Impacting Nutrition Through Agriculture

Examining the concept of nutrition-sensitive agriculture within the context of the Fair Planet program in Butajira, Ethiopia

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Abstract

The organization Fair Planet works with Ethiopian smallholder farmers. Their aim is to increase the vegetable yield and consequently the income and nutrition of smallholders by providing them with high quality vegetable seeds, tailored to local circumstances, combined with training and guidelines. Many opportunities exist for agricultural interventions to positively affect the nutritional well-being of the farmers, next to the agricultural gains that can be achieved. This research focused on the concept of nutrition-sensitive agriculture, which will be examined within the Fair Planet program. Different qualitative and quantitative methods, including semi-structured interviews, questionnaires, observations and literature research were used.

Quantitative results show that being in the Fair Planet program for one year has no effects on elements of the farming system measured. However, qualitative results show that the majority of farmers interviewed had a higher on-farm crop diversity, higher yields and a higher profit from agriculture after being in the program for one year. After one year, farmers interviewed had a higher average dietary diversity score than farmers who were just starting the program. There was no significant difference in specific food group consumption. Nonetheless, the majority of Year 1 farmers said they ate more fruits and/or vegetables and animal source foods compared to the year before. Recommendations for Fair Planet to increase nutrition-sensitivity include incorporating nutrition goals into the strategy, nutrition education, empowering women and focusing on soil health.

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Abbreviations

ASF	Animal sourced foods
DA	Development Agent
DD	Dietary diversity
DDS	Dietary diversity score
DDQ	Dietary diversity questionnaire
DFAT	Department of Foreign Affairs and Trade
ENGINE	Empowering New Generations to Improve Nutrition and Economic Opportunities
FAO	Food and Agriculture Organization of the United Nations
IFAD	International Fund for Agricultural Development
MoA	Ethiopian Ministry of Agriculture
SNNP	Southern Nations, Nationalities, and Peoples' Region
USAID	United States Agency for International Development

1 Introduction and Background

1.1 Smallholders in Ethiopia

In Ethiopia 90 percent of farms belong to farmers owning less than two hectares. A smallholder in Ethiopia is defined by the Food and Agricultural Organization of the United Nations (FAO) as having less than 1.8 hectares of land (Rapsomanikis, 2015). The average Ethiopian smallholder farm size is 0.9 hectares (Rapsomanikis, 2015). The majority of these farmers produce for own consumption and only a small market surplus (Taffesse, Dorosh, & Asrat. P, 2012). Smallholders sell less than a quarter of their produce, keeping the rest for household consumption (Rapsomanikis, 2015).

The country is home to different agroecological zones with different climatic patterns. Most of the accessible fertile land in the country has already been cultivated and, therefore, to feed its growing population, the agricultural productivity of the land must increase (Taffesse, Dorosh, & Asrat. P, 2012). The government has identified that a major constraint to yield and productivity growth is the low levels of input use, such as improved seeds, fertilizer, and pesticides (Taffesse, Dorosh, & Asrat. P, 2012). Currently less than 25 percent of smallholders have access to improved seed varieties (Rapsomanikis, 2015). A report by the Ethiopian Development Research Institute mentions that the adoption of improved seeds inputs has been disappointing, specifically due to poor extension services, cost, shortfalls in supply, and the unavailability of preferred varieties (Taffesse, Dorosh, & Asrat. P, 2012).

Smallholders in Ethiopia have low yields per hectare, generating approximately $0.8 per person per day (Rapsomanikis, 2015). 48 percent of these smallholders live under the national poverty threshold. Annual household income for smallholders is $1657 (Rapsomanikis, 2015).

1.2 Study area

Figure 1. Map of Ethiopia showing Gurage zone and Butajira (Google Maps, 2017)

The study area is Butajira, Ethiopia, 130km south of the country's capital Addis Ababa in the Gurage zone, part of the regional state Southern Nations, Nationalities, and Peoples' Region (SNNP) . Average household size in SNNP is 5.4 people. 45 percent of people above the age of ten are monogamously married and 48.3 percent have never been married. 35.3 percent of male children are not enrolled in school , 60.2 percent in primary school, and 3.1 percent in secondary school. The rates of female children are strikingly similar (Central Statistical Agency and The World Bank, 2015).

92.6 percent of households own their own place of residence. 96.6 percent own their land, on average 0.64 hectares in size. 91.9 percent perform farming activities and 83 percent livestock activities. 34.4 percent of households participated in some sort of non-farm enterprise (Central Statistical Agency and The World Bank, 2015)

45.8 percent of households reported some kind of food shortage in the year of 2013/2014, specifically in the months of May to September (Central Statistical Agency and The World Bank, 2015). United States Agency for International Development (USAID) has partnered with the Ethiopian government and the World Food Programme to set up the Productive Safety Net Program. It provides cash and/or food transfers to households that are chronically food insecure. Some families interviewed as part of this research in the Butajira area were also part of this program and received transfers certain times in the year, especially when food stores run in the months before the grain harvest (Aklilu, personal communication, 2016)(USAID, 2014).

1.3 Nutritional situation

According to the FAO report *The State of Food and Agriculture* (2013), Ethiopian children experienced a 44.2 percent stunting rate, meaning they have a low height for their age, a symptom which can be contributed to undernutrition at an early age. USAID writes that lack of dietary diversity contributes to the high rates of child undernutrition. Stunted individuals have a higher life-long risk of mortality, diseases and deficiencies as well as reduced physical and cognitive development (African Union Commission, NEPAD Planning and Coordinating Agency, UN Economic Commission for Africa, and UN World Food Programme, 2014).

Furthermore, 75.2 percent of Ethiopian children were affected by anaemia, 46.1 percent had vitamin A deficiency, and 68.4 percent had an iodine deficiency, also making them more susceptible to diseases (African Union Commission, NEPAD Planning and Coordinating Agency, UN Economic Commission for Africa, and UN World Food Programme, 2014)(FAO, 2013). In addition to the far-reaching effects on livelihoods, there are significant economic costs associated with undernutrition, estimated to be equivalent to 16.5 percent of the annual national GDP (African Union Commission, NEPAD Planning and Coordinating Agency, UN Economic Commission for Africa, and UN World Food Programme, 2014).

Specifically, in the SNNP region 40.7 percent of children aged 6-59 months were stunted (Central Statistical Agency and The World Bank, 2015). It is one of the regions in the country with the largest amount of stunted children, and national programs aimed to reduce this number have had little success (Wirth, et al., 2016). Smallholder households are among the populations who are the most likely to be malnourished (Herforth, Jones, & Pinstrup-Andersen, 2012).

1.4 The Fair Planet organization

Fair planet is an organization that wants to tackle the above problems by bridging the gap between the seed industry, who have knowledge and seeds for a large range of conditions and farmers' needs, and smallholder farmers. They do this by focusing on vegetables as cash crops.

1.4.1 History

Fair Planet was officially founded by Shoshan Haran in 2012. She had a job with the Hazera seed company in Israel, and had worked in the sector for many years. Having been encouraged to give back to the community from a young age, she had dreamt for

many years about using her knowledge and connections in the sector in a positive way. After much contemplation, she quit her job in order to be able to foster the Fair Planet idea of bringing the knowledge and technology of Western seed companies to smallholders in developing countries.

Shoshan shared her vision with old colleague Alon Haberfeld, also with much experience in the seed company. He was vegetable breeder, as well as responsible for product development for 15 years within the Israeli Hazera seed company. Similarly, he was passionate about the idea and, together they developed a plan. Pitching their ideas to several seed companies gave them positive encouragement and good advice. The seed companies were interested and agreed to provide several seed varieties to use for field tries.

Currently Fair Planet is stationed in Butajira and Dire Dawa where they work with farmers and perform variety trials, as well as Gondar and Haramaya where they have variety trials and plans to start working with farmers in the near future. The Butajira and Dire Dawa sites have a year round paid coordinator to oversee local operations.

1.4.2 Partnerships

Seed companies

One of the main partners of the project are international seed companies. As the founder of Fair Planet, Shoshan Haran, had many ties with and knowledge of different seed companies from her previous job, she laid the foundations for collaboration. The seed companies currently involved are Limagrain, East-West Seed, Syngenta, Enza Zaden, Bayer, and more recently Rijkszwaan. These companies provide different vegetable seed varieties, which Fair Planet then uses in variety trials. Consequently, once the best variety has been identified by Fair Planet in a location, the seed company owning the variety dispatches the seeds, either at a price or as a donation, to a local nursery in charge of producing seedlings for the farmers.

The seed companies are encouraged to participate in the project with the possibility that it will serve as an entry for their seeds into the African market. Additionally, the seed companies also give a voluntary donation of either money or seeds, in some cases as part of the corporate social responsibility. This money is used to fund the project (Haberfeld, personal communication, 2016).

Local partners

Fair planet firmly believes that cooperating with local Ethiopian partners is indispensable in order to achieve results. In two of the locations, they work together

with researchers from the University of Gondar and Haramaya university (Haberfeld, personal communication, 2016). Furthermore, they closely collaborate with the Ethiopian Ministry of Agriculture (MoA).

The MoA has a main office in each *woreda*, which is a collection of townships, known locally as *kebeles*, situated around a larger town or city . In each *kebele*, the MoA has a small office with a coordinator and one or more government extension Development Agents (DAs). Fair Planet has several expert guides in each location that they work in. These experts are employees of the main office who oversee operations in each of the *kebeles*. They are in contact with the development agents and accompany Fair Planet workers when visiting farmers, as well as being present at farmer training sessions. The experts already have knowledge, which will be supplemented to give them the expertise to organize training sessions, extension services and demonstration programs. They receive a training course consisting of topics and recommendations including planting, crop protection, crop nutrition and Integrated Crop Management (Fair Planet, 2016).

They transfer their knowledge to DAs in the network. These DAs serve as farmer trainers, and are given training modules, information in local languages and on-line courses. They are given production guidelines that are specific to the region and expected to pass these on pre-selected lead farmers in each location (Fair Planet, 2016). The figure below shows the predicted transfer of knowledge

Figure 2. Predicted transfer of knowledge within Fair Planet

To promote cooperation, Fair Planet pays each guide 100 birr per day for accompanying their workers to visit farmers. They also pay the DAs 5 birr per field that they visit, as well as 5 birr for filing a report on the situation of the field. These DAs accompany Fair

Planet when visiting farmers in their *kebele* once a week. Yearly, Fair Planet hosts a contest for best DA in their network, who will then earn a bonus, in order to encourage the DAs to actively participate.

1.5 Outline of the report

This report aims to identify the opportunities that exist for Fair Planet to impact the nutritional well-being of the smallholders they are working with. First, the concept and framework of nutrition-sensitive agriculture will be explained, as well as that of dietary diversity and farming system. Next, the research methods will be discussed, as well as the limitations that exist. Subsequently the current Fair Planet strategy is described, including the mission and vision, goals and objectives, and methods.

In chapters four and five, results of the interviews will be displayed and examined, both that of the elements of the farming system and the dietary diversity of the smallholders. This will include both quantitative and qualitative results, as well as the author's observations and comparison with results from literature. Next, results from the literature research will show how agricultural interventions in general can become more nutrition-sensitive. Chapter seven will discuss the results of the research, as well as present realistic ways in which Fair Planet can incorporate nutrition-sensitive agriculture into their current approach. Finally, the report will end with a conclusion and recommendations for further research.

2 Concepts and Methodology

2.1 Concepts

2.1.1 Nutrition-sensitive agriculture

In order to improve the nutritional situation of beneficiaries, there are nutrition-specific interventions and nutrition-sensitive interventions. Nutrition-specific interventions directly target the immediate determinants of nutrition such as adequate food intake, while nutrition-sensitive programs address the indirect determinants, for example by increasing income, through women's empowerment, or by investing in agriculture (United Nations Children's Fund, 2015).

Ruel et al. (2013) writes that many agricultural programs are not originally designed to affect nutrition but have a great potential to do so (Ruel & Alderman, 2013). Agriculture has the power to affect smallholders' food security by influencing the availability and access to foods to create diverse diets and incomes (Herforth, Jones, & Pinstrup-Andersen, 2012).

The FAO writes that "an investment policy, programme or project can be considered nutrition-sensitive if it aims to contribute to better nutrition by addressing some of the underlying determinants of nutrition" (FAO, 2016). The specific ways in which agricultural interventions can affect the nutritional status is shown in the conceptual framework displayed below (figure 3).

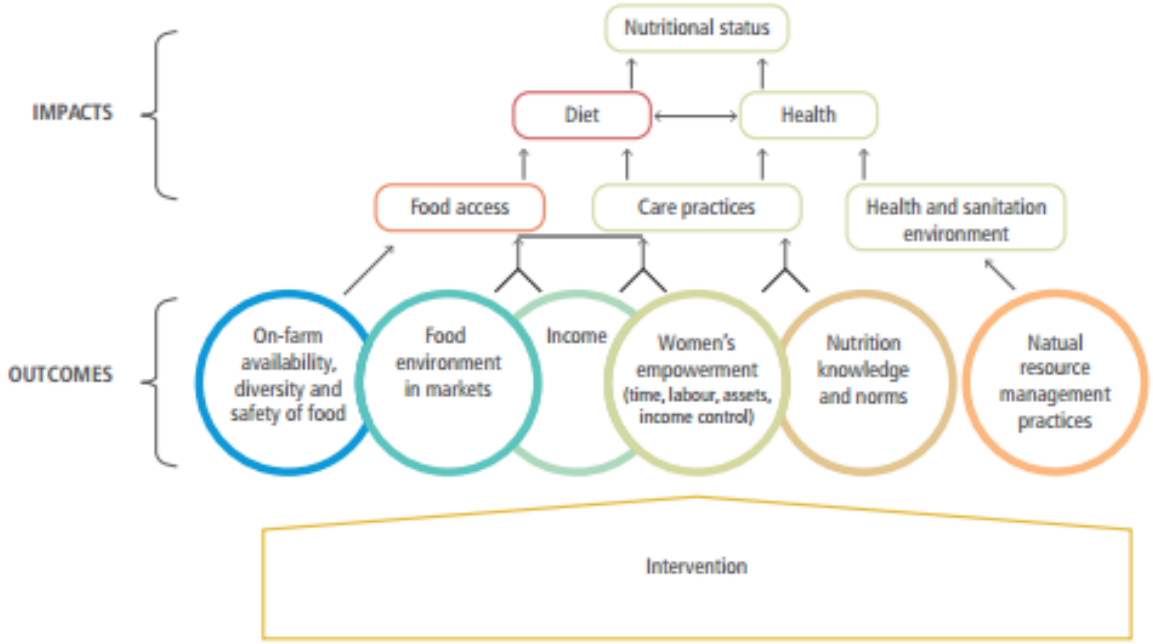

Figure 3. Conceptual framework of how agricultural programs can affect nutritional status (Herforth & Ballard, 2016)

In order for nutrition-sensitive agriculture to take place, agricultural programs can aim to affect one of more of these specific elements:

- **On-farm availability, diversity and safety of food:** for smallholder farmers, household food production is an important objective of their agricultural livelihoods and largely determining their diet (Herforth & Harris, 2014).

- **Food environment in markets**: the food market is decisive in what smallholders purchase and consume. However, smallholders are also key players in this pathway. They determine what reaches the market and collectively, the affordability of items in the market. Government and private policies also play a large role in affordability and availability. Trade policies can impact food imports and affect the diets of locals, and tax and subsidizing policies can positively increase access to certain products. Moreover, marketing and labelling has influence on the purchasing decisions by consumers (Herforth & Harris, 2014).

- **Income:** increasing agricultural income is a good way to improve cash flow and purchasing power, in order to be used for household needs, specifically food items, as well as other things like healthcare and hygiene (Herforth & Harris, 2014).

- **Women's empowerment:** educating and enhancing the involvement of women in agriculture can increase their access to and control over household resources and assets, as well as their capacity to make decisions (European Commission, Food and Agriculture Organization of the United Nations, Technical Centre for Agricultural and Rural Cooperation and World Bank Group, 2014)

- **Nutrition knowledge and norms:** knowledge within households on nutrition and health has great impact on the decisions made regarding food production and consumption (Herforth & Harris, 2014).

- **Natural resources management practices**: this element recognizes the importance of water, climate, soil and biodiversity in the pathways between agriculture and nutrition. Soil quality is directly translated into crop yield and quality, and without sufficient or good quality water, crops will not grow (Herforth & Harris, 2014).

These outcomes will have a direct effect on food access, care practices and/or health and sanitation environment, indirectly influencing both diet and health. This in turn will impact the nutritional status of an individual. In this way an agricultural intervention can become nutrition-sensitive and positively affect the nutritional status of the target group.

2.1.2 Dietary diversity

Dietary diversity is described by Ruel (2003) as "the number of different foods or food groups consumed over a given reference period", and promoted to increase the chances of achieving an adequate diet.

Dietary diversity is often seen as a proxy for nutritional status (Ruel M. , 2003). It is measured using the dietary diversity score (DDS), which correlates positively with nutritional status and micronutrient intakes at the individual level (Food and Agriculture Organization of the United Nations, 2011) (Arimond, et al., 2010). Dietary diversity will be used in this research as an indicator for nutritional status as it is reliable and most realistic in this context.

2.1.3 Farming system

A farm system is described by Fresco and Westphal (1988) as "a decision making unit comprising the farm household, cropping and livestock systems, that transform land, capital (external inputs) and labour (including genetic resources and knowledge) into useful products that can be consumed or sold". (Fresco & Westphal, 1988)

A farm system consists of many components. The research performed for this thesis will examine some of these elements in the physical circuit to understand the effect of the Fair Planet program on the farming system of the smallholders. This includes farm production and outputs, specifically the yields and income, as well as off-farm work.

2.2 Objectives and research questions

The aim of this thesis is to gain a deeper insight into the concept of nutrition-sensitive agriculture, in the context of the Fair Planet program with smallholders in Butajira, Ethiopia, and identify opportunities for further incorporation of the concept.

Main research question:

How can nutrition-sensitive agriculture be better incorporated within the approach of the organization Fair Planet?

Sub research questions:

- *What is the current Fair Planet approach?*
- *How does the Fair Planet program affect elements of the smallholder's farming system after one year?*
- *How does the Fair Planet program affect the smallholder's dietary diversity after one year?*
- *What are opportunities for incorporating nutrition-sensitivity into an agricultural intervention?*

2.3 Methodology

A step-by-step approach was created in order to accurately answer the research questions and understand the extent to which nutrition-sensitive agriculture was currently taking place within the Fair Planet program, as well as the opportunities that exist for improvement. It is described in detail below.

Firstly, it was important to fully understand the Fair Planet approach. This included their history, vision, goals, methods, partnerships, and view on sustainability, as well as the current nutritional goals. Interviews with key members of the organization and personal

on-site observations, as well as strategic documents provided information and insights into these elements and helped to sketch a clear view of the situation.

Secondly, to explore the impact that Fair Planet is having on the farmers, an analysis of elements of the smallholders' farming systems was necessary. Fair Planet did not yet have any baseline data of the farmers, so this was also necessary. To do this, a questionnaire containing baseline information and different elements of a farming system (see annex 1) was carried out among ten farmers participating in the Fair Planet program who had completed their first year (year 1) and ten farmers participating for the first time (year 0), functioning as the control group. The baseline information included age, education level, household size, amount of land, and off-farm employment. The farming system elements measured included number of crops, amount of livestock, percentage of total produce consumed by the household, average yearly profit from agriculture and percentage of total income from agriculture. Answers were placed in one of four categories. Several open-ended questions were also incorporated into the questionnaire for further information and clarification, including what farmers were planning to do, or did, with the profit they earned from tomatoes. Data was stored and graphs were created using excel. Fair Planet documents revealed the amount of tomatoes produced in 2015-2016 season and the income from tomatoes produced in 2015-2016 season for year 1 farmers.

To be able to measure the current impact of the approach on the nutrition of the farmers after one year, the individual dietary diversity questionnaire (DDQ) containing 12 food groups, an indicator suggested by the FAO report *Designing Nutrition-sensitive Agriculture Investments,* was performed (FAO, 2011)(FAO, 2015). This revealed the number of food groups consumed by farmers during the day. The dietary diversity score was calculated by adding up the number of consumed food groups (Swindale & Bilinsky, 2006). Data was stored and graphs were created using excel. The results of ten year 1 farmers and ten year 0 farmers were compared in order to discover if the program had any impact on the nutrition and food availability of the participating farmers after one season. Furthermore, statistical tests showed which factors were associated with the DDS in the population of farmers. Several open-ended questions were also incorporated into the questionnaire for further information and clarification.

Finally, in order to wholly answer the main research question, a literature study was performed. This led to information and opportunities on possible methods to incorporate nutrition-sensitive agriculture into an agricultural intervention. The literature, together with the author's personal observations, provided opportunities for Fair Planet to better incorporate the concept of nutrition-sensitive agriculture within its

approach. The material was pooled and made into concrete recommendations for the organization, described in the discussion chapter.

2.3.1 Farmer selection

The farmers interviewed were all part of the Fair Planet program in the Meskan Woreda. All ten farmers who had completed their first year in the program and were now starting their second year were interviewed. Ten farmers who were registered for the first time were randomly selected to be interviewed. 19 farmers were male and one was female. The farmers are spread between the different *kebeles* in the *woreda* where Fair Planet works, including Yetebon (5), Dobena gola (2), Dobena bati (3), Meqicho (2), Misraq imbor (3), Bati lijano (2) and Batifuto (3) (for map see Annex 2).

2.3.2 Statistical analysis

The data was entered into IBM SPSS Statistics 23. Descriptive analyses were performed in order to determine the characteristics of the farmers. The answers of the two groups were compared using independent samples t-test, which revealed the differences between the year 0 and year 1 farmers. Correlations were examined within and between the baseline statistics and farm system elements using the bivariate analysis tool, specifically Spearman's Rank Correlation. Similarly, Spearman's Rank Correlation was performed in order to find associations between the measured variables and the DDS. The confidence interval was 95% and statistical significance was confirmed by using $P<0.05$ for all tests.

2.3.3 Limitations

Sample size

Due to the small amount of farmers available from the 2015-2016 year, and those participating in the 2016-2017 October planting season, the sample size for this research was small, in total 20 farmers. For an independent samples t-test there is no minimum sample size, however, the power of the statistical test increases with sample size (de Winter, 2013). For a Spearman's Rank Correlation, 20 is also an acceptable sample size, but the power is very low (Brown). Power calculations have shown that the power of this test with a sample size of 20 is 0.13. This means that the results of the bivariate analysis are less reliable.

Timing

Fair Planet is only in its second year of actively working with farmers on a larger scale. In order to truly notice an effect of the program on the farming systems and/or the dietary

diversity of participating smallholders it would have been better to wait several years to perform this research.

Dietary diversity questionnaire

Even though it is officially sufficient to perform the dietary diversity questionnaire (DDQ) one time (FAO, 2011), repeating the questionnaire over a period of time could give more insight into the dietary diversity of the farmers, despite the fact that they usually have very similar diets. For example, in the study by Workicho et al. (2016) respondents were asked if they consumed certain food items in the past week, and their score was based on this rather than the food they had consumed the day before the interview (Workicho, et al., 2016).

Profit

Farmers were asked about their average yearly profit from agriculture. However, the information that they gave was not always realistic or consistent with the information that Fair Planet had collected. For this reason, analyses with questions about profit were not included.

3 The Fair Planet Approach

The current Fair Planet approach is described in detail in this chapter. This shows their focus, goals, and methods, and provides information about the extent to which they aim to influence outcomes and impacts related to nutrition, as described in the framework of Herforth and Ballard (2016).

3.1 Mission and vision

The vision of Fair Planet is to equip smallholder farmers to produce high quality vegetables and allow for additional income, greater food security and improved nutrition (Fair Planet, 2016). Alon Haberfeld names that he wants farmers to become agricultural entrepreneurs and allow smallholders to develop within the horticulture business (Haberfeld, personal communication, 2016).

3.2 Specific objectives

The specific objectives Fair Planet has formulated as part of the project implementation are as follows:

- The use of improved seeds and implementation of improved agro-technical practices, established by the Capacity building for scaling up of evidence-based best practices in agricultural production in Ethiopia (CASCAPE) project, by smallholders
- Continuous implementation of trial varieties
- The training of primary trainers and farmers' trainers
- Strengthening smallholder farmers' links to markets
- Providing agribusiness tools to farmers
- Strengthening the link between smallholder farmers links and cooperatives
- Identification of local seed dealers used by seed companies to ensure the access to high quality seeds for farmers
- Supporting farmer access to finance
- Enabling 1,000 farmers to use high quality vegetable seeds and follow Good Agricultural Practices
- Awareness campaign and scaling the implementation impact to 50,000 farmers

(Fair Planet, 2016)

The above objectives will be implemented with the help of numerous methods, including through farm extension programs, open days, seminars, awareness campaigns using booklets and flyers, and exchanging farmer experiences (Fair Planet, 2016).

Specifically during the training sessions and weekly visits, smallholder farmers in the project receive hands-on teaching and advice on the following topics:

Table 1. Topics included in the farmer training and specific actions accompanying this (Fair Planet, 2016).

Topic	Specific action
Irrigation	Guidelines on how often and how much to irrigate as well as knowledge on water-saving practices through smallholder drip irrigation kits
Fertilization	Guidelines on the amount, type, and application frequency of fertilizer use.
Seedling preparation	Tools and guidelines on how to prepare seedlings in homemade nurseries.
Control of weeds, diseases and pests	Tools to identify common weeds and pests and knowledge on how to combat them using a minimum input of pesticides
Crop rotation	Farmers are encouraged to perform crop rotation to prevent the spread of pests and diseases and preserve nutrients in the soil
Sanitation	Tools and knowledge to ensure highest possible crop quality
Harvesting and marketing	Knowledge on harvesting, proper storage and transport techniques in order for farmers to maximize their profits

3.2.1 Current nutritional goals

Currently there are no specific nutritional goals within the Fair Planet vision. In the beginning of the projects it was expected that farmers would produce vegetables and increase own consumption, thereby positively influencing their household nutrition. However, this has received little consideration as more attention was pulled towards variety trials and setting up the program. Therefore this is not specifically included in the objectives of the project. Fair Planet works with the assumption that due to increased production and income, nutrition will increase (Haberfeld, personal communication, 2016). However, this is not a valid assumption. Herforth writes that the nutritional

effect of an increased income is influenced by the composition of the income, the income flow over time, who controls this income, and the overall household preferences, as well as the amount of income change (Herforth & Pinstrup-Anderson, 2008). This shows that increased income will not naturally lead to increased nutrition.

3.3 Method

Fair Planet aims to introduce the best vegetable varieties for the area to their farmers to help them achieve maximum yield. In every location, Fair Planet starts with a single trial variety field in the first season. It is a small plot containing around 20 pre-selected varieties from different seed companies, as well as the local varieties which serve as a control. In these fields they use locally accessible and affordable agronomic practices (Fair Planet, 2016). In the second year, a validation takes place with up to four best performing varieties from the previous season's variety trial. This takes place in big plots with up to 500 plants of each variety (Haberfeld, personal communication, 2016). Following this, farmer trials with the chosen varieties take place. In this step, a small group of 10 to 15 farmers are chosen to grow three varieties to see how these react to local conditions. Subsequently, the best seed varieties are registered with the Ethiopian government by the seed companies. Then, the seed is introduced to farmers selected for the general program. The above mentioned process generally takes up to four years (Haberfeld, personal communication, 2016).

In 2012 Fair Planet started with tomatoes due to them being a good cash crop and the hybrid seeds having strong advantages, as well as their nutritional component. In 2014 the chili pepper varieties were tested, as these have an extremely high consumption rate within the country and are therefore also very profitable. Tomato trials have shown that compared to local varieties, the fruits were bigger and had a longer shelf life. (Fair Planet, 2016). One location started with onion varieties in 2016 and in 2017 cabbage varieties will be introduced, as a means of promoting crop rotation for farmers (Haberfeld, personal communication, 2016).

Furthermore, a demonstration field is operated in each *kebele*. This is done by a second-year farmer in the community, with help and regular visits from Fair Planet staff. The farmer is partly compensated for this and expected to follow the guidelines fully. It allows other farmers to see experience firsthand the production process (Fair Planet, 2016). Fair Planet believes it is important to have a threshold of two or three lead farmers in a *kebele*, who will be able to generate knowledge from the Ministry of Agriculture and pass this on to other farmers (Haberfeld, personal communication, 2016).

Farmers are selected by local project partners based on suitability of technology introduction. They must have a suitable plot and steady water source. These farmers know beforehand that the purpose is to demonstrate improved performance and practices to fellow farmers. They also must agree to allow fellow farmers onto their field if required. The farmers receive the vegetable seeds for free for the first year and must pay for them starting from the second year onward. They will continue to receive visits and training.

Each farmer will be periodically be visited by Fair Planet staff, expert guides, and development agents (DAs) as part of the extension services. They will advise farmers and adjust the recommendations given based on conditions (Fair Planet, 2016). Furthermore, they are strongly advised to visit the seminars. The table below shows the main focus of the different seminars.

Table 2. Training Activities and target groups (Fair Planet, 2016)

Activity	Main focus
Pre-season Seminar	Land preparation, crop rotation scheme, specific crop information, production guidelines
Mid-season Seminar	Crop development monitoring, pest and disease control, weed management, irrigation and fertilization technologies and schedule
Pre Harvest & Marketing Seminar	Harvest planning, optimal support of crop yields, post-harvest procedures, marketing logistics, market information, market planning, links to infrastructure (dealers, cooperatives, unions, credit and savings)
Open day	Demonstration of crop performance of the various varieties, demonstration of improved agricultural practices

To foster access to agricultural inputs, including seeds, fertilizers and pests, the project is developing links with local cooperatives and unions that supply agricultural inputs, as well as credit and other financial services. These cooperatives are called Primary Cooperatives and formed by groups of farmers and regulated by the Ethiopian Government, through an agency named the Federal Cooperative Agency (Fair Planet, 2016).To increase the chances of farmers adopting the improved seeds after the first year, Fair Planet aims to assist local seed and agro dealers in promoting improved seed varieties and technology by providing all relevant information and designing promotion materials (Fair Planet, 2016). They will invite local dealers to open days.

Fair Planet places a high importance on scaling up in order to transfer knowledge and impact over a wide geographical area, positively affecting more farmer households. After five years the project anticipates reaching 13,000 smallholder households, approximately 80,000 individuals. Five years after the end of the project, Fair Planet expects to have reached 50,000 farmers and 350,000 individuals (Fair Planet, 2016). This is an ambitious goal and presumes the cooperation of many different factors involved.

3.4 Maintaining the natural resource base

Fair Planet realizes that high quality vegetable varieties demand better fertilizer protocols (Fair Planet, 2016). They recognize that high yielding varieties create an increased pressure on the soil and believe in the importance of returning the nutrients back to the soil. Alon Haberfeld quotes that, “we want to leave the soil in the same manner as it was before we came” (Haberfeld, personal communication, 2016).

This is currently the case for the elements nitrogen, potassium and phosphorus. These are incorporated in the guidelines. Farmers should give the fertilizer DAP while preparing the field, and twice weekly apply urea and potassium chloride. Fair Planet has calculated the exact amount to use which will compensate for the amount macronutrients the crops use (Haberfeld, personal communication, 2016).

As of this moment there are no protocols for trace elements. There is currently still a lack of knowledge on the state of trace elements in farmers’ soils. It remains very difficult to measure because the closest soil analysis labs are found in Kenya. The Ethiopian government is doing some research on this and Fair Planet is planning to integrate this into the guidelines in the future as soon as more information is available (Haberfeld, personal communication, 2016). They are currently also working with Alterra, a Wageningen University research institute, on a tool to measure trace elements in farmers’ soils, which will allow them to provide on-site recommendations to farmers (Haberfeld, personal communication, 2016).

In order to promote soil conservation Fair Planet strongly advises farmers to practice crop rotation. The guidelines recommend a spacing of two years between tomato or pepper crops on the same piece of land. Fair Planet advise farmers to use grain and pulse crops in-between in order to restore nutrients to the land, and if they are unable to wait two years, to use these crops for at least two seasons.

Fair Planet also aims to promote responsible pesticide use. This includes reducing prophylactic spraying, which is a habit for local farmers. Fair Planet urges farmers to change their behavior and to daily visit and examine their fields, and spray chemicals as required. Additionally, they educate the farmers on habits regarding spraying slightly before and during harvest times, as well as the importance of following the instructions on the label (Haberfeld, personal communication, 2016).

4 The Smallholders' Farming Systems

This chapter provides information about the background and characteristics of the farmers in the program. Fair Planet did not yet have any baseline data on this group, and therefore some elements were included in the questionnaire. Farmer interviews have conceded quantitative information about the characteristics of the smallholders in the Fair Planet program, including baseline variables and elements of their farming system. This information is of interest as it may affect outcomes of the intervention related to nutrition as described in the framework of Herforth and Ballard (2016), specifically on-farm availability and diversity, and income. This chapter shows the effect Fair Planet has had on elements of the smallholders' farming system after one year and describes what farmers do with their income from agriculture, as well as providing an explanation for the differences between farmers. The table below shows characteristics of the study population.

Table 3. Sociodemographic and socioeconomic characteristics of the participants.

Variables	Frequency	Year 0 (n=10)	Year 1 (n=10)	Total (n=20)
Age	<25	2	1	3
	25-35	5	4	9
	36-45	2	2	4
	>45	1	3	4
Educational status	0-3th grade	3	1	4
	4-8th grade	0	6	6
	9-12th grade	4	1	5
	Higher education	3	2	5
Household size	<5	3	0	3
	5-7	3	4	7
	8-10	4	5	9
	>10	0	1	1
Amount of land (ha)	<0.2	0	1	1
	0.2-0.5	4	2	6
	0.6-1	4	3	7
	>1	2	4	6
Off-farm employment	Full-time	2	0	2
	Part-time	0	1	1
	Sometimes	3	2	5
	None	5	7	12
Number of crops	0	0	0	0
	1-4	6	4	10
	5-10	4	5	9
	>10	0	1	1
Number of livestock	0	1	0	1
	1-4	4	3	7
	5-10	5	5	10
	>10	0	2	2
Household consumption	0-25%	3	0	3
of own produce	26-50%	2	4	6
	51-75%	2	4	6
	76-100%	3	2	5
Percent household income	0-25%	1	0	1
from agriculture	26-50%	1	1	2
	51-75%	2	0	2
	76-100%	6	9	15

4.1 Trends in the population regarding baseline statistics and farming system elements

Statistical analyses with results from the questionnaire show no significant differences in any baseline statistics between year 0 and year 1 farmers, including farmer age, education, household size, land size, and off-farm employment.

When combining the results from year 0 and year 1 farmers, some trends can be found. The age of the farmer had played a significant effect on some elements. For example, the higher the age of the farmer the greater the size of his land. Also, the higher the age of the farmers the greater his percentage of total income from agriculture. Younger farmers were more likely to have off-farm employment. This can be related to the fact that there was a negative correlation between age and education of the farmer. The older the farmer, the lower his education level.

Furthermore, the famer's household size played a role. The larger the household, the greater the size of his land, and the higher the amount of livestock. This can be linked to the fact that Ethiopian agriculture is very labour intensive, and the higher amount of family workers per hectare the higher the amount of productivity, as well as more labour available to tend to livestock (Rapsomanikis, 2015). The median household size of the interviewed farmers was 7.5.

4.2 Effect on different elements after one year

4.2.1 SPSS results

Quantitative answers from Year 0 and year 1 farmers were compared in order to find out if participation in the Fair Planet program had an effect on certain elements of the farming system after one year. Results from the SPSS independent t-test show that $P>0.05$ for all elements, meaning that there is no evidence of an effect on the number of crops, amount of livestock, percentage of total produce consumed by the household, and the percentage of household income from agriculture. However, one must keep in mind that this is only after one season of growing tomatoes.

4.2.2 Qualitative results

Change in elements

Year 1 farmers were consequently asked if the above named elements had become more, less, or remained unchanged. The following graph depicts their answers.

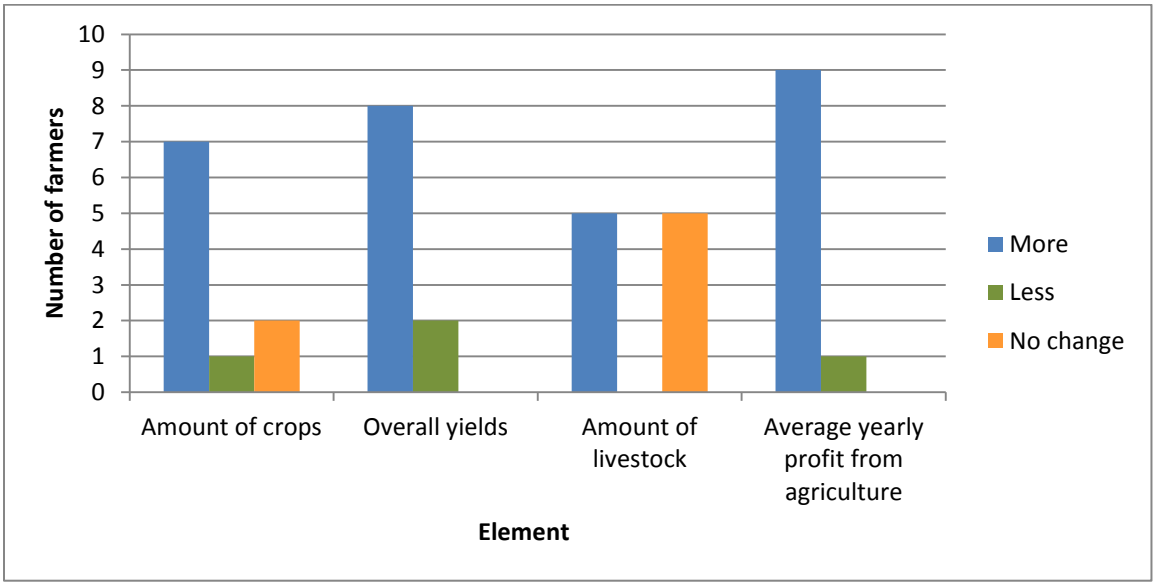

Figure 4. Stated change in specific elements compared to before joining the Fair Planet program

Out of the year 1 farmers interviewed, the majority indicated positive results compared to the year before. For example, seven farmers indicated that they now had more types of crops than before joining the program. Five farmers said they now had more livestock, while five said there was no change in the amount of livestock they had. Eight farmers said that their yields had become higher and nine farmers claimed that their average yearly profit from agriculture had become higher. This, contrary to the quantitative results is evidence of a positive effect of the program after one year on the measured elements. This contrast may be caused by the low number of farmers interviewed, reducing the statistical differences between the two groups due to high inter-personal variance among farmers. On the other hand, the farmers may be giving socially desirable answers during the qualitative section of the interviews. This makes it difficult to draw solid conclusions on the effect of the Fair Planet program after one year.

Profit from tomatoes

Furthermore, it was of interest what farmers do with the profit they receive from their cash crop of tomatoes, as the framework of Herforth and Ballard (2016) states that income can contribute to improved access to food and care practices. Year 0 farmers were asked what they were planning to do with the profit they would receive from their tomato crop once harvested. Year 1 farmers were asked what they did with the profit from their tomato crop from the previous year.

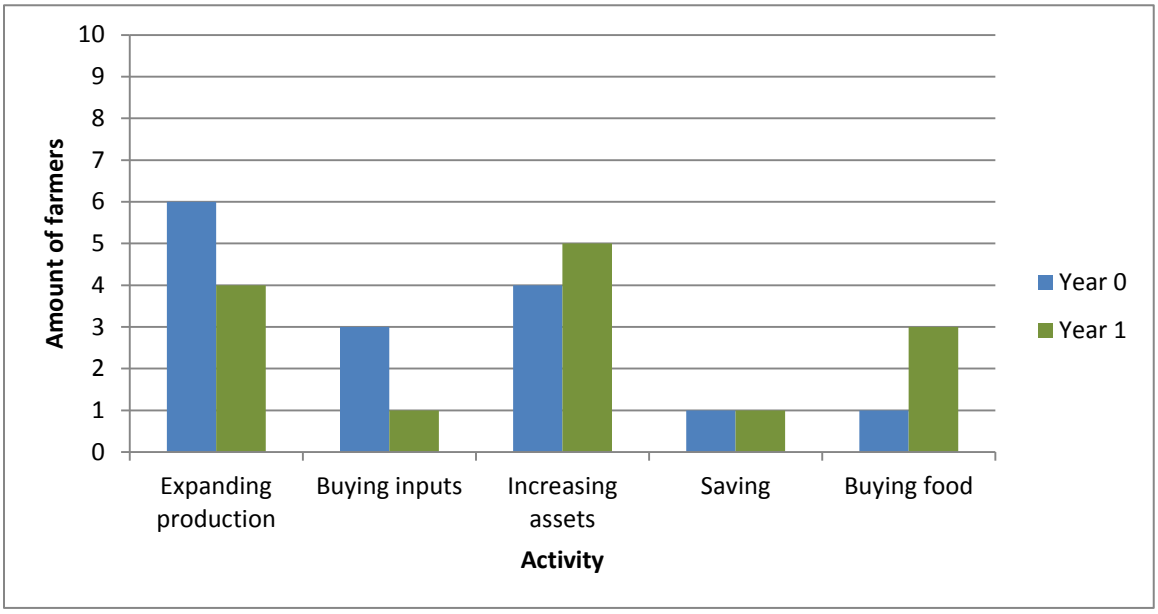

Figure 5. Activities farmers have done (year 1) or wish to do (year 0) with their profits from tomato crops

Most popular among beginning farmers was to expand production. Farmers named things such as "I want to expand the production of vegetables and similar projects" (farmer 3), and "I want to rent more land to increase production" (farmer 4). Furthermore, four farmers were interested in expanding their assets. For example, farmer 4 names building a house as one of the activities he would like to do with his profit. Farmer 5 aims to buy a bajaj, the local name for a three wheeled vehicle used as a taxi. Three farmers would like to invest in inputs such as fertilizer for the following season. Only one farmer said he would spend it on buying more food for his family.

Amongst year 1 farmers, the most prevalent activity was to expand their assets. Three farmers had spent their profits on buying land in the city, while one had bought a house in the city. Farmer 16 quoted, "I bought a Dutch dairy cow for 20,000 birr which I will fatten and then sell for much more". Two farmers named that they had rented more land with their profits to be able to expand their production this year, while farmer 11 had bought avocado and tomato seedlings with his profit. Three farmers said that they

had spent more money on food for their families. The above is evidence that increased income alone does not always lead to increased food access, only in some cases.

The author's observations and local sources have confirmed the general pathway of many farmers in the area as their income increases.

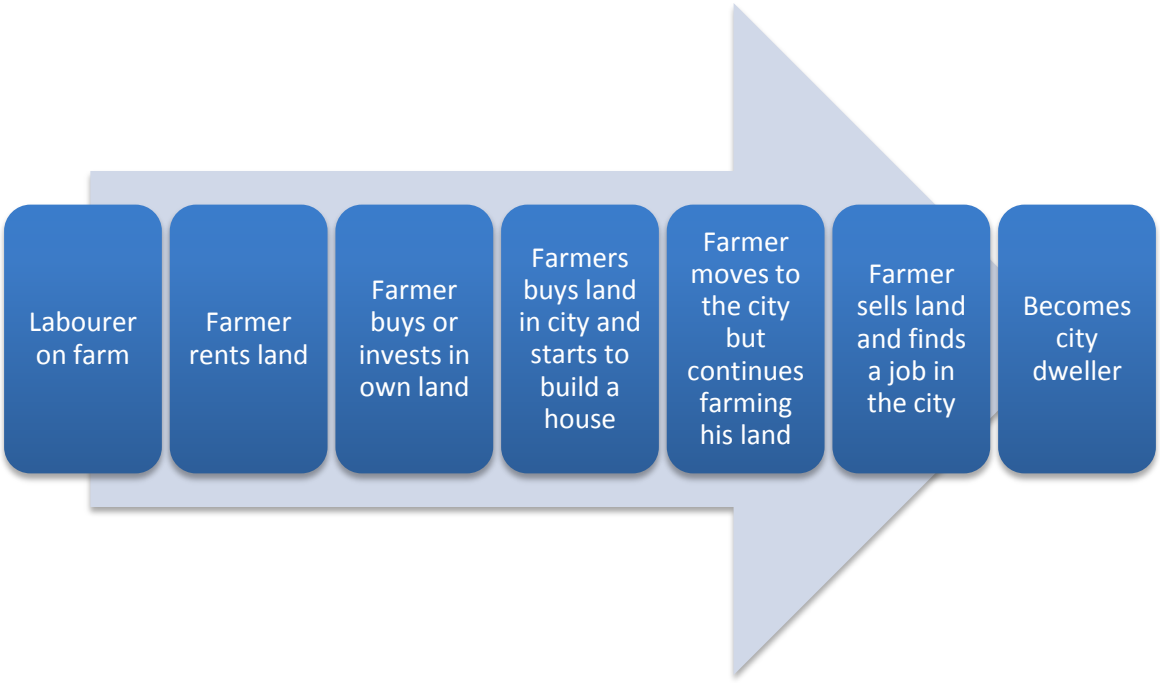

Figure 6. Common pathway of farmers as income increases

This pathway echoes the livelihood goals of many smallholder farmers in and around Butajira. Aklilu names that being a farmer in the Ethiopia is not looked upon highly by society, and mostly associated with rural, uneducated people. Therefore, farmers try to gain assets such as a *bajaj* to be able to become a taxi driver, or land in the city to provide better education for their children, instead of directly spending money on improving their diet or care practices (Aklilu, personal communication, 2016). This shows that farmers are more interested in using farming as a means to change their status and move to the cities. However, not all the farmers interviewed follow the above pathway. The subchapter below provides more insight into the reasons behind this.

4.3 Declaring differences between farmers

Although 20 farmers in the same area were interviewed for this research, there was still a large variance in the assets of the smallholders, as well as what farmers were doing with the profit they received from tomatoes. This can have various explanations, but one hypothesis is that it can be contributed to the mind-set of the farmer. These

farmers do not necessarily follow the income pathway as described above, but have invested in cash crop production and see the potential for their farm to become a long-term profit producing business.

In his report, Kahan (2013) describes different types of smallholders: those farming exclusively for home consumption, those who farm primarily for home consumption but sell surpluses, farmers who sell most of the produce on the market with some home consumption, and those who farm exclusively for the market (Kahan, 2013). The stage in which these farmers are in depends on their circumstances and willingness to take risks, as well as access to finance, land, information, knowledge and labour (Kahan, 2013). Also playing a role is the entrepreneurial spirit of the farmer, consisting of the ability to see his farm in the context of the value chain and the ability to adapt to threats. Pre-entreneurial farmers are those who are developing economic activities and on their way to profit-driven businesses.

(Pre)entrepreneurial farmers in the Fair Planet project were identified by the author, based on information from the report Entrepreneurship in Farming (Kahan, 2013), as following:

- Had doubled their area of tomato production since the previous season
- Invested in land and/or specific materials to increase production
- Consumed 75 percent or less of their own produce

These (pre)entrepreneurial farmers identified were farmer 11, farmer 17, farmer 18, and farmer 20. Characteristics about these farmers include that they all have between three and six different crops and did not have any additional jobs. These four farmers all completed up to grade five or less.

Compared to the other farmers, these farmers were identified as having a significantly higher percentage of income from agriculture, having a higher tomato production level in the previous 2015-2016 season, and having a higher revenue from tomatoes in the previous 2015-2016 season. Noteworthy is that these farmers did not necessarily have significantly more land than the other farmers.

Farmer 11, Nuri Awel, has been identified as a progressive farmer. He is 47 years old, has completed third grade, and lives on his family's 2 hectare land with nine family members. He owns three cows and two oxen, and relies fully on income from his farming to provide for his family. Awel was one of the first farmers in the Fair Planet program. Before the program, he grew primarily maize, as well as some enset, chat, and soybeans. Being enrolled in the Fair Planet program has opened up new opportunities

for him. Awel names that Fair Planet encouraged him to change his working habits. Contrary to the previous years, he now visits his fields every day and claims to work much harder. Fair Planet gave him knowledge about farming habits, specifically about how and how often to irrigate. He has expanded his production from only one season per year to three seasons per year.

With the profit from the first season, he bought extra land and doubled his tomato production. Furthermore, he purchased and planted 400 avocado seedlings from the local nursery as an investment. He is also working on a fish pond, a unique concept in the area, in which the fish will be fed with the droppings from a chicken coup built partly above the water. He can be found at all the Fair Planet training sessions that are held in the area and is known and respected in the community as a good farmer. He shares the knowledge he receives from Fair Planet with his neighbours.

This shows that Fair Planet can play a role in facilitating development in economic activities for the farmer. They already assist in access to information and knowledge through weekly visits and seasonal training sessions. Farmers that have sufficient access to land, labour and finance, as well as an entrepreneurial spirit allowing them to take risks have been able to increase their tomato production and profits. Moreover, together with the appropriate education, this can enable farmers to re-invest profits in their land, conserve natural resources and maintain soil fertility (Kahan, 2013). This ensures long term farm productivity and stimulates sustainable land management.

5 Smallholders' Dietary Diversity

The following chapter describes that dietary characteristics of the farmers. In order to give recommendations for Fair Planet to become more nutrition-sensitive, one must know the impact the program currently has on the dietary diversity of the farmers. Furthermore, as the aim of nutrition-sensitive agriculture is to improve the nutritional status of beneficiaries, it is important to understand the factors influencing the dietary diversity of the farmers.

5.1 Dietary diversity after one year

5.1.1 SPSS results

Data analysis in SPSS showed that there was a significant difference in dietary diversity between farmers in the first year and the control group. The average dietary diversity score (DDS) for year 0 farmers was 6.6, compared to 7.4 for year 1 farmers. SPSS confirms that this is significant difference at $P<0.05$. An higher dietary diversity reflects an improved diet (Swindale & Bilinsky, 2006).

This DDS of the interviewed farmers is even higher than the national situation, as described by the study of Sibhatu et al. (2015), which has found that the nationally representative dietary diversity score is 5.42 in Ethiopia, compared to for example 11.40 in Kenya and 8.48 in Malawi. (Sibhatu, Krishna, & Qaim, 2015). This shows that there is room for improvement. The graph below shows the specific food group consumption of year 0 and year 1 farmers.

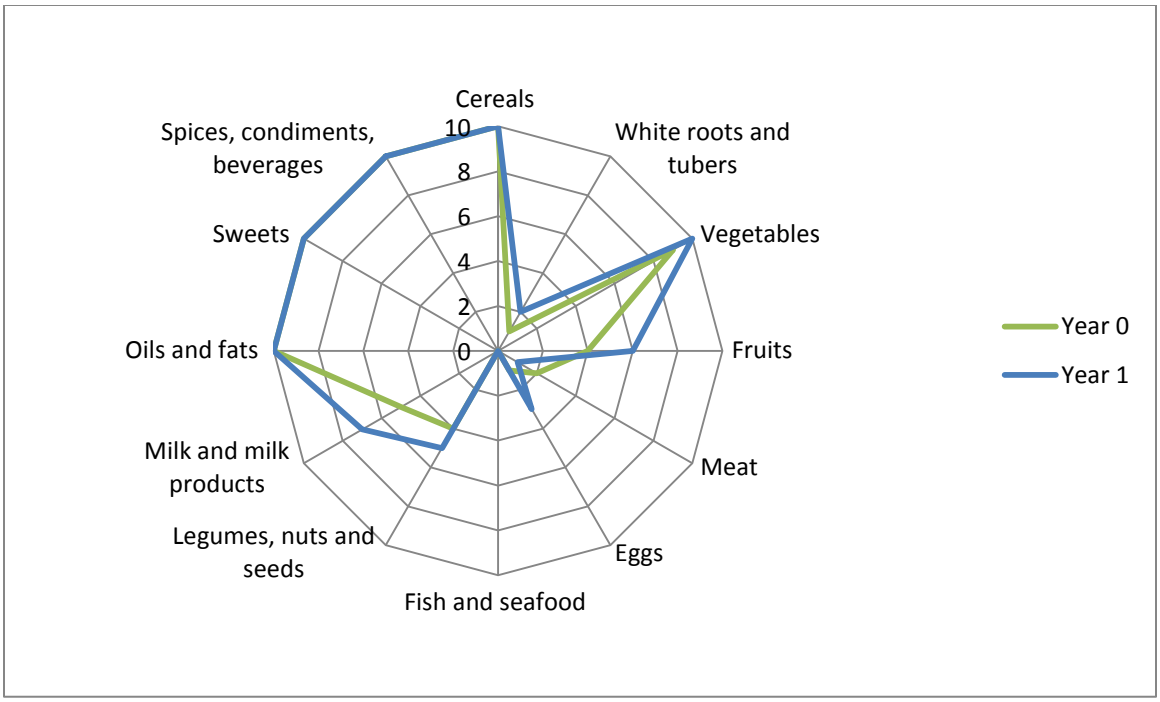

Figure 7. Farmer food group consumption per year

Although the DDS differed between the two groups, there was no significant difference in specific food group consumption. All of the 20 farmers interviewed had consumed of the groups: cereals, oils and fats, sweets, and spices, condiments, beverages. 19 farmers had consumed vegetable, most in the form of a local kale variety, as well as tomatoes. Zero farmers had consumed of the fish and seafood group. The 2011 Ethiopian Welfare Monitoring Survey found similar results, namely that cereals were consumed by 96% of respondents, followed by fruits, while fish and seafood, eggs, and fruits were the least consumed food groups (Workicho, et al., 2016). Local MoA employee Rehema Said confirms that most rural families will eat bread from wheat or corn flower, accompanied by enset, kale, or a lentil mix. They will drink milk from the cows if they own them and eat eggs occasionally if they have chickens. Furthermore, these families almost always eat the same foods daily (Said, personal communication, 2016).

5.1.2 Qualitative results

Year 1 farmers interviewed were asked the question, "How has your diet changed since you joined the Fair Planet project?". The figure below shows the most common answers.

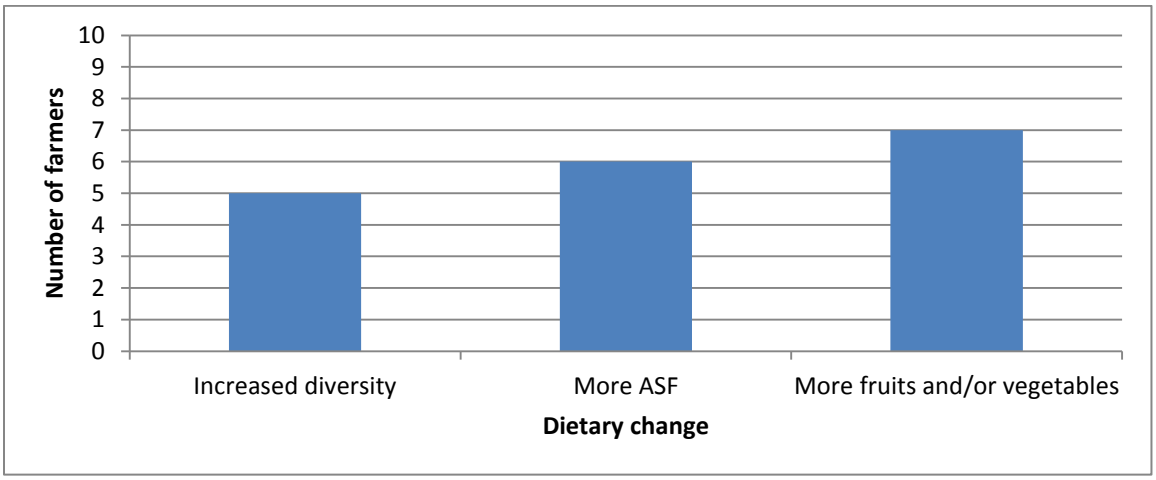

Figure 8. Stated changes in diet since farmers joined the Fair Planet program

Five farmers named increased diversity as a change. This echoes the quantitative results which showed that year 1 farmers had a higher dietary diversity compared to year 0 farmers. For example, farmer 20 said, "Before, my family ate only maize, bread and kale. Now we eat wheat, teff, tomatoes and soybeans. Also, we eat flour from the factory and meat every week". Farmer 11 claimed that contrary to the past, he now eats something different every day and more types of food. Six farmers mentioned that they had increased their intake of animal sourced foods (ASF). One of these farmers is farmer 16, who named that he and his family now drink milk from the dairy cow they had purchased, as well as more eggs. Lastly, seven farmers stated that they now consumed more fruits and/or vegetables compared to the year before. The majority of these farmers name tomatoes as one of the vegetables they eat more often. Farmer 17 says his family now eats more avocados and mangos. This is not reflected in the quantitative results, but may once again be attributed to the low sample size.

5.2 Other factors influencing dietary diversity

A bivariate correlation analysis was performed in order to find if the DDS in the population of farmers interviewed was associated with the eight independent variables measured. The results are displayed below.

Table 4. Correlation between variables measured and the dietary diversity score.

Variable	Correlation coefficient	P-value
Age	0.028	0.905
Education level	0.270	0.249
Household size	-0.012	0.961
Amount of land	-0.169	0.476
Number of crops	0.287	0.221
Number of livestock	0.007	0.978
Household consumption of produce	-0.178	0.452
Percentage household income from agriculture	0.015	0.948

Between all variables and the DDS, the correlation coefficient is low and P value higher than 0.05, meaning there are no significant correlation between any of the variables measured and the DDS in the smallholder population.

The absence of significant associations gives interesting information about non-existing relationships. These results matches that found in the study by Sibhatu et al. (2015), which states that increasing the on-farm production diversity among small scale farmers in Ethiopia does not contribute to an increased dietary diversity (Sibhatu, Krishna, & Qaim, 2015). A study done in Northwest Ethiopia focussing on dietary diversity and associated factors among rural households with 816 participants found similarly found that age, education level, household size and employment status were not determinants of DD (Nega, Endris, Teferi, Nana, & W/Michael, 2015). In the same way, this study shows that farmer age, education, household size, and off-farm employment do not influence DD or specific food group consumption in the interviewed group of farmers. The 2011 Ethiopian Welfare Monitoring Survey showed, similar to results of this study, there was no significant correlation between the DDS and land size or percentage of consumption of own produce (Workicho, et al., 2016).

The only variable which was significantly associated with DDS in other studies is that of 'number of livestock'. In one study, there was a positive correlation between DD and the ownership of small animals such as goats and chickens (Nega, Endris, Teferi, Nana, & W/Michael, 2015). Another Ethiopian study found a positive correlation between owning livestock and a higher DDS (Workicho, et al., 2016).

The absence of significant associations between the measured variables and the DDS means that there must be other factors which influence the diets of smallholders. This is discussed in the sub-chapter below.

5.3 Restrictions to diverse diets

The Ethiopian nationally representative DDS, including that of the smallholders interviewed, is still very low compared to that in other countries such as Malawi with a national DDS of 8.48 (Sibhatu, Krishna, & Qaim, 2015). There are several factors that prevent the smallholders from consuming more diverse diets than is currently the case. These must be overcome in order for nutrition-sensitive agriculture to take place. The restricting factors are explained below.

5.3.1 Religious and cultural influences

It seems that cultural behavior plays a major role in deciding the diets of smallholder households. Meat is traditionally eaten mostly during the holidays or infrequently if farmers eat in the town. Furthermore, due to religious influences, both Wednesdays and Fridays are cultural fasting days, meaning no meat, eggs or dairy is consumed on these days, as well as six other official fasting periods including period of Lent before Easter and the pre-Christmas period (Belwal & Tafesse, 2010) (Seleshe, Jo, & Lee, 2014). The most popular religion in Ethiopia is Orthodox Christian, very dominant and influential in the country, which promote approximately 250 days of fasting per year. On these fasting days most butchers, except the few owned by Muslims, do not slaughter animals forcing even non-believers to withdraw from consuming meat (Seleshe, Jo, & Lee, 2014).

5.3.2 Availability

The availability of certain food influences the diets of smallholders. For example, the consumption of fish in Ethiopia is limited, due to low availability caused by both geographical reasons as well as the fact that is has not been integrated into the diet, even though it is accepted by the religious institutions during fasting times (Seleshe, Jo, & Lee, 2014). This is the greatest reason why fish and seafood was the least consumed food group by farmers.

Dairy is seldom available on a commercial scale. Even in small supermarkets outside of Addis Abeba, milk is rare and relatively expensive. In the families who have milk cows, fresh milk is drunk in coffee, but only in very small amounts.

In Butajira town, there are several small shops and many kiosks selling perishable and non-perishable items. However, the weekly local market is by far the most popular channel for the selling and purchasing of food (Aklilu, personal communication, 2016).

Farmers either sell their own produce in the market or sell it to traders once there who will sell it for them. On the day of the markets farmers sell to small-scale vendors in the morning, who subsequently sell their wares to customers throughout the day. In this market perishable food items are available, including numerous types of local vegetables and fruits. The popularity of this traditional channel allows rural families to have access to fresh produce. However, as the FAO (2013) writes, poor post-harvest storage and lack of infrastructure can cause a lower nutritional quality and increased losses. Consumers are also susceptible to seasonal shortages and prices fluctuate greatly (FAO, 2013).

5.3.3 Lack of knowledge

Another barrier preventing diverse diets is that many Ethiopians base their diet on a single staple food and believe that, "someone has good nutrition when their stomach is full" (Aakesson, Pinga, & Titus, 2014). Farmers in Butajira commonly consume bread with either cabbage or local kale, in some cases up to three times a day.

Furthermore, it seems that there is lack of knowledge on the importance of nutrition, as well as how to prepare unfamiliar foods (Said, personal communication, 2016). Agonafir Aklilu affirms this. He names that farmers, especially in the lower areas of the *woreda* do not grow vegetables such as carrots or beetroot because they lack knowledge of growing practices, but also because there is little market for them. Farmer households in the area do not know how to prepare carrots or beetroot and cannot eat them with bread, their staple food (Aklilu, personal communication, 2016).

6 Opportunities for Incorporating Nutrition-sensitivity into an Agricultural Intervention

In the past decade there has become a greater awareness on the association between agriculture and nutrition, and the opportunities that exist for improvement. There are numerous sources of literature recommending approaches to enhance the effects of agricultural interventions and allow it to have a positive impact on the nutritional situation of smallholder farmers. This chapter summarizes the results of a literature study on applying nutrition-sensitive agriculture to agricultural interventions in general.

The International Fund for Agricultural Development (IFAD) writes that typically, agricultural interventions aim to "improve nutrition by increasing food production and raising incomes" (IFAD, 2015). However, IFAD continues to make clear that this alone will have only a limited effect on nutritional status, and it may take many years to show results. Real impact requires both social and behavioral changes, and therefore a more targeted and extensive approach is needed. IFAD describes the need of an approach that will increase the availability, accessibility and consumption of diverse and nutritious food in multiple parts of the supply chain (IFAD, 2015).

The Second International Conference on Nutrition took place in November 2014. During this conference experts and members of over 170 countries world gathered to create ten specific principles for 'Improving nutrition through agriculture' (FAO, 2015). These ten programming principles are as follows:

1. **Incorporating explicit nutrition objectives and indicators into their design**: improved nutrition should be an objective and indicator. Within this it is important to distinguish specific actions that will contribute to nutrition (IFAD, 2015). The impact pathway must be identified, and consequently the project actions that will affect different steps. As part of this, opportunities and constraints affecting the pathway should be investigated through partnerships and policy engagement (IFAD, 2015). The objectives created should seek synergies with social, environmental and economic objectives (Herforth & Harris, 2014).

2. **Assess the context at the local level, to design appropriate activities to address the types and causes of malnutrition**: it is essential to understand the local context, including the nutritional and agricultural opportunities and constraints from the point of view of all stakeholders involved (Herforth & Harris, 2014). Specific assessments can include access to food, infrastructure, and markets, as well as

income, gender dynamics, and opportunities for collaboration with other organizations in the area (FAO, 2015). This will help to address the types and causes of malnutrition in the area.

3. **Target the vulnerable and improve equity**: the poorest households and those most affected by agricultural incomes and food prices are highly vulnerable. These are often smallholder farmer households and landless labourers (Herforth, Jones, & Pinstrup-Andersen, 2012). Additionally, due to their increased needs, women of childbearing age, lactating women, and children under five are most susceptible to nutritional shortages. Targeting these groups in interventions though access to resources and participation can have significant outcomes (Herforth, Jones, & Pinstrup-Andersen, 2012). Equity is ensuring hard-to-reach populations, regardless of status, are covered (USAID, 2014).

4. **Collaborate and coordinate with other sectors**: joint planning and programming must take place at national, regional and local levels, and across the sectors of health, sanitation, nutrition, education, economic growth and agriculture (Jaenicke & Virchow, 2013)(USAID, 2014). Similarly, there should be increased linkages between humanitarian assistance and development programs in order to build resilience and improve economic and social opportunities, creating sustainable outcome (USAID, 2012). Multisectoral linkages can be strengthened by structures such as a national council, shared funding for coordinated projects, and on a local level multidisciplinary extension teams and increased communication between staff of different sectors (FAO, 2015).

5. **Maintain or improve the natural resource base:** in order to support long term agricultural production, food security and sustainability of livelihoods, there should be a focus on promoting the sustainable management of resources like biodiversity, soil and water (European Commission, Food and Agriculture Organization of the United Nations, Technical Centre for Agricultural and Rural Cooperation and World Bank Group, 2014). In practice, this can take place by, for example, reducing pesticide use, investing in sustainable land management practices, stopping deforestation, and using efficient irrigation systems (FAO, 2015).

6. **Empower women:** a focus on women in an agricultural intervention, including through increasing their incomes, providing them with knowledge and technology, and/or influencing cultural norms, can strengthen the nutritional outcomes (Herforth & Harris, 2014). When woman gain decision-making power through the above mentioned activities this translates into nutritional gains within the family

(Herforth, Jones, & Pinstrup-Andersen, 2012). This is because women play a crucial role in determining household food consumption, as well as childcare and feeding practices (FAO, 2013)

7. **Facilitate production diversification, and increase production of nutrient dense crops and small-scale livestock:** a direct route to improving diet quality and quantity for vulnerable producers is to increase production of a range of foods. This includes horticultural products, livestock and fish, legumes, and biofortified crops (European Commission, Food and Agriculture Organization of the United Nations, Technical Centre for Agricultural and Rural Cooperation and World Bank Group, 2014).

8. **Improve processing, storage and preservation:** in order to reduce post-harvest losses and improve access to nutritious foods, appropriate techniques are essential (FAO, 2015). Specifically, techniques can include preserving or processing foods after harvesting, fortification, using cool and dark storage facilities to improve shelf life, controlling pests in harvested produce, and investing in timely and efficient transportation (FAO, 2015).

9. **Expand markets and market access for vulnerable groups, particularly for marketing nutritious foods:** value chain and marketing strategies can be beneficial for smallholder farmers. Fostering local markets, as well as transportation to and from them, can provide a source of diverse, nutritious and affordable products for consumers (USAID, 2014). Furthermore, farmer associations and access to price information give farmers an advantage (Herforth & Harris, 2014).

10. **Incorporate nutrition promotion and education:** a strong emphasis on providing nutrition knowledge can lead to an increased demand for nutritious food in the general population but also the impact of production and income in rural households (Herforth, Jones, & Pinstrup-Andersen, 2012). This knowledge should be built on local attitudes and practices, and can include topics such as food preparation, healthy food choices and nutritional requirements of different family members (FAO, 2015).

The above mentioned principles can help an agricultural intervention to become more nutrition-sensitive. Alongside these principles, it is of great importance that there is a good monitoring, evaluation and learning component within the strategy (USAID, 2014). It should have realistic impact level indicators to monitor progress and data must be routinely collected. Consequently the intervention should be adjusted according to evaluation results (USAID, 2014). Actively following the principles will allow a program

to make a positive impact on the nutritional well-being of its target population. Realistic ways in which Fair Planet can actively incorporate some of these principles in order to become more nutrition-sensitive will be described in the next chapter.

7 Discussion

This chapter will discuss the current Fair Planet program, including strengths and weaknesses, and provide recommendations for Fair Planet on how to apply the principles described in the previous chapter and become more nutrition-sensitive.

7.1 Farm productivity

Fair Planet's strategy focusses on the agricultural empowerment of smallholder farmers. Providing them with better quality seeds suited to the local conditions is their main focus. Weekly visits from staff and local extension workers allow farmers to be encouraged, learn and adjust their farming practices. The farmers are highly enthusiastic about this and express their appreciation.

The emphasis on extension services and the weekly visits Fair Planet coordinates in partnership with the local Ministry of Agriculture has many benefits. Well organized agricultural extension has the power to contribute to increasing the speed of technology transfer, increasing farmer knowledge and helping farmers to improve management practices, therefore improving overall productivity (Feder, Murgai, & Quizon, 2004). Without the visits, many farmers in the program would not have regular contact with extension services.

A study performed in a similar district to Butajira showed that participation in an agricultural extension program increases farm productivity by 20 percent (Elias, Nohmi, Yasunobu, & Ishida, 2013). In the same research investigation, improved seed use increased productivity by 19 percent (Elias, Nohmi, Yasunobu, & Ishida, 2013). This shows that the Fair Planet strategy aimed to increase overall farm productivity can be successful. Fair Planet's farmers say that their yields have increased since entering the program.

Fair Planet's focus om empowering local MoA staff and the transfer of knowledge carries great potential for generating long-term change (Feder, Murgai, & Quizon, 2004)(Haberfeld, personal communication, 2016).

7.2 Nutritional impact

Fair Planet has a good strategy in place to increase farm productivity and vegetable production. However, the implication that the nutritional situation of the farmers will improve with the increased productivity and income is not valid.

Herforth et al. (2012), write in a World Bank paper that, “merely producing more food does not ensure food security or improved nutrition.” (Herforth, Jones, & Pinstrup-Andersen, 2012). Gillespie et al. (2012) concluded after performing a review of papers focussing on the link between agriculture and nutrition that enhancing agricultural productivity does generally increase production, income and consumption, but that this does not necessarily translate into nutritional status impacts (Gillespie, Harris, & Kadiyala, 2012).

Findings from this research confirm this information. Although the average DDS of year 1 farmers was higher than that of year 0 farmers, this could not be contributed to any of the measured variables. Income, as well as greater crop diversity, larger land size, and amount of livestock had no effect on the dietary diversity of the smallholders interviewed. In other literature only the amount of livestock a farmer has was found to contribute positively to the dietary diversity score. Important determinants of dietary choices among smallholders in Ethiopia are cultural and religious beliefs, as well as familiarity with the product (Aakesson, Pinga, & Titus, 2014) (Seleshe, Jo, & Lee, 2014). This shows that one cannot make the assumption that improved income alone will lead to higher dietary diversity or any other nutritional gains, and specific action must be undertaken to address the underlying determinants of the smallholders’ nutrition, also specifically the outcome nutrition knowledge and norms (Herforth & Ballard, 2016). The recommendations described below will aim to help Fair Planet become more nutrition-sensitive.

7.3 Opportunities for Fair Planet

As Fair Planet works closely with their farmers, they have a great potential to positively affect the practices of smallholders in the local context, but not necessarily on a policy scale. Taking the above information into account and personal observations of the author, recommendations for Fair Planet will focus on four areas, which will aim to realistically increase nutrition-sensitivity within the current program.

7.3.1 Including goals and indicators

Keding et al. (2013) writes that some forms of malnutrition are partly due to agricultural projects not having nutrition outputs as an explicit goal (Keding, Schneider, & Jordan, 2013). Taking this fact into account, Fair Planet should first start by including specific nutritional goals and indicators into its approach (Herforth, Jones, & Pinstrup-Andersen, 2012). Currently there are no goals or specific activities dedicated towards improving the nutritional situation of smallholders in the program (Haberfeld, personal

communication, 2016). Questions to be answered while formulating appropriate goals include, 'which determinants of nutrition will most likely be impacted the by the project?' and 'which nutrition objectives are relevant to the nutritional problems in the area and can be related to the project impact pathway?' (FAO, 2015).

Once goals have been created, the nutritional impact pathway can be identified, including the synergies with other factors. The impact pathways of how the diet quality will be improved should be clear (FAO, 2015). This will allow for the promotion and implementation of certain nutrition enhancing activities, as described further in this chapter. Of importance is to include specific impact indicators to monitor impact and progress (FAO, 2015) (USAID, 2014). A realistic and straightforward indicator is the individual dietary diversity score, which can be performed among farmers in the program, and leads to the outcome diet quality. This indicator is recommended by the FAO, and was tested with success in the field by the author. Also of interest is using the comparable, but more tailored, minimum dietary diversity score among women and young children of the family to measure if improvements are reaching vulnerable family members (Herforth & Ballard, 2016). Furthermore, the household dietary diversity score indicator can be used to assess household access to food, which is a large determinant of nutrition to be affected by agriculture (Herforth, Jones, & Pinstrup-Andersen, 2012) (Ruel & Alderman, 2013).

7.3.2 Education and partnership with other sectors

IFAD believes that there are four elements affecting the quantity and quality of diets. These are knowledge, practices, resources, and attitudes. It also mentions that higher incomes and increased diversity in production should be coupled with nutrition information such as media campaigns and education in order to promote better food choices and diets (IFAD, 2015). Similarly, Webb (2013) writes that agriculture has the opportunity to be used as a platform to deliver messages on nutrition knowledge and practices, not merely extension. Furthermore, integration with the health delivery systems can help to reach both men and women (Webb, 2013). Specifically, strategies can offer instruction on food preparation and information on how to identify signs of nutritional deficiencies (The World Bank, 2007).

Herforth et al. (2012) describe an example of the introduction of the orange-fleshed sweet potato in Mozambique. They say that partly responsible for the success of the project is due to the integrated extension agent pairs which included a male agricultural agent and a female nutrition agent, who visited villages and gave education on numerous agricultural and nutrition topics. This illustrates the possibilities available to Fair Planet. They are currently already visiting farmers weekly with a male agricultural

agent, and there is a female agricultural extension officer, mainly focused on nutrition, in place and employed by the district.

The female officer, named Rehema Said, was interviewed as part of the research. She works throughout the district, and has set up 'development' groups comprised of 20-40 women in each *kebele*. Through these groups, and working closely with the *kebele* health extension officers, she teaches women mainly about nutritional issues, as well as family management and saving and credit opportunities (Said, personal communication, 2016). She has noticed that families almost always eat the same types of food, and attributes this to cultural norms, as well as lack of knowledge on preparation practices. Therefore she has created a teaching segment where the women come together to taste and prepare locally available vegetables such as carrots and lettuce. She has seen great success and willingness on behalf of the women to start serving these products to their families (Said, personal communication, 2016), showing that a more diverse diet is possible.

A valuable opportunity for Fair Planet is to start working with Said, and ask her to accompany the team to farmer visits. Said names that rural households get their nutritional information directly from the radio, ministry of agriculture, or the health centre. Said, working in partnership with local health officers, can be a direct source of information, as well as promote the consumption of own produce. She names that although her approach is very low budget, she needs more resources for transport and availabilities to reach households (Said, personal communication, 2016). Fair Planet is able to fill this need within its current structure and this partnership would be an excellent opportunity to increase nutritional awareness and education within farmer households.

This action would help fulfill the recommendations of IFAD, which deems it necessary for multiple actors across different levels to coordinate actions in order to be optimally effective in making agriculture more nutrition sensitive (IFAD, 2015).

Empowering New Generations to Improve Nutrition and Economic Opportunities (ENGINE) is one activity related to USAID's Feed the Future program in Ethiopia. It focusses on providing DAs and MoA staff with training on nutrition in order to deliver nutrition information while performing regular technical assistance to farmers. In their evaluation they found that "trainings implemented to date with DAs and other MOA staff have been successful at imparting new skills as well as changing attitudes about nutrition and its importance" (Aakesson, Pinga, & Titus, 2014). Also, cooking demonstrations bolstered the production and consumption of different kinds of food,

especially fruits and vegetables. Women's participation is playing a large role in this (Aakesson, Pinga, & Titus, 2014). This is proof that focusing on nutrition education and women's empowerment can induce social and behavioral change and overcome cultural and religious barriers and that the recommendation to Fair Planet to use this method is powerful.

7.3.3 Empowering women

The importance of women empowerment is repeatedly stated by experts. Women's empowerment is a key pathway in affecting nutrition through agriculture. In Ethiopian society, household decisions and spending are controlled by men. However, when woman gain decision-making power this translates into nutritional gains within the family (Herforth, Jones, & Pinstrup-Andersen, 2012). The World Bank reports that woman reached by agricultural programs which include nutritional information are very effective in delivering improved nutrition outcomes (The World Bank, 2007)

Said describes the situation in and around the city of Butajira. In rural households, farmers control the financial resources, however, regarding household activities such as food preparation, women are allocated money from the men. As in the case of the majority of the Fair Planet farmer households, woman usually had to consult with their husbands in order to use the income. At harvest time, the woman calculates how much maize or wheat the family will need for own consumption, and she will sell the rest at the market (Said, personal communication, 2016). Therefore, women play a deciding role in household food consumption. However, as household income increases, the male as head of the household will start to eat outside of the house in the town more often (Aklilu, personal communication, 2016). This leads to the men having a more diverse diet while the rest of the family continues to consume the same types of food.

Fair Planet is already working on women empowerment within their program with the aim to include more women in the list of farmers participating in the program. In Ethiopia, there are 2.2 women on average working per hectare for every 2.4 men (Rapsomanikis, 2015), however these women are often not reached. Training women farmers is one way to positively affect household nutrition because this can strengthen their control and decision making power over household resources (FAO, 2013) (The World Bank, 2007). However, more can be done. There is a great need to include both men and woman during educational sessions. Including men in discussions can allow for changes to take place within the household (FAO, 2015) (Herforth, Jones, & Pinstrup-Andersen, 2012).. Within this nutritional education, elements of appropriate processing, storage and cooking techniques should be incorporated (The World Bank, 2007). In this way, the Fair Planet program is more likely to reach the vulnerable family members.

However, sufficient attention must be paid to the approaches applied and ensure that they do have negative effects on nutrition. The project should make sure not to divert time away from important activities such as cooking, childcare, and maintaining hygiene. Some studies have shown that this is the case with projects focusing on woman, and in this way can have a negative influence on household nutrition (Herforth, Jones, & Pinstrup-Andersen, 2012).

7.3.4 A focus on soil health

The vegetables grown by the smallholder farmers in the Fair Planet program can provide much needed micronutrients for members of their own or surrounding families. However, the micronutrient content of these vegetables is dependent on the nutrients in the soil. The amount of micronutrients in the soil will decide the uptake of micronutrients by the plants (Welch & Graham, 2005). Soil sustainability is therefore essential to human health (Melnick, Navarro, McNeely, Schmidt-Trabu, & Sears, 2005). Lal (2009) writes that soil degradation affects more than just the quantity of food production. It has adverse effects on the balance and availability of plant nutrients and water, meaning it can impact the nutritional quality of the food, including protein and micronutrient values (Lal, 2009). The nutrition of households consuming these foods can therefore be greatly impacted by a reduction in soil fertility.

A nutrient deficit in the soil can be caused by bad management practices, including the low fertilizer application rate, removal of crop residues, unnecessary plowing, uncontrolled grazing, and poor crop rotation (Lal, 2009). The nutritional potential of high yielding crop varieties, such as those promoted by Fair Planet, can only be realized with good management practices (Twomlow, Shiferaw, Cooper, & & Keatinge, 2008).

An increased focus on soil conservation techniques and sustainable land management practices can promote soil fertility and prevent the deterioration of the natural resource base over time (Pretty, Morison, & Hine, 2003). Even though there may be sufficient application of NPK fertilizers, as is the case with Fair Planet farmers, unless micronutrient deficiencies are identified and corrected, the sustainability of high yield and soil productivity can decrease (Tandon, 1998). Enhancements in micronutrient concentration of the plants can significantly contribute to reducing micronutrient deficiencies in humans, specifically that of iron and zinc, two of the most widespread deficiencies causing severe health problems such as anemia and cognitive disabilities (Welch & Graham, 2005). Strategies for improving the availability of microelements in the soil include using micronutrient fertilizers based on soil tests and utilizing organic fertilizers, as well as the adoption of good management practices (Welch & Graham,

2005). Other examples of sustainable land management practices include activities such as crop rotation, intercropping, physical anti-erosion structures, water harvesting, and reduced tillage (Shiferaw, Okello, & Reddy, 2009).

It is of importance that Fair Planet maintains a focus on soil health, and does everything it can to make sure the knowledge of good management practices remains with the local partners when they leave in order for the project to be sustainable. Fair Planet shows dedication to improving soil quality by working together with research institutes like Alterra to find additional opportunities, although in the field this is not yet being translated into action. In addition, Fair Planet could experiment with practices such as intercropping, reduced tillage, integrated pest management and using compost to further prevent degradation, improve soil health and consequently farm productivity (FAO, 2015) (Pretty, Morison, & Hine, 2003). The adoption of these techniques by farmers can improve the nutritional quality of crops in Sub-Saharan Africa and meet the nutritional needs of present and future populations (Lal, 2009).

7.4 Connection to the framework

With simple adjustments Fair Planet can include actions in their current strategy influencing the six outcomes described in the framework of Herforth and Ballard (2016) and become a nutrition-sensitive agricultural intervention. Fair Planet is already affecting the **on-farm availability and diversity** of food by encouraging the use of high quality vegetable seeds and supervising the growing process. Most farmers are used to growing only staple crops, and including vegetables is new and adds diversity to their farm. This can consequently influence the diversity of their diet. Using vegetables as a cash crop can also increase **income** of smallholders, because they are producing beyond only for home consumption. **Sustainable natural resource management practices** are being promoted up to a certain extent within the Fair Planet guidance and guidelines, although this could be strengthened by including more sustainable land management practices as mentioned earlier. **Nutritional knowledge and norms** seem to be the greatest limitation to a diverse diet for Ethiopian smallholders. Therefore nutrition education is of great importance and can be included in the strategy. **Women's empowerment** is gaining attention within Fair Planet and reflected in its goal to have more women farmers joining the program. However, this could be strengthened by including them in regular training sessions and other educational activities. Working together with a female DA, who has focus on nutrition, will further empower women. All these outcomes if performed properly, with adjustments if necessary, will contribute to dietary impacts and eventually the nutritional status of smallholders.

8 Conclusion and recommendations for further research

The main research question of this thesis is as follows:

How can nutrition-sensitive agriculture be better incorporated within the approach of the organization Fair Planet?

The research performed has attempted to answer this question using different methods. Primarily it was important to understand the current strategy of Fair Planet, and then assess the impact it was having on different aspects of the smallholders' farm system and diets. Using the acquired information and that provided by literature, realistic recommendations could be made.

Fair Planet has included improving the nutrition of Ethiopian smallholder farmers as part of its mission, but is currently not yet active in pursuing this. Quantitative data shows no effect of the program on several elements of the farming system after one year, but year 1 farmers are overwhelmingly positive about the effects. They majority say they have a larger diversity in crops, higher overall yields, more or the same amount of livestock, and a higher average yearly profit from agriculture. With their profit from tomatoes from the first season they have primarily increased their assets such as land or a vehicle, as well as invested in expanding production. Farmers who have an entrepreneurial mindset have made greater gains.

Year 1 farmers in the program had a higher average DDS than year 0 farmers, but there was no difference in specific food group consumption. However, the majority of farmers noted that they ate more fruits and/or vegetables, followed by more ASF. The greatest barriers to farmers consuming a more diverse diet were cultural and religious beliefs, as well as lack of access and knowledge on nutrition and/or food preparation.

The Fair Planet program can become nutrition-sensitive by addressing some of the underlying determinants of nutrition in order to contribute to improving the nutrition of the farmers (FAO, 2016). Specifically, literature and the author's observations has provided with four recommendations in order to allow for this to take place. Fair Planet must include nutritional goals in its objectives and actively monitor and evaluate the outcomes, adjusting the approach if necessary. It should continue focusing on empowering women by including female farmers in the program, and inviting them to come to training sessions. Also, it can implement nutrition education for smallholder households, including both male and females, by working together with the female

agricultural extension officer already in place in the district. Lastly, it should focus on soil health and promote the use of good management practices, as well as compost and micronutrient-enriched fertilizers, in order to ensure long-lasting sustainability and soil fertility, hereby also preserving the nutritional value of the vegetables.

Further research has the potential to elaborate and continue to increase the nutrition-sensitivity of the Fair Planet program. For example, more opportunities for processing, storage and preservation of tomatoes and other vegetables grown by the smallholders should be explored. This would help them have a more diverse diet, improve year-round food access and reduce seasonality (FAO, 2015). Similarly, it could add value to crops and reduce food waste, benefitting both farmer revenue and home consumption (FAO, 2015).

Fair Planet has great potential to be more than only an agricultural intervention. By making small, realistic changes, as mentioned earlier, they can become nutrition-sensitive and have a greater impact on the lives of smallholders and their families in Butajira.

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Annex 1: Farmer questionnaire

Farmer name:
Township:
Age:
Number in household:
Education:
Date of interview:

Farm system questionnaire for year 0 farmers

Background and resources				
1. Do you own or rent land?	Own	Rent		
a. How much? (Ha)	<0.2	0.2-0.5	0.6-1	>1
2. How many crops do you have right now?	0	1-4	5-10	>10
a. Which crops?				
3. How many pieces of livestock do you have?	0	1-4	5-10	>10
a. Which livestock?				
Income				
4. Do you have other work besides farming?	Yes (fulltime)	Yes (parttime)	Sometimes	No
a. Which work?				
5. How much of your household income is from agriculture?	0-25%	26-50%	51-75%	76-100%
6. What is your average yearly profit from agriculture? (birr)	<20,000	20,001-40,000	40,001-60,000	>60,000
7. What do you plan to do with the profits from tomatoes?				
Nutrition				
8. What percentage of produce is consumed by the household?	0-25%	26-50%	51-75%	76-100%
9. Are you able to buy sufficient food for your household?	Yes	Sometimes	No	
Influence of Fair Planet				
10. What is your reason for collaborating with Fair Planet?				

Farm system questionnaire for year 1 farmers

Background and resources				
11. Do you own or rent land?	Own	Rent		
a. How much? (Ha)	<0.2	0.2-0.5	0.6-1	>1
12. How many crops do you have right now?	0	1-4	5-10	>10
a. Which crops?				
b. How has this changed since last year?	More	Less	No change	
13. How many pieces of livestock do you have?	0	1-4	5-10	>10
a. Which livestock?				
b. How has this changed since last year?	More	Less	No change	
Income				
14. Do you have other work besides farming?	Yes (fulltime)	Yes (parttime)	Sometimes	No
b. Which work?				
c. How has this changed since last year?	More	Less	No change	
15. How much of your household income is from agriculture?	0-25%	26-50%	51-75%	76-100%
a. How has this changed since last year?	More	Less	No change	
16. What is your average yearly profit from agriculture? (birr)	<20,000	20,001-40,000	40,001-60,000	>60,000
a. How has this changed since last year?	More	Less	No change	
17. What have you done with the profits from tomatoes?				
Nutrition				
18. What percentage of produce is consumed by the household?	0-25%	26-50%	51-75%	76-100%
a. How has this changed since last year?	More	Less	No change	
19. Have you noticed any change in your diet since you entered the program?				
20. Are you able to buy sufficient food for your household?	Yes	Sometimes	No	

Influence of Fair Planet				
21. What is your reason for collaborating with Fair Planet?				
22. What things do you do differently now that you are in the Fair Planet program?				
23. Do you attend the training of Fair Planet?	Yes	Sometimes	No	
a. If yes, do you find the trainings helpful?	Yes	Sometimes	No	
b. Will you share knowledge with your neighbours?	Yes	Some	No	
24. Do you see agriculture in a different way now that you are in the Fair Planet program?				

Dietary diversity questionnaire

Please describe the foods (meals and snacks) that you ate or drank yesterday during the day and night, whether at home or outside the home. Start with the first food or drink of the morning.
Write down all foods and drinks mentioned. When composite dishes are mentioned, ask for the list of ingredients. When the respondent has finished, probe for meals and snacks not mentioned.

Breakfast	Snack	Lunch	Snack	Dinner	Snack

When the respondent recall is complete, fill in the food groups based on the information recorded above. For any food groups not mentioned, ask the respondent if a food item from this group was consumed.

Q.	Food group	Examples	Yes=1, No=0
1	CEREALS	Corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + *insert local foods e.g. ugali, nshima, porridge or paste*	
2	WHITE ROOTS AND TUBERS	White potatoes, white yam, white cassava, or other foods made from roots	
3	VITAMIN A RICH VEGETABLES AND TUBERS	Pumpkin, carrot, squash, or sweet potato that are orange inside + *other locally available vitamin A rich vegetables (e.g. red sweet pepper)*	
4	DARK GREEN LEAFY VEGETABLES	Dark green leafy vegetables, including wild forms + *locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach*	
5	OTHER VEGETABLES	Other vegetables (e.g. tomato, onion, eggplant) + *other locally available vegetables*	
6	VITAMIN A RICH FRUITS	Ripe mango, cantaloupe, apricot (fresh or dried), ripe papaya, dried peach, and 100% fruit juice made from these + *other locally available vitamin A rich fruits*	
7	OTHER FRUITS	Other fruits, including wild fruits and 100% fruit juice made from these	
8	ORGAN MEAT	Liver, kidney, heart or other organ meats or blood-based foods	
9	FLESH MEATS	Beef, pork, lamb, goat, rabbit, game, chicken, duck, other birds, insects	
10	EGGS	Eggs from chicken, duck, guinea fowl or any other egg	
11	FISH AND SEAFOOD	Fresh or dried fish or shell fish	
12	LEGUMES, NUTS AND SEEDS	Dried beans, dried peas, lentils, nuts, seeds or foods made from these (eg. hummus, peanut butter)	
13	MILK AND MILK PRODUCTS	Milk, cheese, yogurt or other milk products	
14	OILS AND FATS	Oil, fats or butter added to food or used for cooking	
15	SWEETS	Sugar, honey, sweetened soda or sweetened juice drinks, sugary foods such as chocolates, candies, cookies and cakes	
16	SPICES, CONDIMENTS, BEVERAGES	Spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages	
	Did you eat anything (meal or snack) OUTSIDE the home yesterday?		

(Swindale & Bilinsky, 2006)

9 Annex 2: Map of Meskan Woreda including different kebeles