sources is applied by almost all farmers and provides them with an income during the lean season.



Figure 45: Rice with groundnut soup. Foto credits: Ine ter Berg.



Figure 44: Waakye with tomato stew. Photo credits: Ine ter Berg.



Figure 46: Ampesi: Kontomire stew with boiled plantain. Photo credits: Ine ter Berg.

Figure 47: Red red. Photo credits: Imma Calute. Accessed on February 2, 2017 from <http://www.africanbites.com/red-redafrican-stewed-black-eyed-peas/>



Hence, availability and accessibility of food is not the major issue here. Utilization of food i.e. nutrition is where smallholder farmers stand to gain. In line with previous studies on nutritional conditions of (rural) Ghanaians (FAO & VIFIMS, 2009), food consumption does meet their energy requirement but diversity of food consumption is low and dishes consist largely of carbohydrates. The latter is not necessarily wrong, as energy is required by farmers to work on the farm, but nutritional conditions would be improved if this would be alternated with legumes every now and then. And even though food consumption analyses demonstrate that vegetables and fish are consumed most frequent and during almost every meal, regardless of the height of the FVS or DDS, one must bear in mind that these products are part of the ingredients for stews and soups which are prepared with a lot of vegetable oil and cooked thoroughly. Moreover, it was observed that one portion of stew is likely to contain a tenth of a tomato, pepper and onion. Thus, net consumption of vegetables is very low and vitamins and minerals may be significantly reduced during cooking (Kimura & Itokawa, 1990). Furthermore, ingredients for groundnut soup and kontomire stew are almost similar (see figure 49 and 50). Likewise, food variety- and dietary

diversity analyses demonstrate that protein is not under consumed, which is not in line with expectations. This can be explained as protein-rich items are mostly consumed in small portions. Milk for example is poured in tea and one portion of (dried) fish may weigh not more than 50 grams.



Figure 49: Groundnut soup in progress. Photo credits: Ine ter Berg.



Figure 48: Cowpeas for making waakye. Photo credits: Ine ter Berg.



Figure 50: Ingredients for kontomire stew. Photo credits: Ine ter Berg.



Figure 51: Ingredients for groundnut soup. Photo credits: Ine ter Berg.

Recommendations

Lack of nutritious food may lead to micronutrient deficiencies of iron, iodine and vitamin A (FAO, 2013; FANTA, 2013) and consumption of a typical Ghanaian diet may lead to “high blood pressure [and] high levels of cholesterol in the blood” (GMOH, 2009: 6). One of the benefits of enhancing dietary intake and nutritional status is increased productivity (Strauss, 1986). It is questionable how and to what extent an inclusive agribusiness should be concerned with food security at such an explicit level, but being involved in the agribusiness and having ambitions and opportunities for developing new products, HPW Fresh and Dry Ltd. could for example develop fortified products. Farmers indicate to eat a lot of heavy carbohydrate-rich foods like cassava, maize and rice as it keeps them satisfied for a long time. Protein-rich foods like legumes, eggs or milk however are also found to have a positive effect on fullness (Dhillon *et al.*, 2016). As fruit blends perfectly with milk, I see opportunities for HPW Fresh and Dry Ltd. to work with businesses that are active in the dairy sector. FrieslandCampina for example has the Dairy Development

Programme to *inter alia* improve the quality of the milk, increase the productivity per cow, produce milk on a more sustainable way and raising the living standards of farmers in several countries in Asia, Africa and Eastern Europe. Indeed, except for the different context, these objectives are similar to those as found by HPW Fresh and Dry Ltd. Combining the milk of FrieslandCampina with the fruit(pulp) of HPW Fresh and Dry Ltd. would create a fruit milk that is high in iodine, iron, vitamin A, B-carotene and C and may easily be fortified with vitamin A and D. Indeed, these nutrient values are exactly those that are under consumed in the traditional Ghanaian diet.

Slightly less ambitious but of equal momentous are several recommendations at the grassroots level:

- First of all, it appeared that not all farmers are well aware of the conditions as written in the supply-agreement. These documents are in English and as several farmers have not attained any education or completed primary school only, it can be assumed that those farmers cannot fully understand what is written in the contract.
- With regards to the quality requirements for the fruits and as seen as an example from coconut farmers, a picture of a fruit in good condition and a fruit in bad condition may be more comprehensible than a description of the quality requirements the fruit should adhere.
- The input-program of HPW Fresh and Dry Ltd. may be enhanced by supplying on point fertilizers and pesticides. For this to work out, it would be good to collaborate with input-supplying companies and develop inputs for different purposes that do not harm the soil quality.
- Mango- and coconut farmers' associations should be stimulated to lobby for receiving MBBS- and CSPWD resistant varieties.
- The Ministry of Transport and Ministry of Roads and Highways should improve infrastructure throughout the country and trucks for transporting the fruits from the farm to the factory should be equipped with refrigerating facilities. Such a refrigerator can run on solar power (Bergeron, 2001).

And with regards to contributing to food security:

- The provision of solar-powered refrigerators would enable farmers to store food products for a longer time.
- Collaboration of HPW Fresh and Dry Ltd. with MOFA for establishing trainings on the benefits of eating varied and nutritious foods, would enhance their nutritional conditions which contributes to agricultural productivity.

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APPENDICES

1. Overview of collected data

Accra

Interviews:

1. Geert Demeyere (M): AgroFair
2. Fleur Hoog Antink (F): Managing Director Ghana Netherlands Business & Culture Council (GNBCC) – October 13, 2016
3. Willem Albert Toose (M): Managing Director AgroEco – Louis Bolk Institute – October 14, 2016
4. Eric Agyare (M): Programme manager CORIP/DSO/DDE Solidaridad West Africa – October 17, 2016
5. Willem Albert Toose (M): Managing Director AgroEco – Louis Bolk Institute – October 14, 2016

Events:

1. Attended CSR: Simply Smart Business by GNBCC and Dutch embassy – November 30, 2016

Nsawam

Interviews

1. George (M) & Eunice (F): HPW Fresh and Dry Ltd. sourcing
2. Maik Blaser (M): Manager HPW Fresh & Dry Ltd. – Adeiso: November 5, 2016
3. Emmanuel (M): Owner of 2K farms – November 17, 2016
4. Merjem Groen (M): Dutch farmer in Ghana – November 17, 2016

Focus group discussions

1. Male pineapple farmers – Adeiso: October 21, 2016
7 participants
2. Female pineapple farmers – Pokrom: November 4, 2016
8 participants

Surveys

45 pineapple farmers
12 papaya farmers

Somanya

Focus group discussions

1. Male mango farmers – Somanya: November 9, 2016
8 participants
2. Female mango farmers – Somanya: November 9, 2016
12 participants

Surveys

43 mango farmers

Axim

Focus group discussions

1. Male and female coconut farmers – Aiyinase: November 14, 2016
4 participants

Surveys

17 coconut farmers

2. Household surveys

Province:	Research assistant name:
District:	Date:
Village:	GPS reference:
Interviewer name:	Interviewee:

Consent

This survey is undertaken to gather information about farmer households who are selling (part of) their production to HPW. The findings of this survey will be used for writing a Masters' thesis at Utrecht University, the Netherlands. The survey will take approximately 60 minutes and your answers will be handled with complete confidentiality. Participation is voluntarily and you may stop participating at any time.

Please read the following statements, and if you agree to them, please sign below.

- I confirm that I consent to be interviewed for the research of Klaske de Vries and Ine ter Berg, master students from Utrecht University, the Netherlands;
- I agree that the information I will provide will be used by them to write their masters' thesis;
- I understand that this report will be published at Utrecht University, the Netherlands and shared with HPW. In addition, it may be shared with other institutions or organizations that are interested in the findings of the report;
- I confirm that I have read and understood the above information, and that I am signing this willingly

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1) Household composition

	Name	Relationship (to head of household)	Gender	Age	Highest attained education	Main occupation
		** Head of household 2. Spouse/partner 3. Son/Daughter 4. Brother/Sister 5. Father/ mother/parent-in-law 6. Other relative 7. Employee 8. Other non-relative	M/F	Years	1. None 2. Primary (1-5) 3. Lower Secondary (6-8) 4. Secondary (9-10 /SLC) 5. Higher Secondary (11-12) 6. Technical college 7. University 8. Other (specify)	1. Farmer 2. Wage laborer 3. Business owner 4. Housewife 5. Student 6. Retired 7. Unemployed 8. Other (specify)
1						
2						
3						
4						
5						
6						
7						
8						

2) Crop production last year

	Crop 1	Crop 2	Crop 3	Crop 4	Crop 5	Crop 6
Crop name*						
Harvested (KG)						
% for own use						
Sold (KG)						
Post-harvest losses (KG)						
Price (Cedi/KG)						
Net Income						
Selling location **						
Income change last three years ***						

* Rank; crop 1 is most important, crop 6 is least important

**1) HPW, 2) Local market, 3) Other:

*** 1) Increased, 2) Stayed the same, 3) Decreased

Vulnerability context

3) Did the following aspects have a negative impact on your livelihood the past three years?

	Always	Most of the time	Sometimes	Rarely	Never
Shortage of water					
Small volume of market outlet					
Low sales prices					
Health problems					
Crop diseases					
Shortage of raw material					
Shortage of manpower					
Government policies					

Social Capital

4) Who helps you with farming activities like planting and harvesting?

- ☐ Relatives (specify): _____
- ☐ Non-relatives

5) Are you member of a cooperation?

- ☐ Yes (specify): _____
- ☐ No

6) How do you benefit from this cooperation? [Multiple answers possible]

- ☐ Knowledge exchange
- ☐ Financial support
- ☐ Purchasing in bulk
- ☐ Advocacy

- ☐ Sharing machineries/equipment
- ☐ Labor support
- ☐ No benefit
- ☐ Other: _____

Financial Capital

7) What is the total monthly income of your household [Cedi's]? _____

8) What are your households' sources of income? *[Rank in importance – 1 = most important; 5 = least important] + [mention amount in Cedi's]*

e.g. selling main crop, selling other crops (specify), off-farm activities (specify), loans, remittances.

	Source	Amount [in Cedi's]
1		
2		
3		
4		
5		

9) [IN CASE LOANS ARE MENTIONED IN QUESTION 8]

Who is the money lender?

- ☐ Micro-finance agency
- ☐ Rural development bank
- ☐ Trader
- ☐ Cooperative
- ☐ Neighbor
- ☐ Other: _____

10) [IN CASE LOANS ARE MENTIONED IN QUESTION 8]

Where do you use the loan for? Mention the three most important purposes + amount in Cedi's

Purpose	Estimated amount in Cedi's

11) Does your household have any savings?

- ☐ Yes
- ☐ No

12) [IN CASE 'YES' IS ANSWERED TO QUESTION 10]

Where do you have savings?

- ☐ Bank
- ☐ Trader
- ☐ At home
- ☐ Other: _____

13) [IN CASE 'YES' IS ANSWERED TO QUESTION 10]

How much are your savings in total? _____

14) Do you use inputs for farming?

- ☐ Yes
- ☐ No

15) [IN CASE 'YES' IS ANSWERED TO QUESTION 14]

Please fill out the following table:

Type of inputs*	Supplier of inputs**	Costs of input {per year}
-----------------	----------------------	---------------------------

*1) Planting materials, 2) Fertilizers, 3) Pesticides, 4) Fungicides, 5) Farming equipment

**1) HPW, 2) Local store, 3) Other (specify)

16) Where do you spend the most money on? *[Rank in importance – 1 = most important; 6 = least important]*

Education of children	
House	
Farm	
Food	
Leisure	
Other (specify):	

Physical capital

17) Do you have access to the following assets to support your farming practices? *[Tick the right box]*

	Yes	No
Affordable transport		
Paved road		
Affordable machines		
Affordable tools		
Adequate water supply		
Affordable energy		
Access to information		

Human capital

18) What is your households' religious background?

- ☐ Animist
- ☐ Christian
- ☐ Muslim
- ☐ Not-religious

19) Where do you obtain knowledge for improving farming skills? *[Rank in importance – 1 = most important; 6 = least important]*

Friends/relatives	
School	
Books/internet	
HPW	
Cooperation	
Other (specify):	

20) [IF HPW IS RANKED 1 OR 2 AT QUESTION 19]

On what matters have your farming skills been improved after involvement with HPW?

- ☐ Group management skills
- ☐ Access to financial services
- ☐ Basic market skills
- ☐ Technological skills
- ☐ Production and resource management skills

21) On what topics would you like to increase your knowledge? *[Multiple answers possible]*

- ☐ Group management skills
- ☐ Access to financial services
- ☐ Basic market skills
- ☐ Technological skills

- ☐ Production and resource management

22) What services provided by HPW do you make use of? [Multiple answers possible]

- ☐ Credit
☐ Equipment
☐ Market information
☐ Selling of your products
☐ Technical assistance
☐ Other (specify): _____

Natural capital

23) Please fill out the table below:

Plot [Crop Name]	Plot size [Acres]	How far is this plot from irrigation stream? [Meters]	Ownership*	Income from land rented out [Cedi's]	Expenditures on rented land [Cedi's]

* Ownership 1) title on family name, 2) cash fixed rent, 3) community land, 4) unclaimed land, 5) Government owned, 6) other (specify)

24) [IN CASE ONE OF THE PLOTS IS OWNED BY THE FAMILY]

How did you acquire the land?

- ☐ Inherited
☐ Bought
☐ Claimed
☐ Other (specify): _____

Livelihood strategies

25) What is your main strategy the coming years to improve your living conditions?

- ☐ Intensification
☐ Expansion
☐ Diversification
☐ Off-farm activities
☐ Stop farming

Livelihood outcomes

26) Please fill out the following table:

	A lot worse since involvement with HPW	Worse since involvement with HPW	Same since involvement with HPW	Better since involvement with HPW	A lot better since involvement with HPW
Ability to support your family financially					
Productivity (kg per acre)					
The profit you make					

Total amount of food your household eats daily					
Diversity of food products your household eats					
Exposure to risk					

Food availability

27) Please fill out the following table.

In which month(s) of the year is food best and least available for your household?

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Best												
Least												

Food access

28) Where does your household obtain food for daily meals?

Food group	Market	Own land	Common pool resources	Other (specify)
Starchy roots and plantain				
Grains and cereals				
Animal products				
Beans, nuts, oilseeds				
Fruits and vegetables				
Fats and oils				

29) How many minutes do you travel to obtain your food products from the following locations?

Market	
Forest, river, lake	
(street) Vendor	
Other (specify):	

30) Who decides on what amount of money is spend on food?

- ☐ Household head
☐ Spouse
☐ Other (specify): _____

Food utilization

31) Does your household use soap to wash themselves?

- ☐ Yes
☐ No

32) Has anyone in your household experienced any of the following diseases in the past 12 months? If yes, indicate how many times this has occurred per person.

[numbers 1-6 relate to the household composition as answered in question 1]

	1	2	3	4	5	6
Diarrhea						
Cholera						

33) Where do you collect water for the following purpose?

	Washing food	Cooking food	Bathing/washing	Drinking purposes
Stream				
Lake				
Community well				
Household well				
Tap				
Other (specify):				

34) Where did you learn about health and cooking practices?

- ☐ Relatives
- ☐ Friends
- ☐ Neighbors
- ☐ NGO
- ☐ At school
- ☐ Other (specify): _____

35) Now I'd like to ask you to describe everything that you ate or drank yesterday during the day or night, whether you ate it at home or anywhere else. Please include all foods and drinks, any snacks or small meals, as well as any main meals. Remember to include all foods you may have eaten while preparing meals or preparing food for others. Please also include food you ate even if it was eaten elsewhere, away from your home. Let's start with the food or drink consumed yesterday.

	Dish	Ingredients	[Food group*]	[Food category**]
Morning				
Later in the morning				
Mid-day				
Afternoon				
Evening				
Later in the evening				

* Food groups:

1) Starchy roots and plantain

Products: *cassava, plantain, yam, cocoyam, sweet potato.*

Dishes: **fufu** (a pounded mash of cooked cassava with plantain or cocoyam), **ampesi** (boiled root, tuber or plantain); **kokonte** (cooked meal of dried cassava flour); **gari** (roasted fermented maize meal); **agbelima** (a fermented dough)

2) Grains and cereals

Products: *maize, rice, wheat.*

Dishes: **kenkey** (cooked balls of fermented maize dough); **banku** (cooked meal of fermented maize and cassava dough); **porridge**; **boiled rice served with stew**; **waakye** (rice and beans boiled together); **omutuo** (rice balls); **rice water**; **bread**

3) Animal products

Products: *fish, meat, eggs, milk, poultry, snails*

Dishes: **in soups and stews**; **in hot pepper sauce** as an accompaniment to the major staples

4) Beans, nuts and oilseeds

Products: *cowpeas, groundnuts, melon seeds; soybeans;*

Dishes: **in stews/soups**; **as waakye**; **in the roasted form as a snack**; **aghushie**; **bambari**; **neri**;

5) Fruits and vegetables

Products: oranges, mangoes, pineapples, pawpaw, watermelon, and banana * pepper, onion, tomato. garden eggs, green leafy vegetables

Dishes: **in soups and stews** or **as a hot pepper sauce accompaniment** to kenkey, banku or kokante; **okro** (in some stews and soups);

6) Fats and oils

Products: palm oil and palm fruits, refined cooking oil; margarine; shea butter; coconut oil

Dishes: **in soups/stews; as accompaniment** to cooked beans and gari;

**Food categories:

A) Condiments and seasoning – chilies; spices; herbs; fish powder; tomato paste; flavor cubes or seeds;

B) Other beverages and foods – tea or coffee; broth; alcohol; pickles, olives, similar

Miscellaneous

36) Do you have any questions or additions regarding this survey? _____

Closing

[FIRST, CHECK WHETHER YOU HAVE NOT SKIPPED ANY QUESTIONS]

[SECOND, ARE ALL THE NOTES YOU MADE CLEAR?]

3. Focus group discussion questions – farmers

- How is farming going these days? / Is this a good year or a bad year and why?
 - Any problems related to seasonality, price rates, diseases, market access etc.?
 - What would be possible solutions for these problems?
 - What products and services would you need to become more successful?
- What is the most difficult time of the year and why?
 - How do you manage during these months?
 - How can the negative impacts be limited and by whom?
- What has changed in the last few years?
 - Is one of the big changes related to HPW? If so, how?
- How are relationships with outside institutions these days? (local government, banks, HPW etc)
 - What do you think about the role and effort of the local government for agricultural production?
- Compared to the other pineapple farmers, who is getting richer? What happened?
- Are you food insecure? If so, how come and in what way? (availability, accessibility, nutrition)
- Is there anything else we should know about?

4. Focus group discussion questions – spouses of farmers



















- What is your role in the household?
- What kind of problems do you encounter for you and your household?
→ Did this increase or decrease in the past 10 years?
- What is the most difficult time of the year to provide your household with their needs?
→ How do you manage during this period?
- Can the current period be regarded as 'neutral' – far enough away from the food shortage season? When do you experience food shortage?
- How do you deal with food shortage?
- Is the food you eat during the weekend very different from what you eat during the week?
- Do you eat from common bowls?
- What meals do you cook at home and which ones do you take from a vendor?
- Who decides what the household eats?
- What are the most important needs for you and your family?
→ What products/services do you need for this to limit such issues?
- If you're looking at the food conditions available for your household, is it better now or 10 years ago? (availability, access, variety in food products)
- Who in your household is the most fit/healthy? Why?
- What kind of food products/dishes do you consider healthy/What is healthy food?
- Is healthy food important for you? Are you able to eat healthy on a regular basis?
- If you would have (more) money, where would you spend it on? Why?
- If you would have (more) money to spend on food, what products would you buy? Why?








5. Nutrient values of the various products.

Food group	Name	Products/crops	Dishes	Energy (kcal) kJ	Water (g)	Protein (g)	Fat (g)	Carbohydrate (g)	Fiber (g)	Ash (g)	Vit A-RAE (mcg)	Retinol (mcg)	B-carotene equivalent (mcg)	Vit D (mcg)	Vit E (mg)	Vit B6 (mg)	Vit B12 (mcg)	Vit C (mg)
1	Starchy roots and plantain																	
		Cassava	<div> <div></div> <div>Fufu</div> </div> <div> <div></div> <div>Kokonte</div> </div> <div> <div></div> <div>Gari</div> </div> <div> <div></div> <div>soakings</div> </div> <div> <div></div> <div>Banku</div> </div> <div> <div></div> <div>Agbelima</div> </div> <div> <div></div> <div>Ampesi</div> </div>	(161)682	58.2	1.2	0.3	37.4	1.9	1.0	1	0	15	0	0.02	0.07	0	22.0
		Yam	<div> <div></div> <div>Ampesi</div> </div>	(134)569	63.4	2.0	0.2	28.9	4.3	1.1	2	0	30	0	0.49	0.26	0	9.5
		Cocoyam	<div> <div></div> <div>Ampesi</div> </div>	(136)576	63.2	2.5	0.2	28.9	4.3	1.3		0		0	2.53	0.19	0	5.9
		Plantain	<div> <div></div> <div>Fufu</div> </div> <div> <div></div> <div>Red red</div> </div> <div> <div></div> <div>Ampesi</div> </div>	(133)564	65.0	1.1	0.3	30.5	2.2	0.9	39	0	469	0	0.19	0.21	0	12.2
2	Cereals and cereal products																	
		Maize	<div> <div></div> <div>Banku</div> </div> <div> <div></div> <div>Kenkey</div> </div> <div> <div></div> <div>Tom Brown</div> </div>	(136)573	65.9	3.5	1.7	24.7	3.7	0.5	17	0	20.7	0	0.50	0.10	0	0
		Rice	<div> <div></div> <div>Rice with stew</div> </div> <div> <div></div> <div>Jollof rice</div> </div> <div> <div></div> <div>Waakye</div> </div> <div> <div></div> <div>Omotuo</div> </div>	(134)570	66.2	2.6	0.2	30.1	0.5	0.3	0	0	0	0	0.04	0.04	0	0
		Millet	<div> <div></div> <div>Koko</div> </div> <div> <div></div> <div>Porridge</div> </div>	(145)613	63.2	4.5	1.7	26.1	3.7	0.8	Tr	0	Tr	0	0.02	0.19	0	0
		Wheat	<div> <div></div> <div>Bread</div> </div> <div> <div></div> <div>Biscuits</div> </div>	(249)1050	36.5	8.4	1.8	48.4	3.1	1.9	0	0	0	0	0.5	0.06	0	0
		Oats	<div> <div></div> <div>Porridge</div> </div>	(379)1587	10.8	13.1	6.5	69.0	1.7	1.8	0	0	0	0	0.4	0.1	0	0
	Animal products																	
3		Meat	<div> <div></div> <div>Soups or stews</div> </div>	(209)880	55.3	36.2	7.2	0	0	1.7	0	0	0	0.5	0.29	0.15	1.4	0
		Fish	<div> <div></div> <div>Soups or stews</div> </div>	(144)607	66.0	27.2	3.9	0	0	2.4	34	34	0	4.0	0.58	0.31	2.1	Tr
		Poultry	<div> <div></div> <div>Soups or stews</div> </div>	(140)595	66.5	31.1	1.8	0	0	1.3	6	6	0	0.1	0.13	0.41	0.3	0

4

5

	Egg	 Kontomire stew	(139)578	76.2	12.6	9.5	0.7	0	1.1	152	152	5	1.9	1.05	0.14	0.7	0
	Milk	 Tea with milk	(65)271	87.7	3.4	3.7	4.4	0	0.8	33	31	18	0.1	0.09	0.05	0.6	1.5
	Snail		(90)	79.2	16.1	1.4	2.0	0	1.3	-	-	-	-	5.0	0.1	0.5	0
	Beans, nuts and oilseeds (legumes)																
	Cowpeas	 Waakye  Red red  Koose	(117)494	67.3	7.9	0.5	17.5	5.7	1.2	1	0	12	0	0.14	0.09	0	0.2
	Groundnut	 Groundnut soup	(585)2440	7.5	20.6	48.8	11.7	8.4	3.0	0	0	0	0	10.90	0.59	0	0
	Agushi	 Agushi stew															
	Kolanut	 Snack	(342)1450	11.5	5.8	1.5	74.3	4.0	2.9	0.1	0	0	0	-	-	0	-
	Fruits and vegetables																
	Orange		(45)190	87.8	0.7	0.3	8.9	1.7	0.5	8	0	90	0	0.28	0.07	0	46.8
	Mango		(64)272	82.7	0.6	0.2	13.9	2.1	0.5	168	0	2020	0	1.05	0.11	0	36.3
	Pineapple		(54)228	85.8	0.4	0.2	12.0	1.3	0.3	5	0	61	0	0.10	0.09	0	29.8
	Papaya		(36)151	89.8	0.5	0.1	7.3	1.9	0.4	80	0	966	0	0.13	0.02	0	58
	Banana		(99)421	73.6	1.2	0.2	22.1	2.0	0.8	4	0	50	0	0.37	0.34	0	10.4
	Watermelon		(29)124	92.5	0.5	0.2	6.2	0.3	0.3	42	0	503	0	0.05	0.07	0	7.2
	Coconut		(389)1500	43.1	3.6	36.9	6.2	9.3	1.0	0	0	0	0	0.73	0.05	0	2.2
	Tomato	 Soups and stews	(28)117	91.7	1.3	0.2	4.2	1.8	0.7	64	0	768	0	1.12	0.08	0	23.2
	Onion	 Soups and stews	(45)88	87.2	1.4	0.1	8.4	2.2	0.8	0	0	1	0	0.05	0.08	0	4.2
	Leafy vegetables (cassava leaves)	 Kontomire stew	(102)432	71,7	7,9	0,9	13,6	3.8	1.9	271	0	3250	0	2.53	0.21	0	16
	Okra	 Okra soups and stews	(37)158	88.4	1.9	0.3	5.0	3.6	0.7	28	0	341	0	0.40	0.17	0	10.3
	Garden eggs	 Garden eggs stew	(32)135	90.2	1.2	0.2	5.0	2.8	0.6	3	0	31	0	0.03	0.07	0	4.1
	Pepper	 Soups and stews  Hot pepper stew	(45)191	87.3	1.9	0.3	7.6	2.2	0.7	53	0	640	0	0.69	0.39	0	193.1
	Carrot	 Jollof rice	(38)158	88.1	1.0	0.3	6.1	3.3	1.2	683	0	8200	0	0.49	0.17	0	3
	Cabbage	 Jollof rice	(28)118	91.0	1.6	0.1	3.9	2.7	0.8	8	0	91	0	0.15	0.07	0	22.0
	Lettuce	 Salad	(18)75	94.5	1.0	0.2	2.3	1.2	0.8	93	0	1120	0	0.60	0.20	0	5.3

Fats and oils																	
	Refined vegetable oil	 Soups and stews	(900)3700	0	0	1000	0	0	0	Tr	0	Tr	0	39.22	0	0	0
	Palm oil (red)	 Red red  Soups and stews	(900)3700	0	0	100	0	0	0	5720	0	68680	0	15.94	0	0	0
	Palm nuts	 Palm nut soup	(609)2520	13.5	6.1	55.3	19.6	4.0	1.5	-	0	-	0	-	-	0	-
	Margarine	 Bread  Biscuits  Pastries	(730)3000	16.5	0.2	80.7	0.7	0	1.9	819	768	610	0	9.00	0.01	0.1	0.2

6. Important contributions of various food items as based on the FAO food based guidelines.

<i>Vitamin</i>	<i>Sources</i>	
<i>Energy</i>	2,200 (sedentary) - 3000 (active)/day	
<i>Protein >10 g</i>	0,8 grams of protein/kilogram = approximately 60 g/day	Meat, fish, poultry, oats, egg, snail, groundnut
<i>Fat >10 g</i>	10-15% of the total caloric requirement = approximately 220-450g	Vegetable oil, palm oil, margarine, palm nut, meat, egg, coconut, groundnut
<i>Carbo-hydrate >20 g</i>	50% of the total energy intake and a minimum of 130 grams/day	Cassava, (coco)yam, plantain, maize, rice, millet, wheat, oats, kola nut, banana
<i>Fiber > 4 g</i>	Minimum of 25g/day	(coco)yam, cowpeas, groundnut, kola nut, coconut, palm nut
<i>Ash >1,5 g</i>		Wheat, oats, meat, fish, groundnut, kola nut, cassava leaves, palm nut, margarine
<i>Vitamin A-RAE >50 mcg</i>		Egg, mango, papaya, tomato, cassava leaves, carrot, lettuce, palm oil, margarine
<i>Retinol (vitamin A) > 30 mcg</i>	600mg	Fish, egg, milk, margarine
<i>Vitamin A (as B-carotene) > 50 mcg</i>		Plantain, orange, mango, pineapple, papaya, banana, watermelon, tomato, cassava leaves, okra, pepper, carrot, cabbage, lettuce, palm oil, margarine
<i>Vitamin D > 0,5 mcg</i>		Meat, fish, egg
<i>Vitamin E > 2.0 mg</i>		Cocoyam, snail, groundnut, cassava leaves, vegetable oil, palm oil, margarine
<i>Vitamin B6 > 0,25 mg</i>		Yam, fish, groundnut, banana, pepper
<i>Vitamin B12 >0,3 mcg</i>		Meat, fish, poultry, egg, milk, snail
<i>Vitamin C >20 mg</i>	45mg	Cassava, orange, mango, pineapple, papaya, tomato, pepper, cabbage