ETH zürich

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Ministry of Fisheries and
Agriculture, Seychelles

Master Thesis by

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The agricultural system in a small island developing state:

Characteristics, challenges and embedding in the socio-political context –

The case example of the Seychelles

November 2017

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Assignment of tasks

Name of student	Melina Glimmann
Title	The agricultural system in a small island developing state: Characteristics, challenges and embedding in the socio-political context – The case example of the Seychelles
Objectives	- Characterize the agricultural system on Mahé in terms of its current state, challenges and most critical components - Examine the perception of the local population towards the agricultural sector and locally produced food
Research question	What are the characteristics and the challenges of the agricultural system in a small island developing state and how is it embedded in the socio-political context? – The case example of the Seychelles
Theoretical approach and methods	- Qualitative system analysis of the agricultural system on Mahé, with data gathered through literature research and expert interviews - Explorative survey with local residents of Mahé on their perception of the agricultural sector and locally produced food
Expected results	- System model and system dynamics of the agricultural sector on Mahé that allow for a deeper understanding of the sector - Data on the perception of the local population towards the image and the importance ascribed to the agricultural sector, the agricultural labour market and locally produced food, including possible differences between socio-demographic groups
Referent	Dr. Pius Krütli
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Acknowledgement

Executive Summary

Many small island developing states (SIDS) share the challenges of having underdeveloped domestic agricultural sectors and being highly reliant on imported food products, challenges which subsequently put them in a vulnerable position when it comes to food and nutrition security. Research has been conducted on many of the current challenges that agriculture in SIDS is facing, for example on the role of limited natural resources or the progressive involvement of SIDS in international trade markets. Limited attention has been paid so far, however, to the local population's perception of the sector and their role in influencing agricultural practice. This thesis aims to contribute to filling this gap by examining the characteristics and challenges of the agricultural system on the main island of Mahé, Seychelles, and its embedding into the socio-political national context. By conducting a qualitative system analysis of the agricultural system, the main characteristics and current challenges of the sector have been examined and the role of the local population has been described. Findings show that many challenges in the agricultural sector today were closely linked to the local society. The local population is of importance for the sector in three different ways: they are responsible for the largest part of the demand for locally produced food, they are the potential workforce, and they also hold a certain amount of political decision power. By conducting a survey with local residents, the local population's opinion and image of these three areas was examined. Findings show that the local population has a generally positive attitude towards the sector. Respondents on average valued local food highly, acknowledged the importance of local agriculture in terms of ensuring food security, and were in favour of strong governmental support for the sector. It was also shown, however, that more than two decades of very limited priority and funding from the government towards the sector have clearly left their mark. Production and productivity for major crops and livestock have been decreasing and the agricultural system is in desperate need of assistance to reverse this trend and to be able to increase local food production in the future. Findings from this study further point out that, even though the public may be supportive of the agricultural system, whilst the sector remains in its current condition, the population alone has got very limited possibilities for action in order to reverse agricultural trends. It has therefore become evident that a strong institutional framework and higher funding as well as a consolidated effort from the different actors involved is needed to strengthen the sector.

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List of Abbreviations

CAADP	Comprehensive Africa Agriculture Development Program
CLISSA	Competitive Local Innovations for Small Scale Agriculture Project
EA	Enumeration Area
EFA	Explorative Factor Analysis
IFAD	International Fund for Agricultural Development
IMF	International Monetary Fund
MLUH	Ministry of Land Use and Housing Seychelles
MFAg	Ministry of Fisheries and Agriculture Seychelles
NBA	National Biosecurity Agency Seychelles
NBS	National Bureau of Statistics Seychelles
PUC	Public Utilities Corporation
QSA	Qualitative System Analysis
SAA	Seychelles Agricultural Agency
SAHTC	Seychelles Agricultural and Horticultural Training Centre
SIDS	Small Island Developing States
WTO	World Trade Organization

1 Introduction

Small island developing states (SIDS) are countries in different parts of the world that share characteristic such as remoteness, limited natural resource availability, fragile ecosystems, small size, strong dependence on international trade, and vulnerability to global environmental and economic changes (FAO, 2014; Lowitt, Ville, Lewis, & Hickey, 2015; Philpot, Gray, & Stead, 2015; United Nations, 2011). Food security and agriculture are aspects of SIDS that have shown to be particularly vulnerable to global change in the past (International Fund for Agricultural Development, 2014; Lowitt et al., 2015). Many SIDS share the challenges of underdeveloped agricultural sectors with limited production capacities, rising food prices and increasing shares of food imports. Imported food products are often highly processed, energy dense and poor in micronutrients, which contributes to increasing rates of non-communicable diseases within the population, such as the double burden of malnutrition (undernutrition as well as over-nutrition leading to overweight and obesity being present in a population at the same time), diabetes, and hypertension (FAO, 2014; Lowitt et al., 2015; United Nations, 2011). There is a common understanding that for most SIDS self-sufficiency in food production is not feasible. However, a strong agricultural sector that can consistently supply a certain share of domestic food demand is key to combat the challenges associated with long term food and nutrition security (FAO, 2014; International Fund for Agricultural Development, 2014; Lowitt et al., 2015). Also, most SIDS have in their history been at a point where domestic food production was able to contribute more towards self-sufficiency than it does today. Often, plantation industries for cash crop production that were built up after colonialization weakened and replaced traditional agricultural production for self-sufficiency and led to rising import shares over time (Eriksen, 2011; Lowitt et al., 2015).

The Republic of Seychelles is one example of a SIDS facing many of the aforementioned challenges (Government of Republic of Seychelles, 2013; Ministry of Fisheries and Agriculture Seychelles, 2015a, 2015b; Morel, 2014). The country is located around 1,500km east of mainland Africa in the Indian Ocean. The Republic consists of 115 islands that are spread over a sea area of 1.4 million km^2. Mahé, the country's largest island, accounts for more than a quarter of the total land area of the Republic, with a size of 152.5 km^2 (FAO & Government of Republic of Seychelles, 2014). It is also home to around 81,000 of a total of 94,000 Seychellois inhabitants (National Bureau of Statistics Seychelles, 2016). Economically, the most important sectors in the country are tourism and fisheries (Ministry of Fisheries and Agriculture Seychelles, 2015b). The agricultural sector has experienced a comparatively low level of support and importance ascribed from the government over the last 20-30 years. This has led to a decrease in both production and productivity for many crops as well as livestock. In

combination with increasing competition from imported food products due to a gradual liberalization of markets and joining the WTO in 2014, this has led to 70-80% of food being imported in 2015 (Government of Republic of Seychelles, 2013; Ministry of Fisheries and Agriculture Seychelles, 2015a, 2015b).

A number of exogenous shocks restricting food importation capacities—such as the global food price rise in 2008-2009; a volcanic eruption in Iceland in 2011 that restricted air traffic; and a number of piracy incidents in Seychelles' waters during the same time period—made it evident that importing such a high share of domestic food requirement posed high risks and made the country vulnerable to external disturbances. In response to this, the Seychelles government formulated policies stating that domestic agricultural production should be increased in order to improve food and nutrition security (Government of Republic of Seychelles, 2013; Ministry of Fisheries and Agriculture Seychelles, 2015b).

A number of challenges to increasing agricultural production in the Seychelles have since been identified. Among the most important are: limited natural resources such as agricultural land and fresh water; underdeveloped value chains and poor market access; and low access for farmers to financial services like loans. In addition, there is an overall underappreciation and stigmatization of the agricultural sector by the Seychellois population (Government of Republic of Seychelles, 2013; Ministry of Fisheries and Agriculture Seychelles, 2015b).

The local community's opinion and perception of agriculture is of great importance for the sector in different ways, since the domestic population *a)* is responsible for the majority of demand of national food consumption, *b)* represents the domestic potential labour force and *c)* holds some degree of democratic decision power. A certain level of goodwill and support from the local population is therefore crucial in order to establish an agricultural sector that is sustainable not only in ecological terms but also (and especially) in its economic and social dimensions. This thesis adheres to the Brundtland (1987: 292) definition of sustainability, which defines sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs". To the present author's knowledge, no extensive research on this topic in the Seychelles or in any other SIDS has so far been conducted. This has led to the formulation of the following research question:

- *What are the characteristics and the challenges of the agricultural system in a small island developing state and how is it embedded in the socio-political context? – The case example of the Seychelles*

Since the main island of Mahé accommodates over 85% of the Seychellois population and is central to most of the economic and institutional activities of the country, it was decided that restricting the research focus to this area would still result in overall sufficiently representative findings for the country. To answer the research question, it was further decided that the thesis would be split into two sections. In the first section, the current agricultural system on Mahé should be examined and characterized. The goal was to gain a good understanding of the sector's present state, the most important actors involved and difficulties occurring. This was deemed to be necessary in order to then put the findings of this paper's second section in context, in which the local population's perception of agriculture was examined. Summarized, this thesis' objectives are therefore to:

- *Characterize the agricultural system on Mahé in terms of its current state, challenges and most critical components*
- *Examine the perception of the local population towards the agricultural sector and locally produced food*

In order to generate the relevant results and to reach the goals described, first a qualitative system analysis (QSA) of the agricultural system on Mahé was carried out, followed by a survey conducted with individuals from the local population on Mahé. The methodological approach thereof is described in section 2. This is followed by the presentation of the results of both the QSA and the survey in section 3. In section 4 the relevant findings as well as limitations are discussed, and conclusions are drawn in section 5.

2 Methods

The methods section contains two parts. In the first part 2.1, the implementation of the Qualitative System Analysis (QSA) of the agricultural system in the island of Mahé is described. The second part 2.2 concerns the development, organization and implementation of the perception survey on Mahé as well as the analysis of the data gathered thereby.

2.1 Qualitative system analysis of the agricultural system on the island of Mahé, Seychelles

The QSA was conducted based on the approach of Vester (2013), with some adaptions made to fit the goals of this thesis. Since the QSA was not the only core element of the thesis, some parts of the analysis as suggested by Vester (2013) were simplified or left out since considered unnecessary for fulfilling its purpose. The overall aim was to gain a deeper understanding for the agricultural system in the Seychelles and to afterwards being able to interpret the findings from the perception survey in the context of the current condition and situation of the agricultural sector. For this, data from the literature as well as through a number of expert interviews was collected. In a next step this data was used to describe the system's current state in detail. Based on these findings, 19 system variables were defined to characterize the system sufficiently. After defining the influences that each of the variables had on all the other variables, the relations were represented and analyzed graphically in different ways. The detailed procedure is described in the following sections.

2.1.1 Data collection

Information and data was collected through informal talks, site visits, literature review and expert interviews. The first step consisted of reviewing the existing literature relating to the agricultural system in the Seychelles. This included policy papers, production and trade statistics and surveys, project reports as well as scientific papers discussing agriculture in the Seychelles and other SIDS. After arriving in the Seychelles, informal talks with farmers, employees of the Ministry of Fisheries and Agriculture (MFAg) and people from the general public as well as some site visits to farms, markets and the agricultural research station from the Seychelles Agricultural Agency (SAA) followed. To structure and further deepen the insights gained so far, nine expert (or as synonymously used in this thesis: key informant) interviews were conducted in May and June 2017. According to Baur & Blasius (2014) expert interviews can have the purpose of gaining different forms of knowledge and information, the following also applying to this thesis: inside knowledge about institutional procedures and knowledge about background and contexts of areas, that are small, informal and/or hardly accessible for an outsider. Additionally, in the context of the QSA and therefore for this thesis also opinions and subjective assessments of people knowing and acting inside the system are

valuable since they themselves can influence it substantially (Vester, 2013). The expert interviews conducted were semi-structured guideline interviews that were adapted to the experts' particular background. The interview guides can be found in Appendix 1.

2.1.2 System description

The first step of the QSA consisted of describing the agricultural system in the Seychelles. The goal of this was to develop a first systemic picture that helped understand what the system overall looks like. With the information collected (described in the previous section 2.1.1), a system definition was created with a superordinate and partial goals of the system as well as its spatial, systemic and temporal boundaries. According to Vester (2013), in this first step it is crucial to include the views of different actors involved in the system which was accounted for through using the different information sources originating from different actors described previously. For this step further a stakeholder analysis was conducted. The approach chosen was based on the so called snow-ball sampling, where stakeholder categories are identified and then individuals from these different categories are interviewed to expand the understanding about the stakeholder situation and possibly create new or adapt existing categories (Reed et al., 2009). In the present case this was done by first identifying a number of stakeholder categories from the existing literature. The experts that were interviewed belonged to different stakeholder categories and were asked to comment on these categories and potentially missing ones. Based on this, a picture of the most relevant stakeholders and their connections in the agricultural system was drawn.

2.1.3 Definition of impact variables

From the system description a set of variables was derived. A variable (or impact/system variable, as synonymously used in this thesis) is of changeable quantitative or qualitative nature and represents an important aspect of the system (Vester, 2013). Examples for variables in an agricultural system would be the workforce, agricultural land or the institutional framework of the sector. The goal of this step was to define 15-20 variables that would sufficiently describe the system and cover its important aspects. Doing this was an iterative process that included reviewing the data gathered so far, collecting new information and also, where necessary, make some adaptions to the system description completed in the previous step. The variables had to be precisely defined and checked for their relevance in representing the agricultural system on Mahé. This was first done by using a set of criteria designed by Vester (2013). It was checked that all the different criteria were covered by one or multiple variables. For example, there should be variables in the set that have a primarily material character (such as infrastructure) and others that have a primarily energy-related (e.g. power consumption) or information-related (e.g. perception or information channels) character. The

full list of criteria and variables covering them can be found in Appendix 2. To make sure that the variable set represented the real and not only a theoretical system, as a last step, a workshop with agricultural experts from the MFAg was conducted. In the workshop, first the concept of the QSA was explained. Afterwards, the system description of the agricultural sector done so far was presented as well as the preliminary list of variables and their definitions. The four experts attending were asked to comment first on the system description and second on the selection of variables as well as their definitions. Comments and suggestions were noted down and afterwards integrated into the final set of variables.

2.1.4 Studying interactions between variables

To study the interactions between the variables, a matrix of influences was used. In a table, for each variable the direct influence was assessed that it would have on all the others, if that one variable was changed. The strength of the influence was classified as follows: '*0 = no influence*', '*1 = weak influence*', '*2 = medium influence*' and '*3 = strong influence*'. Again, these estimations were based on all the data and results obtained up to that point. Further, the influence matrix was filled out in close collaboration with an expert from the MFAg. The sum of all the influences that a variable had on all the other variables indicated how active this variable is within the system. The sum of all the influences that variables have on one other variable on the other hand showed how passive the variable is within the system.

2.1.5 Systemic picture

With the help of the software SystemQ V10.0 (Copyright 2007-2014, Systaim GmbH, Sep 2017) the influences of the variables between each other were visualized. This enabled identifying which variables tended to be passive or active, buffering or critical. The visualizations also provided a good overview over the general system, its degree of complexity and made it possible to make a general judgement about the system in terms of its activeness or sluggishness (as discussed by Vester, 2013). Again, these outputs were discussed with and validated by experts from the MFAg in July 2017. The concept of the QSA was explained, the strong influences were presented (the system graph) as well as the systemic picture (a system grid of direct impacts showing which variables were active, passive, critical or buffering). Afterwards the experts were again asked to comment on the results, especially focusing on whether the system model represented the reality of the agricultural system on Mahé well. The results and comments were afterwards integrated into the system, by adjusting the variables' definitions and influences on each other.

2.2 Perception survey

The goal of the survey was to reflect the opinion about the agricultural and food system of the general population living on the main island of Mahé. The data was obtained by using a standardized questionnaire. It was decided that this instrument would best be suited to allow making a decision about confirming or rejecting the main hypothesis of the agricultural sector being undervalued and stigmatized. Further it was aimed to evaluate the sub-hypothesis that belonging to different socio-demographic groups could be associated with giving different answer types.

2.2.1 Development of questionnaire

In a first step the questionnaire was designed. It covered three main thematic areas: Demand and perception of locally produced compared to imported food, the attractivity and image of the agricultural labour market and the general current image of the agricultural sector in the Seychelles. Most questions were posed in a likert scale format, using a range from '*1 = not at all agree*' to '*7 = strongly agree*'. This question type is common in social sciences and well suited for assessing attitude dimensions (Baur & Blasius, 2014), like in the present case the attitude towards the before mentioned three main thematic areas. Other questions included were single and multiple response questions with answer options given, open ended questions and one question that asked participants to rank items according to importance. Data on age, gender, educational level, household income, household members and district of residence was also collected to allow for differentiation of results between different socio-demographic groups. The questionnaire was pretested in a first phase with a total of 7 people. After adaptions were made, a second pretest with a total of 18 people took place before the final version of the questionnaire was finalized both in English and Creole. The complete questionnaires can be found in Appendix 3.

2.2.2 Survey sample

The targeted number of respondents for the questionnaires was 250 people to represent the total population of Mahé. In view of time, financial and personal resources constraints it was decided that a cluster sampling method would be best suited for determining the survey participants. In contrast to a simple random sampling, in the cluster sampling a primary and, if necessary, secondary sampling unit is chosen first, before doing a simple random sampling within these units (de Leeuw, Hox, & Dillman, 2008). In the case of this survey, as primary sampling unit four districts from the four different regions on Mahé were selected: Anse Royale in the South-Eastern Region, Grand'Anse in the Western Region, Beau Vallon in the Northern Region and Saint Louis in Greater Victoria. After consulting with the National Bureau of Statistics Seychelles (NBS) it was decided that these four districts would best be suited to reflect each of the four regions. Due to an expected number of non-

respondents the targeted number of 250 people was increased to 350 and the latter was split onto the four districts according to their population size. As secondary sampling unit within the districts, two enumeration areas (EA) were randomly selected. The EA were created by the NBS that split each district in a number of EA, in order to conduct surveys and collect census data. The number of people to interview in the chosen districts was again split to the two EA according to their population size. Within the EA, the so calculated number of respondents targeted was randomly selected out of all the households listed in the EA. From each household only one member was interviewed. For the pretesting the approach of Kish (1965) was used which choses a random person from all household members after listing all the household members. However, it got apparent that this method resulted in very low response rates, because many of the so targeted respondents were not at home at the time of the visit. Since it was not possible to reschedule interviews and make multiple visits to the same household, it was decided to apply the Kish Grid method of random selection in a way that it only included the household members that were at home at the time of the interview. This meant that only these members were listed and the person to interview was only chosen from these people, ignoring household members that were not at home during this time. Knowing that this would introduce some kind of respondent selection bias, it was still decided that this measure was necessary in order to being able to reach enough respondents. The number of respondents thereby reached was 239. Assuming a total population on Mahé of 81'000, with a confidence interval of 95% this results in confidence levels of about ±6.3%.

2.2.2.1 Non-response in survey sample

To account for non-respondents, the households chosen were oversampled by 40% (350 sampled households and 250 households as a target). When there was no response from a household (e.g. because no household members were at home), the interviewers went on to the next household sampled. Unfortunately it was not noted how often this happened and therefore no precise non-response rate can be calculated. However, two points were observed: first, it happened very rarely that someone directly refused to take part in the survey (the author was present at about 55% of all interviews in all different districts and noted this only happening 3 times). Second, if all the 350 sampled households would have been visited, with 239 respondents out of these 350 agreeing to get interviewed the response rate would has been around 68%. However, not all the 350 sampled households were visited. This means that 68% is the lower boundary of the actual response rate. Yet, this has to be relativized up to a certain point, since the selection of the household member to be interviewed was restricted to the people being at home at the time of the visit. If the selection of the respondents would have been strictly randomized with the Kish grid method within all the members living in the household, the response rate would have been lower.

2.2.2.2 Goodness of fit of respondent sample

To assess whether the respondent sample provided a good match to the known distributions of different socio-demographic factors in the total population, being age, gender, educational level, household income and household size, a chi square goodness of fit test was conducted. The data that was used for the comparison was obtained from the Household Budget Survey 2013 (National Bureau of Statistics Seychelles, 2013), which is covering the three main islands of Mahé, Praslin and La Digue. Even though the data from the three islands is aggregated, it was still the best option to use since no such detailed data is available for the island of Mahé alone. Furthermore, 87.4% of the respondents from the Household Budget Survey 2013 were located on Mahé. This led to the assumption that, with carrying potential uncertainties in mind, the data provided the best approximation available to characterize the population of Mahé:

H_0: *The distribution of the socio-demographic characteristic looked at in the sample is the same as its distribution within the population of Mahé.*

H_1: *The distribution of the socio-demographic characteristic looked at in the sample differs from its distribution within the population of Mahé.*

Significance level: p = 0.05

For the socio-demographic variables age (Pearson Chi-Square (3) = 2,523, p = 0.471) and district of residence (Pearson Chi-Square (3) = 2,584, p = 0.460) H_0 was accepted and it was therefore assumed that the distribution of these variables in the collected sample were the same as in the total population.

For the variables income (Pearson Chi-Square (5) = 51,424, p = 0.000), household size (Pearson Chi-Square (4) = 16,820, p = 0.002), educational level (Pearson Chi-Square (4) = 64,581, p = 0.000) and gender (Pearson Chi-Square (1) = 14,725, p = 0.000), H_0 was rejected, meaning that the distributions of these variables within the sample differ from the distributions in the total population.

Within the sample, both lowest (less than 4,000 SCR) and highest (more than 20,000 SCR) income groups were underrepresented compared to the total population. Consequently, in the sample the intermediate categories were overrepresented which was leading to a smaller variance within the monthly household incomes of survey respondents compared to the population.

There were about 10% more households belonging to the smallest household size category (1-2 members) in the population than in the sample. Consequently, the share of all the larger households was slightly overestimated in the sample compared to the population. In total, the household size

was therefore overestimated in the sample compared to the population.

Compared to the total population, the share of respondents having completed obligatory primary/secondary school as a highest educational level reached was underrepresented in the sample by about 19%. On the other hand, people not having completed obligatory primary/secondary school and people having completed polytechnic school, A levels or similar were overrepresented in the sample by about 8% and 11% respectively.

The sample of respondents showed an overrepresentation of women, with a share of 61% compared 48% in the total population. Male respondents were consequently underrepresented in the sample by about 13%. Some selection bias of respondents was most probably introduced due to some people not being at home during the day when the survey was conducted. This means that people who were more likely to be at home during the day were more likely to be interviewed. This selection bias combined with focusing on four districts only and having a rather limited number of respondents are most likely the reasons for the differences found in socio-demographic characteristics in the respondent sample compared to the total population. However, the variable that showed to be associated with the most differences in answers, the district of residence of respondents, showed the same distribution in the respondent sample and the total population. Further, the other socio-demographic variables that were differing in the respondent sample and the total population, did so only to a maximum of 13% (for gender, where no differences in answers between female and male respondents could be observed) which was considered to be acceptable.

2.2.2.3 Dependencies between socio-demographic variables

To check for dependencies between different socio-demographic variables, a Pearson's Chi-Square Test was conducted between all of them. This was deemed necessary for making sure that the afterwards following tests for differences in answers given between different socio-demographic groups could be interpreted correctly. An example for this pitfall would be if living in a certain district would be associated with giving a certain answer type, without acknowledging that within this district the occurrence of another socio-demographic characteristic, e.g. high monthly household incomes, is highly prevalent, which could also have been the reason for the association with the certain answer type.

For the following three pairs, dependencies were found: Gender and previous agricultural working experience (Chi-Square (1) = 5.222, p = 0.022), educational level and monthly household income (Chi-Square (20) = 72.933, p = 0.000) and monthly household income and district (Chi-Square (15) = 32.360, p = 0.006).

More women (82%) than men (69%) never worked in agriculture before and consequently the share of people who have had previous working experience in the agricultural sector consisted of more men (31%) than women (18%).

Looking at the relationship between educational level and monthly household income it was observed, that higher education seemed to be associated with higher household income. From the respondents that were belonging to the two lowest monthly household income categories (less than 4,000 SCR up to 8,000 SCR), 63% also belonged to the two categories indicating lowest educational levels reached (no school completed or obligatory primary/secondary school completed), whereas only about 23% belonged to the two highest educational level categories (having finished Polytechnic, A levels or similar up to university or equivalent). From the respondents belonging to the two highest household income classes (from 16,000 to more than 20,000 SCR per month), only 31% belonged to the lowest two educational levels (no school completed or obligatory primary/secondary school completed) and almost 68% to the two highest categories (having finished Polytechnic, A levels or similar up to university or equivalent).

For the monthly household income categories, in Anse Royale, 64% of the respondents were belonging to lower half of the spectrum (less than 4,000 – 12,000 SCR) and 36% belonging to upper half (12,000 – more than 20,000 SCR). For Saint Louis, these percentages were 61% (less than 4,000 – 12,000 SCR) and 39% (12,000 – more than 20,000 SCR). In Grand'Anse exactly half of respondents were belonging to each lower and upper half of the scale, whereas in Beau Vallon comparably least respondents (39%) were belonging to the lower half of income categories and the highest share of all districts (61%) belonged to the upper half (12,000 – more than 20,000 SCR). Also, Beau Vallon by far had the highest share (30%) of respondents belonging to the highest monthly household income category (more than 20,000 SCR) compared to the other districts (5-11%).

2.2.3 Implementation of survey

The survey was conducted between August 10th and 28th 2017. There was a total of 10 interviewers which, besides from the author, all were employees from the MFAg or the SAA. The interviewers were briefed about participant selection, the questionnaire and further aspects of conducting the face-to-face interviews before going out to the field. Face-to-face interviews were chosen for two reasons: first, it was the easiest way to contact the respondents from the chosen sample and second, with direct contact it is usually easier to make sure that respondents understand the questions correctly and are therefore able to give valid answers to them (de Leeuw et al., 2008). Due to the author's lack of prior experience with surveys in the Seychellois context, this second point was viewed to be of crucial importance, as confirmed after a consultation with the NBS during the planning phase.

2.2.4 Analysis of responses

Statistical analysis of the sample collected and of the responses from the questionnaires was done using the software SPSS Statistics Version 24 (Copyright IBM Corporation and its licensors, 1989, 2016, Sep 2017). The content analysis comprised an explorative factor analysis, a descriptive analysis of frequencies and ranges of answers and checking for differences in answers given between different socio-demographic groups by using the Kruskal-Wallis test method.

2.2.4.1 Explorative factor analysis

Before examining the hypotheses, an explorative factor analysis (EFA) was conducted to search for latent variables in the data (from now on referred to as components). This was done to find structures and overall themes in the answers of respondents and to later being able to summarize findings and present them more clearly. As input variables all the questions that produced at least ordinal answer data were used. These were the Likert scale questions as well as questions that asked for the frequency of buying locally produced food products. After the execution of the EFA, the internal reliability of each resulting component was tested by using Cronbach's Alpha. Components that had a Cronbach's Alpha value of lower than 0.5 were excluded from further analysis since values this low are considered unacceptable (Field, 2009). Also, if removing a variable from a component led to a higher Cronbach's Alpha value, it was done so.

The EFA was conducted using a varimax rotation method. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO = 0.642) as well as Bartlett's Test of Sphericity (Chi-Square(253) = 1024.87, $p = 0.000$) indicate that the chosen method is an accepted approach for the data. The scree plot as well as the number of variables per component pointed in the direction of using 4 components. However, the Eigenvalue criterion of being higher than 1 as well considerations of content suggested using 7 components that together explained 56.42% of the total variance. Two of the components were excluded from further analysis after reliability testing since they had a Cronbach's Alpha value of less than 0.5 which is considered unacceptable (Field, 2009). From component 2 one variable was removed ('*Currently, about 75% of food in Seychelles is imported. This share should be increased in order to have more imported food products*') since with its exclusion the Cronbach's Alpha value for the component increased from 0.690 to 0.742. The final five components were interpreted in terms of the variables they contained are presented in the following table:

Component	Variables (= items from questionnaire)
Component 1: *Importance ascribed to* *and image of the*	Q3b) Agriculture is an important part of the Seychellois culture and national identity (answer on Likert scale of agreement 1-7)
	Q3e) Agriculture is a part of the landscape of the Seychelles (answer on Likert

agricultural sector *(Cronbach's Alpha: 0.731)*	scale of agreement 1-7) Q3f) Seychellois agriculture is a valuable tradition that should be preserved (answer on Likert scale of agreement 1-7) Q3c) Agriculture plays an important role for food security in the Seychelles (answer on Likert scale of agreement 1-7) Q3k) The government of Seychelles should constantly support farmers financially to guarantee the survival of local food production (answer on Likert scale of agreement 1-7) Q2b) I believe that working in agriculture is prestigious (answer on Likert scale of agreement 1-7)
Component 2: *Importance ascribed to locally produced food* *(Cronbach's Alpha: 0.742)*	Q1c) I am willing to pay a higher price for meat if I know that it has been produced locally (answer on Likert scale of agreement 1-7) Q1b) I am willing to pay a higher price for vegetables and fruit if I know that it has been produced locally (answer on Likert scale of agreement 1-7) Q1a) In general I pay attention whether the food I am consuming is locally produced or imported (answer on Likert scale of agreement 1-7)
Component 3: *Current condition of the agricultural sector* *(Cronbach's Alpha 0.665)*	Q3g) The agricultural sector in Mahé is doing well (answer on Likert scale of agreement 1-7) Q3h) The agricultural sector in Mahé is providing fresh and tasty food for the population (answer on Likert scale of agreement 1-7)
Component 4: *Frequency of purchase of locally produced fruit, vegetables & root crops* *(Cronbach's Alpha: 0.580)*	Q1d) If you buy vegetables or root crops, how often do you choose locally produced products compared to imported products? (answer on frequency scale from 0-4) Q1f) If you buy fruit, how often do you choose locally produced products compared to imported products? (answer on frequency scale from 0-4)
Component 5: Frequency of purchase of locally produced chicken and other meat *(Cronbach's Alpha: 0.603)*	Q1j) If you buy other meat, how often do you choose locally produced products compared to imported products? (answer on frequency scale from 0-4) Q1h) If you buy chicken, how often do you choose locally produced products compared to imported products? (answer on frequency scale from 0-4)

Table 1: Components resulting from the EFA and the questionnaire items they are containing. The Cronbach's Alpha value gives an indicator of the internal consistency of the components. The variables are ordered according to their factor loadings, meaning that factor loadings are successively decreasing from first to last mentioned variable for a component.

The factor scores were determined after the internal reliability tests that were leading to the removal of some of the variables. They were calculated as mean value of the items included in the

components. This had various reasons: First, after the internal reliability test, from some of the variables an item was removed. This means that the item loadings as such within the components were not accurate anymore, however, they would be the basis of calculation for more sophisticated factor score determination like the Bartlett's method (Field, 2009). Second, Cronbach's Alpha assumes that all items on a scale are given equal weight in order to estimate reliability. Since this method was used to determine which items to keep within the components and also which components as such to further use and which not, it was deemed appropriate to also use the equal weighting of the items to calculate the factor scores. A third reason for using the mean over another method to calculate the factor scores was, that this method is more transparent and results in answer scales that are the same as the ones used for the items within the components. Both of these aspects lead to easier and better interpretability of the factor scores.

Further it has to be noted that for item Q2b in component 1 there was a slight translation inaccuracy: the Creole version rather translated to 'I believe that working in agriculture has value' than to 'I believe that working in agriculture is prestigious'. Since both of these meanings fit well into the component 1 it was still decided to keep the item in the component, with bearing in mind the implications this has on possible interpretations.

2.2.4.2 Descriptive analysis

To make an overall statement to the main hypothesis of the agricultural sector being undervalued and stigmatized, an evaluation was done of the range and frequencies of answers given. Open answer questions were previously reviewed and categorized according to the content of answers given. All the further questions that produced nominal data, namely the open questions, multiple answer questions and ranking questions, were displayed and analyzed descriptively.

2.2.4.3 Differences between socio-demographic groups

To make a judgement about the sub-hypothesis that there are differences in answers given between different socio-demographic groups, a Kruskal-Wallis test was conducted for each of the components found in the EFA as well as for some single items. The Kruskal-Wallis test was chosen since the data did not pass the tests for normal distribution and neither was suited to being used in any kind of regression analysis. For the socio-demographic variables where there was found a significant difference in mean ranks in the Kruskal-Wallis Test, following a Jonckheere-Terpstra Test was conducted to determine whether there was a clear trend to be found within the data or not.

3 Results

3.1 Qualitative system analysis

3.1.1 Qualitative system characterization

The system description section is divided into three sub-sections: System definition, goals and boundaries (3.1.1.1); the different parts of the agricultural sector (3.1.1.2); and the results of the stakeholder analysis (3.1.1.3). As described in the methodology section (2.1.1) the data and information used were collected through expert interviews and literature review.

3.1.1.1. System definition, goals and boundaries

For the purpose of the Qualitative System Analysis (QSA) the main goal and at the same time the definition of the system was set as an agricultural system in Mahé, Seychelles, that is socially, economically and environmentally sustainable. In order to reach this main goal, a sub-goal of increasing domestic food production was set. This was deemed necessary also to reduce the vulnerability to food security arising from the great dependence of imported food stuffs as described as well within the Seychelles National Agricultural Investment Plan 2015-2020 (Ministry of Fisheries and Agriculture Seychelles, 2015b), and also to strengthen the system itself and its importance within the national context.

The spatial boundaries of the system were set to the main island of Mahé. On a systemic level, the analysis was restricted to professional agriculture (crops and livestock), including agricultural inputs, the production, distribution, marketing and the legal and institutional framework it is embedded in. The temporal boundaries were not considered essential for this thesis since its focus is not on the development of recommendations or constructing future scenarios but on gaining a deeper understanding of the current state. However, as rough orientation for temporal boundaries serves a time horizon until 2030.

3.1.1.2. Description of the current state and important historical developments of the agricultural system

Building on the data gathered through literature review and expert interviews, the different aspects of the agricultural system were described. These are weather and climate; agricultural land, topography and soil; technology, mechanization and infrastructure; agricultural inputs; education and agricultural labour market; historical development and current situation of national production and food imports; producers cooperation, value chains and market access; demand and perception of local population; and institutional and legal framework, which are presented in this section:

A) Weather and climate

The climate of the Seychelles is warm (24-34°C) and humid (79-83%) throughout the whole year. There are two main seasons, the relatively cooler and dryer Southeast Monsoon (May-October) and the warmer Northwest Monsoon (December-March) that also brings more rainfall. June, July and August are the driest months with July having only an average of 47mm of rain. During this dry time, there can be severe water shortages affecting the agricultural sector. In December, January and February on the other hand precipitation is highest reaching a maximum in January with an average of 483mm (the averages were calculated with data between 1972 and 2006). However, rainfall patterns usually vary substantially over the years. Due to climate change these variations are expected to intensify, as well as the average annual temperature in Mahé is expected to increase by about 0.6°C until 2025, with extremely high temperature events occurring more often. Precipitation is projected to overall increase with heavy rainfall events being the main contributor, which could increase problems such as flooding on coastal plateaus, soil erosion and nutrient runoff (Abu Dhabi Urban Planning Council, 2015; Ministry of Fisheries and Agriculture Seychelles, 2015a). Key informant 3 stated that many farmers are noticing changes in the before quite constant weather and seasonal patterns, especially generally warmer temperatures and more extreme events like severe dry times and strong rainfalls. It was also added that most of the farmers clearly associate these developments with climate change. Since the soils water holding capacities are low, runoffs are usually high and the mentioned drought periods are predicted to increase, it is expected that severe water shortages will occur more often, exacerbated by a rising demand from both the local population and the tourism sector (International Fund for Agricultural Development, 2017).

B) Agricultural land, topography and soil

In 2015, there were 500 registered farmers on Mahé. Farms are comparatively small, with farms producing on more than 2ha of area already considered to be large farms in the Seychelles context (Ministry of Fisheries and Agriculture Seychelles, 2015b). The island of Mahé has a size of 152.5km^2 (FAO & Government of Republic of Seychelles, 2014). In the whole country, *1701ha* are potentially arable. Of these, about *1021ha* are allocated for agricultural use but only about 357ha were in use by farmers in 2011 (Ministry of Fisheries and Agriculture Seychelles, 2015a). The following figure 1 shows the spatial distribution of agricultural activity on the island of Mahé in 2015. Most of the agricultural activity is located in the South-Eastern region of Mahé.
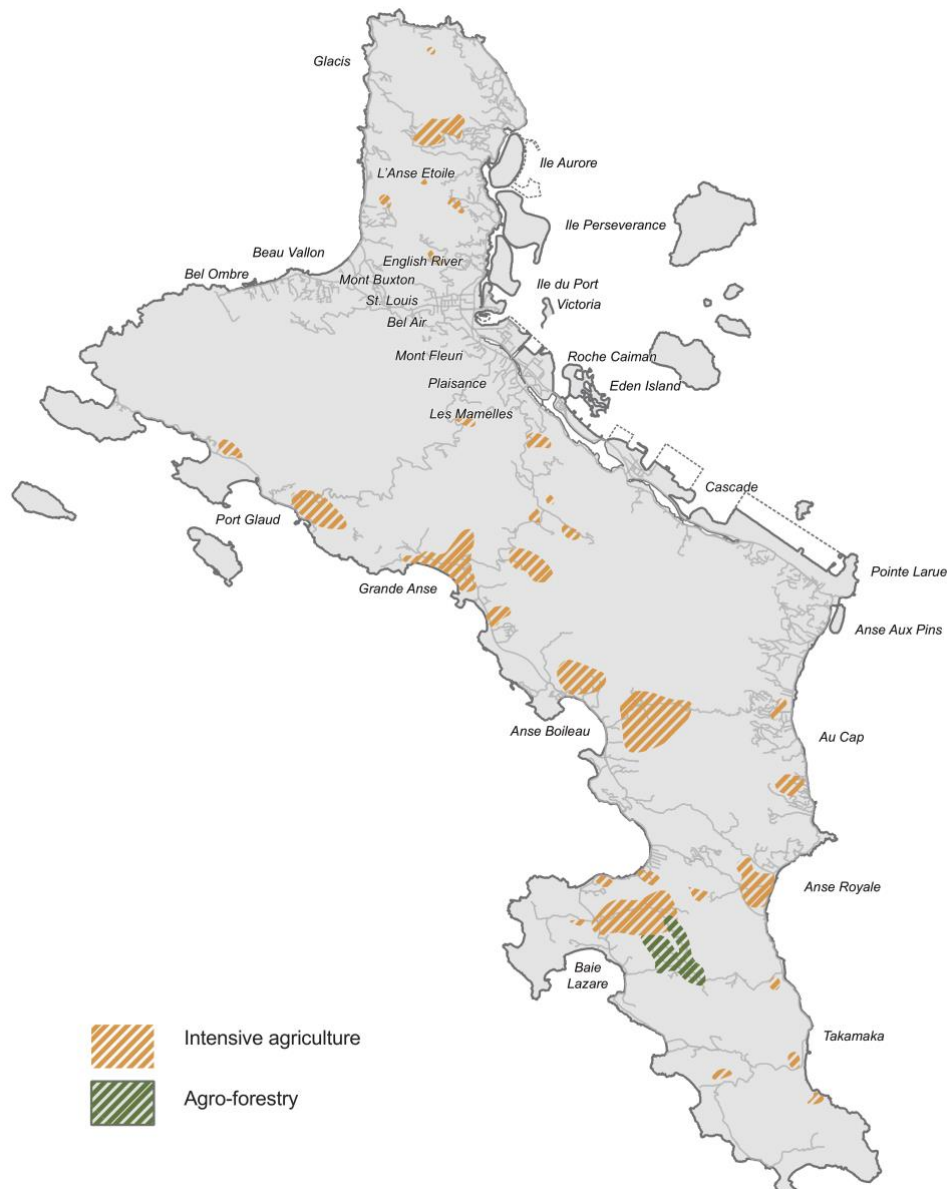
Figure 1: Areas of intensive agriculture and agro-forestry practiced in 2015 on the island of Mahé (source: Abu Dhabi Urban Planning Council, 2015)

Key informants 1 and 3 agreed that even though it seems that at the moment agricultural land is still abundant, there are some challenges with the valorization of the land. The overall responsibility for territory and therefore also for leasing state land lies with the Ministry of Land Use and Housing (MLUH). The implementing actor however is the SAA which administers the lease directly with the interested farmers (Ministry of Fisheries and Agriculture Seychelles, 2015a). Key informant 3 explained that it happens quite some times that farmers lease land for a longer time period but after a while decide not to use it for farming purposes anymore. It was further added that in this case it is very difficult to re-allocate this land to farmers who would actually want to use it. In addition to the limited available land resources in general, agricultural land is also being under constant pressure

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from other sectors, like tourism, that seem to be more profitable (Government of Republic of Seychelles, 2013).

There are two main types of soil found on agricultural land on Mahé: sandy soil in coastal regions and red soil found on hills and mountains of the granitic islands. These soil types lack in important micro and macro nutrients and usually have a low organic matter content (0.3-0.5%). The fertility as well as water holding capacity is low (Abu Dhabi Urban Planning Council, 2015; Ministry of Fisheries and Agriculture Seychelles, 2016a). Nearly three quarters of farms on Mahé are located in mountainous regions with less than 20% of these using terracing on slopes (Seychelles Agricultural Agency, 2015). Key informant 3 stated that this practice sometimes leads to heavy soil erosion if not done correctly, for example if terraces are built during the wet season. Besides soil erosion, the soil and topographical conditions in combination with reoccurring heavy rainfalls also often lead to the washout of the already low concentrated nutrients (Abu Dhabi Urban Planning Council, 2015).

C) Technology, mechanization and infrastructure

The level of mechanization and advanced technology used by farmers is generally low. Especially small farms are highly dependent on manual labor. Mechanical operations are mostly restricted to irrigation operations and land clearance. Almost half of the farmers (49%) use some sort of sprinkler or drip irrigation system (Seychelles Agricultural Agency, 2015). Other operations like tillage, planting, weeding, fertilizer application and harvesting are mostly manually done. Reasons for this could be small farm sizes, farm topography (especially small farms are often located in hilly regions which are not well suited for the use of machinery), price and availability of equipment (Seychelles Agricultural Agency, 2015; Key informant 2 and 3). Additionally, new technologies are dispersed and adopted only very slowly by farmers (Morel, 2014).

One of the most common types of farm infrastructure used are shade houses which had been introduced in 1990 and enabled farmers to produce certain crops, especially vegetables, more consistently than before (Ministry of Fisheries and Agriculture Seychelles, 2015a). In 2015, 65% of vegetables produced were cultivated underneath shade houses (Seychelles Agricultural Agency, 2015).

D) Agricultural Inputs

Due to the mostly low nutritional content of soils, many farmers respond by using high amounts of fertilizers (Ministry of Fisheries and Agriculture Seychelles, 2015a). 85% of farmers in 2015 reported to always or often use organic fertilizer, mainly poultry manure, compost, cattle or other manure. The manure is either self produced or bought from other farmers, especially from chicken farmers (Seychelles Agricultural Agency, 2015). Key informant 1 in that regard strongly emphasized the

importance of the livestock sector on Mahé and pointed out that without the livestock sector the crop sector in its current form could not exist, because manure as fertilizer plays a crucial role. 42% of farmers also reported on using always or often inorganic types of fertilizer (Seychelles Agricultural Agency, 2015). However, key informant 3 pointed out that these numbers have to be treated with caution. First, self-reported numbers could be unreliable due to social desirability of reporting lower usage of inorganic fertilizers and second, it was explained that especially large farmers tend to use a lot more inorganic fertilizers than smaller farmers, which means that the ratio of organic and inorganic fertilizer used might look a lot different, if amount or area under usage would be compared instead of farmers. A report from the MFAg (2016) additionally mentioned that with a decreasing number of livestock in recent years the availability of manure has declined and farmers have been forced to use more inorganic fertilizers as a replacement.

Key informants 3, 4 and 6 stated that besides organic fertilizer, most of the inputs used were imported, like certain seedlings, young animals or pesticides, although some farmers would produce their own seeds or hatch their own young animals, especially chicken. In 2017 there were three main livestock feed providers in place that have outlets on Mahé. Two of them are Mauritian companies importing the feed products they are selling and one is a Seychellois company producing feed on the island but with imported inputs as well. In 2016 the two Mauritian companies were responsible for around 87% of feed sold in the Seychelles, only 13% of the feed sold was produced by the Seychellois company (Estico, 2017). None of the farming key informants (4, 5 and 6) reported input supply being associated with major issues for them lately. However, in general input prices are often high and availability can be problematic due to importation (IFAD, 2017; Key informant 1).

E) Education and agricultural labour market

Currently there is one main institution in place for agricultural education on Mahé, which is the Seychelles Agricultural and Horticultural Training Centre (SAHTC) at Anse La Mouche (Ministry of Fisheries and Agriculture Seychelles, 2015b). There also were discussions with the University of Seychelles about incorporating agricultural sciences in the final year of the bachelor program in environmental sciences, however, this has not been officially introduced yet (Key informant 1). The SAHTC has experienced a severe gradual decline in student applications as well as in drop outs of enrolled students over the last years, with only a quarter of 80 available yearly student places taken in the beginning of the academic year in 2017 (Key informant 2). Key informant 2 named different reasons for this. First, there is growing competition from other educational institutions. Further it was mentioned that students generally perceive working conditions in the agricultural sector to be unfavourable both in terms of having to do physically hard work as well as career options being limited and salaries poor. In addition it was stated, that the bad image of the sector in general and

missing education about agriculture in primary and secondary schools result in no cultivation of interest. It was also mentioned, that the majority of students who actually finish their degree at SAHTC do not work in the agricultural sector afterwards but seek employment in other sectors with better working conditions (Key informants 2 and 9).

A study conducted by Morel (2014) showed that the low interest in student enrollment in the SAHTC was perceived as problematic by farmers, since it is very difficult to find skilled and reliable local workforce. This was confirmed by key informants 1, 2, 4, 5 and 6. In 2015, there were 500 registered farmers on Mahé which reported to have a total of 755 employed workers (Ministry of Fisheries and Agriculture Seychelles, 2015b; Seychelles Agricultural Agency, 2015). About a third of workers were expatriates, many of them coming from Bangladesh and being mainly employed at larger farms (Seychelles Agricultural Agency, 2015; Key Informant 2, 4 and 5). All the key informants that were farmers themselves (4, 5 and 6) stated, that they would prefer hiring local workforce to expatriates. On one side this was reported to be cheaper (Key informants 4 and 6) and on the other hand there also seemed to be certain mistrust in foreign workers. Key informant 4 and 5 explained, that they were generally afraid of foreigners gaining too much control and power within the agricultural sector. The two of them as well as key informant 2 also agreed that if nothing changed, in the future there would be more and more relatively large farms with only expatriate workers swallowing up the smaller farms that still worked more with Seychellois employees. On the other hand, all of the farming key informants (4, 5 and 6) as well as others (key informants 1 and 2) agreed that working with local employees was very difficult up to impossible. The main issues mentioned were workers having problems with drug abuse, stealing from their employers, not being reliable and not being willing or able to work long hours. None of these problems were reported with expatriate workers.

When it comes to gender, about 88% of farmers as well as workers are male (Ministry of Fisheries and Agriculture Seychelles, 2015a; Seychelles Agricultural Agency, 2015). Key informant 2 stated that there is a gender issue with female workers, since many farmers do not want to employ women because they are afraid of a possible pregnancy, in which case the farmer would need to pay for a female worker that is not able to work for some time.

F) Historical development and current situation of national production and food imports
The agricultural sector has suffered considerably due to a low level of governmental support in the last 20-30 years (Ministry of Fisheries and Agriculture Seychelles, 2015b; Key informant 1). This has led to an overall decline of production and productivity for many crops as well as livestock (Ministry of Fisheries and Agriculture Seychelles, 2015b). At the same time, market liberalization measures were accelerated after the financial crisis in 2008 to facilitate the import of food products. It was believed, that this would lower domestic food prices for the population but also, and more

importantly, the liberalization measures were a requirement posed by the International Monetary Fund (IMF) in return for a bail-out after the financial crisis. In 2010 the importation of meat was completely liberalized. In 2014, Seychelles joined the WTO which has been leading to an additional increase of food imports. Currently, about 70-80% of food consumed in the Seychelles is imported. Many imports are drastically competing directly with local production, especially since they are often sold at a lower price than the local equivalents. Farmers in the Seychelles have comparably high production costs, because many inputs have to be imported, there are extremely low economies of scale and many farmers are lacking in marketing skills (Ministry of Fisheries and Agriculture Seychelles, 2015a, 2015b, 2016b; Key informants 1, 2, 3, 5 and 6).

From 2008 to 2015, overall domestic livestock production in the Seychelles had declined by around 60% (Estico, 2017). In the case of chicken, imports have increased fourfold from about 800t in 2006 up to almost 3'200t in 2013 for the whole country, due to an increased demand and the market liberalization measures (Ministry of Fisheries and Agriculture Seychelles, 2015b). In contrast, between 2011 and 2015 there was a 70% decrease in the local chicken population, mainly due to a sharp decline in broiler chicken for meat production (Seychelles Agricultural Agency, 2015). Pork production was affected as well, with local pork population declining by almost 30% between 2011 and 2015, while imports were rising sharply from about 550t in 2011 to over 2'000t in 2013 (Ministry of Fisheries and Agriculture Seychelles, 2015b; Seychelles Agricultural Agency, 2015). Cattle population on Mahé is quite low with only about 330 cattle on Mahé in 2015, of which more than 80% are used for producing manure for own use or for selling to other farmers (Seychelles Agricultural Agency, 2015). Local beef production has however experienced a decline from 10t in 2006 to about 4t in 2013, with imports declining at the same time from 691t to 496t (Ministry of Fisheries and Agriculture Seychelles, 2015b). Other livestock produced on Mahé are goats, that actually have increased in live population from about 800 in 2011 up to 1'100 in 2015. The majority of goats is used for manure production and agro tourism, only a small percentage is used for meat production. Further livestock produced in smaller amounts include ducks, rabbits or tortoises (Seychelles Agricultural Agency, 2015).

In contrast to the livestock sector, overall crop production had seen an increase from about 3'000t up to 6'150t between 2005 and 2011 on a national level. However, imports had increased sharply between 2009 and 2011 as well, from about 5'300t up to more than 21'000t, which was predicted to strongly impact the local crop production. It was estimated that in 2013, the vegetable most produced was pumpkin (1'090t) followed by tomatoes (850t), eggplant (782t), chinese cabbage (694t), cucumber (672t) and sweet potatoes (617t). In the fruit category the highest production volume was ascribed to mango (1'107t), banana (520t) and pineapple (385t). In that same year, it was estimated that locally produced vegetables could cover 88% and fruit even 93% of national

demand (Morel, 2014). However, when looking at the most current numbers of crop production area, a drastic decrease from about 690ha in 2011 to only 200ha in 2015 can be observed. The largest decrease (-93%) occured in vegetable production area, from 470ha in 2011 to a mere 30ha in 2015 (Ministry of Fisheries and Agriculture Seychelles, 2015b).

G) Producers cooperation, value chains and market access

Lack of supply coordination, low market access and underdeveloped value chains are described as main current challenges for the agricultural sector in the Seychelles (Ministry of Fisheries and Agriculture Seychelles, 2015a, 2015b; Morel, 2014; Seychelles Agricultural Agency, 2015; Key informants 1, 2, 3, 4 and 5).

Starting on the production level, there seems to be very little cooperation among farmers. This can be problematic if it for example results in many farmers producing the same goods at the same time and therefore having to sell their produce at a very low price, if being able to sell them at all, since the market is flooded. In contrast at other times there can be a scarcity of that same product on the market (Morel, 2014; Seychelles Agricultural Agency, 2015; Key informant 5). Key informant 2 also mentioned other areas where cooperation between farmers could be useful, one example being enabling smaller farmers to bulk order needed machinery or technology from abroad. Yet, key informants 2, 3, 4 and 5 emphasized that there is a strong prevalent unwillingness to cooperate among farmers. They all agreed that the majority of farmers is reluctant to cooperate and for example share their knowledge since they often mistrust each other. Key informant 5, who is in the farming business, stated being afraid that another farmer would 'steal' his/her ideas and technology that s/he invested a lot of time and money in to develop. Key informants 3 and 4 agreed on farmers cooperation being almost impossible with the current mindset of farmers, where "everyone just looks out for themselves". At the moment there only exists one farmers' association on Mahé in Val D'Endore, which has the goal of promoting agricultural activities in this region and in 2015 had 21 members (International Fund for Agricultural Development, 2015; Key informants 2 and 3).

One possible solution to deal with surplus production would be to practice some kind of agro-processing. This could enable farmers to differentiate their products as well as possibly make them longer storeable (Morel, 2014; Key informant 5). Key informant 6 mentioned that recently having integrated some value adding steps in the farm also helped saving a lot of costs. However, in general this is done very little. In 2015, on Mahé only 46 farms carried out value addition in the form of agro-processing. Despite the small number, this still presented a six time increase since 2013. The most common processed agricultural goods included juices, jams, chips, preserved or pickled products, essential oils, processed meat and honey (Seychelles Agricultural Agency, 2015).

About a quarter of farmers in 2015 reported to sell their products at the market in the capital of Victoria and roughly a fifth would sell on other markets. This was followed by selling to wholesalers, at farm gate or to supermarkets (each about 14%). Very little farmer reported on selling directly to hotels (11%) or restaurants (4%) (Seychelles Agricultural Agency, 2015). Not represented in these numbers is that many farmers are constantly struggling with finding an accessible market to sell their products at (Ministry of Fisheries and Agriculture Seychelles, 2015a; Morel, 2014; Seychelles Agricultural Agency, 2015; Key informants 1, 3, 4, 5 and 6). The before mentioned problem of missing supply coordination with the resulting flooding of the market with the same product at the same time is one reason for this. Other causes can be high transportation costs to markets, inability to find or pay for trustworthy workers needed for selling process or overcrowded market places (Seychelles Agricultural Agency, 2015; Key informants 4 and 5). One of the biggest challenges also is competition from food importers, who are usually able to deliver in larger quantities, can offer more consistency and have lower production costs. Many farmers are unable to reach certain quality and safety standards and can often also not offer consistent supply (Ministry of Fisheries and Agriculture Seychelles, 2015a, 2015b; Morel, 2014), which again could potentially be addressed with enhanced cooperation between producers (Key informant 3 and 5). This might be one of the reasons why it is very difficult for farmers to get legally binding sales contracts, making income from selling their produce often highly uncertain (Key informants 4 and 5). Especially hotels, which, with a growing tourism industry could be a good potential market, usually prefer buying imported food products (Morel, 2014; Seychelles Agricultural Agency, 2015; Key informants 2 and 5).

In a study conducted by the MFAg (2015) it was stated that one way to strengthen local producers in their marketing position would be to improve labelling and branding of local products. This is currently underdeveloped (Key informant 9). Key informants 1 and 5 agreed that this would be a comparably easy and very effective way to differentiate local, possibly organic products and to also justify a certain price premium.

H) Demand and perception of local population

With the growing importance of tourism and fisheries sectors and the simultaneous decline of governmental support towards the agricultural, the perceived importance people attached to sector also tended to decline (Ministry of Fisheries and Agriculture Seychelles, 2015a; Key informant 1). Key informant 2 explained that the image of farming had changed negatively in comparison to previous generations and that the whole sector was inadequately valued. This has also led to farming being perceived as an unattractive career option by most of the population (Government of Republic of Seychelles, 2013; Key informant 2).

Simultaneously to this, the eating habits of the local population have changed from more traditional Seychellois dishes with rice, fresh vegetables, root crops and fish to more imported and often highly processed foods (Ministry of Fisheries and Agriculture Seychelles, 2015a; Key informant 7). Key informant 7 stated that especially young people increasingly prefer a more westernized diet composed of more meat, more processed food and snacking between meals. This is problematic, since these changes contribute to overweight and associated non-communicable diseases such as diabetes, which are on the rise. The National Food and Nutrition Security Policy (NFNSP) published by the Government in 2013 reported 60% of Seychellois being overweight and 25% of this group being obese. The problem is also increasing in children, with about every fifth boy and almost a quarter of girls being overweight (Ministry of Fisheries and Agriculture Seychelles, 2015a).

Even though many institutions encourage the consumption of locally produced food, a lot of people chose imported products because there is no locally produced alternative or if there is, it is often more expensive (Key informants 7, 8 and 9). Key informants 8 and 9 stated that many people would prefer locally produced food but due to the above mentioned reasons they are still often left with no other choice than the imported product. On the contrary, key informants 1 and 7 explained that a part of the population perceives imported foods as superior because it is associated with high income westernized countries with better and stricter production and safety standards.

I) Institutional and legal framework

Currently, there are two main policy and strategy plans regarding agriculture in the Seychelles in place, the National Food and Nutrition Security Policy (NFNSP) and the Seychelles National Agricultural Investment Plan (SNAIP). They both were created by the Ministry of Fisheries and Agriculture and got overall support by the Government.

The NFNSP was created in 2013 and had the aim of creating an environment that helps ensure access to healthy as well as adequate food at all times and to satisfy the nutritional needs to guarantee optimal health for the whole Seychellois population (Government of Republic of Seychelles, 2013). Two years later, the SNAIP was put into action, which aimed at harmonizing, consolidating and accelerating the implementation of all nutrition and food relating strategies and policies from 2015-2020. Both of these policies and strategies have in common, that they describe among other issues the necessity of strengthening and increasing local agricultural production (Ministry of Fisheries and Agriculture Seychelles, 2015b). Further, they were developed in assistance of the Comprehensive Africa Agriculture Development Program (CAADP) which is an initiative of the African Union and helps countries to develop consistent and sustainable national agriculture investment plans (Ministry of Fisheries and Agriculture Seychelles, 2015a).

Additionally, there are also a couple of relevant donor-funded activities, with the currently most important being the Competitive Local Innovations for Small-Scale Agriculture Project (CLISSA) funded by the International Fund For Agricultural Development (IFAD) that started in 2014. The development objective of this project is to promote sustainable and environmentally friendly agricultural and fishery practices and to increase and diversify market access for smallholder farmers and fishers (Ministry of Fisheries and Agriculture Seychelles, 2015a). According to key informant 1 the start of this project, which has a budget of 3 Mio USD over the course of 3 years, was an important step in the direction of revitalizing the agricultural sector, bearing in mind that the MFAg, which also includes the fisheries sector, has a total budget of about 4.5 Mio USD over the same time span.

Since the tourism and fisheries sectors have grown in economic importance for the Seychelles, the governmental support for the agricultural sector has gradually declined since the mid-nineties (Ministry of Fisheries and Agriculture Seychelles, 2015b; Key informant 1). Between 2007 and 2010 the government allocated about 3% of its total annual expenditure to agriculture, between 2010 and 2014 it was only on average about 1.65%, despite the CAADP's recommendation of about 10% (Ministry of Fisheries and Agriculture Seychelles, 2015a, 2016a). In 2017, the budget allocated by the Seychelles government to the MFAg was 20.2 Mio SCR, which is equivalent to about 1.45 Mio USD (Larose, 2016).

Underfunding of the agricultural sector and a subsequent lack of subsidies and support was perceived as a major challenge by many of the key informants (Key informants 1, 2, 3, 4, 5 and 6). It is for instance problematic that without subsidized interest rates loans are hardly accessible for farmers, which is constraining many of them in investing and growing their business (Government of Republic of Seychelles, 2013; Morel, 2014; Key informants 1, 2 and 3). It was further mentioned that the existing extension service does often not have enough capacity for up to date research and for meeting all the needs of the farmers, especially in the area of value chains and marketing, where there would be a great need for further education (IFAD, 2017; Key informants 2, 4, 5 and 6). The three key informants that practice agriculture themselves stated that they obtain the information they need from private partners (key informants 4, 5 and 6) or online (Key informant 5). Key informant 6 admitted not even knowing whether there was an extension officer responsible for the region concerned and key informant 5 explained being hesitant to call extension services because of the fear that they would inspect the technologies used on the farm and pass them on to other farmers, which would result in comparative advantage lost. Only key informant 4 described having gotten in contact with extension services to receive some information about pest and disease control.

In summary the system description showed, that the agricultural system on Mahé currently is characterized by mostly small-scale farming structures and traditional production methods. A number of challenges were identified, such as limited natural resources, vulnerability to climate change, and a need to import most of the agricultural inputs. Further, value chains in the sector are underdeveloped, market access for many farmers is very limited and local workforce is scarce. The agricultural sector has been ascribed limited priority from the government over a time period of 20-30 years, which resulted in limited funding for the sector and a consequent decrease in production and productivity. At the same time, market liberalization measures resulted in a sharp increase of imported food products that are strongly competing domestic production. Currently about 70-80% of food consumed in the Seychelles is imported.

3.1.1.3 Stakeholder Analysis

The following table gives an overview about the most important stakeholders in the agricultural system of Mahé. The information presented was obtained by interviewing the key informants and from two different reports published by the MFAg (Ministry of Fisheries and Agriculture Seychelles, 2015a, 2015b).

Stakeholder	Role / Description
Institutional level	
Ministry of Fisheries and Agriculture (MFAg)	Responsible for policy formulation and decision, international relations and is also overseeing to two executing agencies which are the National Biosecurity Agency and the Seychelles Agricultural Agency
Seychelles Agricultural Agency (SAA)	Providing research, extension, plant and animal health and business facilitation services. Further involved in infrastructure development for facilitation of the agricultural activities and managing land leasing affairs
National Biosecurity Agency (NBA)	Responsible for controlling all the agricultural imports and exports (including agricultural inputs) in order to prevent diseases and pests from spreading
Ministry of Land Use and Housing (MLUH)	Holding overall responsibility for territory and for allocating and leasing state land to the different sectors
Public Utilities Corporation (PUC)	Responsible for overall allocation of water abstraction rights to sectors and provision of water, sewage and electricity
Ministry of Finance, Trade and Economic Planning	Responsible for the management of the Seychelles finances and therefore also for budget allocation to the different sectors, including agriculture

Farmers Associations	Empower farmers and strengthen cooperation between them
Donors	Mostly foreign organizations that are implementing projects related to the agricultural sector, most important at the moment being IFAD with the CLISSA project (2014-2017 with most probably a second 3 year phase starting in 2018)
Private actors	
Farmers	Small-, medium- and large-scale producers of crops and livestock on Mahé
Private Sector Entrepreneurs	Private actors being involved in the agricultural sector, for example input providing businesses
Retailers	Retailing actors such as supermarkets or smaller shops
Private Tourism Sector Actors	Actors in the tourism sector with demand for locally produced food, such as hotels or restaurants
Importers	Private actors importing food that is competing with local products
Consumers	Local population and tourists having a demand for locally produced food

Table 2: Most important stakeholders in the agricultural system on Mahé

3.1.2 Qualitative system model

3.1.2.1 Impact variables

Building on the previous step of the system description, a final set of 19 variables were defined to sufficiently describe the system in terms of the before mentioned goals and system boundaries. These variables serve as basis for developing the model of the agricultural system in the following steps. Table 3 provides an overview of all the variables and their definitions:

Variable Name	*Definition*
Natural Resources and Environment	
Agricultural land	Availability and quality of agricultural land, including ownership or leasing conditions, location, soil characteristics and topography
Fresh water availability	Availability and quality of fresh water for agricultural purposes
Pest and disease pressure	Damage caused by pests and diseases on agricultural production
Environmental impact	Level of harmful impact on the environment that is associated with agriculture, like contamination through pesticides and fertilizers or soil erosion
Knowledge, information and human resources	

Agricultural education and extension services	Quality and availability of agricultural education and of extension services supporting farmers
Workforce	Availability of workforce willing and skilled to work within the agricultural sector
Farmer collaboration	Existence and well-working of farmers' associations and general level of coordination and collaboration between farmers
Infrastructure, Technologies and Mechanization	
Infrastructure and technologies	Availability and usage of technology and mechanization as well as quality and type of infrastructure on farms
National Market – Supply Side	
Food prices	Sale prices for food on national market
Local food production	Amount, variety, quality and consistency of local food production
Agricultural inputs	Quality, quantity, consistency of supply and variety of agricultural inputs such as seeds, fertilizers, pesticides or animal feed and the accessibility thereof for livestock farmers
Value chains	Presence and well-working of value chains (vertical or horizontal), including processing and transportation to markets
Food imports	Amount, availability, variety and price of food imports competing with local produce
Market access and demand	
Market access for agricultural producers	Availability, consistency and accessibility of places or customers where farmers can sell their products
Institutional and Legal Framework	
Government spending and support for agriculture	Financial and human resources spent and institutions in place by the government in order to support the agricultural sector
Loan availability	Availability and affordability (in terms of interest rates) of loans for farmers
Branding and certification	System that allows to differentiate between different quality categories of the same product and makes it possible to introduce price premiums for higher quality classes (for example organic or locally produced)
Societal setting	
Public image	Perception and image that the civil society has of agriculture in general, the agricultural labour market and locally produced food
External disturbances	
External disturbances	Frequency and severity of external disturbances like piracy, economic crisis or weather conditions that have an impact on the national food system

Table 3: Definition of all the impact variables used in the analysis to characterize the agricultural system

In order to make sure that the variables reflect all aspects of the system sufficiently, Vester (2013) developed 18 system criteria which should be covered by the impact variables defined. The system criteria are classified into four different categories, which are *a) 'area of life'* (asking about participants, activities, space etc.), *b) 'physical base criteria'* (asking whether variables have a material, energy-related or information-related character), *c) 'dynamic base criteria'* (asking for example whether variables are expressing flows or determining structures) and *d) 'system-relatedness'* (asking whether variables are opening the system by input or output and whether they are controllable from the inside or outside). The analysis showed that all the criteria are sufficiently covered with the selected variables from table 4. The detailed table with the system criteria and further explanations can be found in Appendix 2.

3.1.2.2 System structure and dynamic

After having selected the variables for the system, in a next step the influences of each variable on every other variable was determined with data gathered in the previous steps and additionally with the substantial input of an agricultural expert from the MFAg. The strength of the influence was classified as follows: *'0 = no influence'*, *'1 = weak influence', '2 = medium influence'* and *'3 = strong influence'*. As described in the methods section 2.1.4, the sum of rows and columns directly shows indicator values of passivity and activity for the different variables. The complete influence matrix can be found in Appendix 4. What could quickly be identified were the variables with highest values in the activity column, which are therefore most active (*Government Spending and Support*, followed by *External Disturbances*) and the ones with highest values in the passivity row and are therefore most passive (*Local Food Production*, followed by *Value Chains*). The following section 3.1.4 shows the results in a graphic and more intuitively understandable way.

3.1.3 Systemic picture

In this section, the results from the influence matrix (see Appendix 4) were visualized with the help of the software SystemQ V10.0 (Copyright 2007-2014, Systaim GmbH, Sep 2017). Two figures are presented in this section, that are both visualizing the same results from the influence matrix but focusing on different aspects: A system grid of the variables (figure 2) which presents the activity and passivity of the impact variables, and a system graph (figure 3) that shows the strong influences between the different variables.

System Grid of Direct Impacts
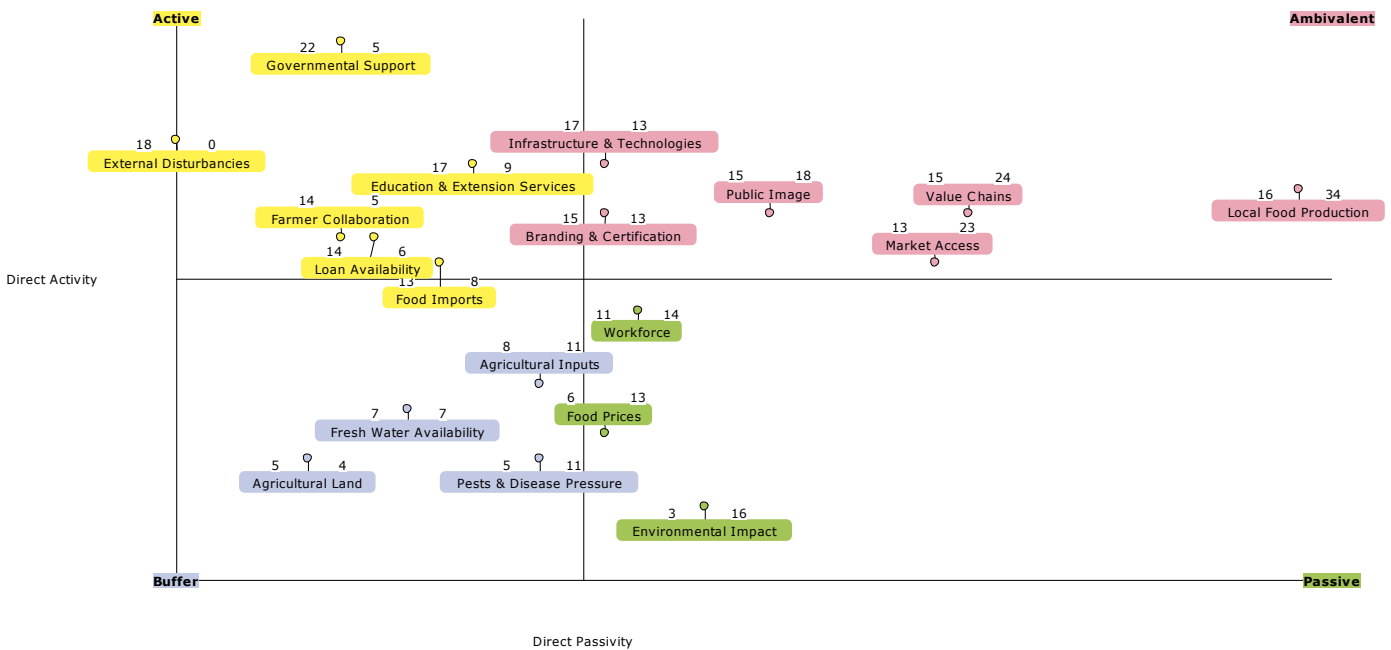
Figure 2: System Grid of direct impacts. The lines dividing the grid into four quadrants are presenting the mean passivity and activity values

The system grid of direct impacts shows the position of each variable in terms of their passivity (X-axis and value on the upper right of each variable) and activity (Y-axis and value on the upper left of each variable). The grid is divided into four quadrants: Active (high activity and low passivity scores, in the upper left), passive (low activity and high passivity scores, in the lower right), ambivalent (high activity and high passivity scores, in the upper right) and buffer (low activity and low passivity scores, in the lower left). The lines dividing the grid represent the mean activity and the mean passivity values of all variables. As already seen in the influence matrix in section 3.1.3, *Governmental Support and Spending* and *External Disturbances* are the most active variables. This means that they are highly influencing a lot of other variables but are themselves not easily influenced if other variables within the system are changing. Such active variables can function as levers if they are changeable by actors in the system themselves (such as governmental supports and spending) since changing them will have a large impact on the whole system. Other active variables in this case are *Agricultural Education and Extension Services, Farmer Collaboration, Loan Availability* and *Food Imports*. Three of the variables are classified as passive, being *Workforce, Food Prices* and *Environmental Impact*. These variables are being influenced by a lot of other variables but are themselves not influencing a lot of others. Most passive are *Environmental Impacts* while *Workforce* is closer to the ambivalent quadrant. The variables in the ambivalent quadrant are both influencing a lot of other variables as well as being highly influenced by them. This makes them critical for the system but also not easily predictable since their relationships within the system are complex. In this case, the ambivalent variables are *Infrastructure and Technologies, Branding and Certification, Public Image, Value Chains, Market Access* and *Local Food Production*, with the latter having by far the highest passivity score

(34) and therefore being extremely influenced by many other variables. The rest of the variables belong to the buffer quadrant, meaning they are neither influencing a lot nor influenced by many other variables and are therefore able to absorb certain effects.
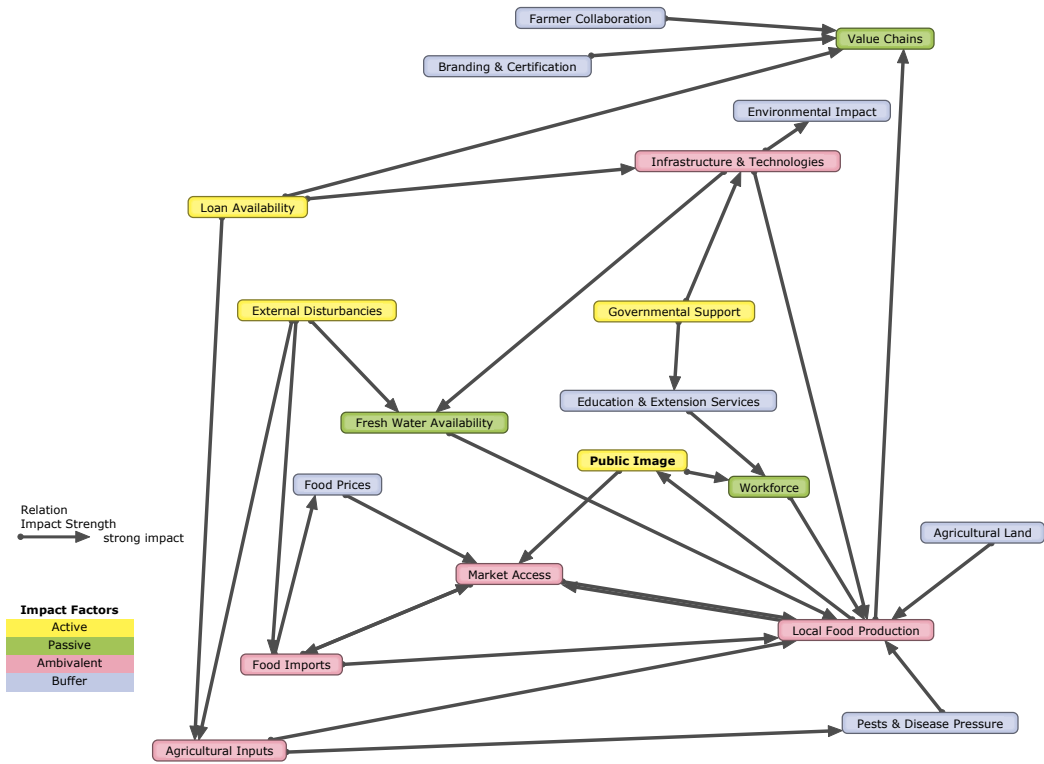
Figure 3: System graph of impact variables, with visualization of all the influences between variables that were categorized as 3=strong influence. The arrow shows the direction of the influence and the colouring of the variable show their categorization into active, passive, ambivalent or buffer, based on only direct influences (as shown in figure 2: System Grid of Direct Impacts)

For reasons of clarity, the system graph only shows the strong influences (represented by value 3 in the influence matrix, Appendix 4) between variables. It therefore gives an idea about the system dynamics for that it shows for example, which variables are highly or less highly connected and to which other variables. The most connections are clearly attributed to the variable *Local Food Production*, which is strongly influenced by 8 other variables being *Agricultural Land, Pest and Disease Pressure, Agricultural Inputs, Food Imports, Market Access for Agricultural Producers, Fresh Water Availability, Workforce* and *Infrastructure and Technologies*. The variable has a strong influence on 3 other variables, namely *Market Access for Agricultural Producers, Public Image* and *Value Chains*. Further strongly interconnected (ambivalent) variables are *Infrastructure and Technologies* (being influenced by 3 and influencing 2 other variables), *Market Access for Agricultural Producers* (being influenced by 4 and influencing one other variable) and *Food Imports* and *Agricultural Inputs* (both being influenced by 2 and influencing 2 other variables).

Other variables are more active in the sense of having strong influences on other variables but not being strongly influence at all (*Loan Availability, External Disturbances* and *Governmental Spending and Support*) or only by one other variable (*Public Image*).

Passive variables in the system include the *Value Chains* (strongly influenced by 4 and not having any strong influence on other variables), *Fresh Water Availability* and *Workforce* (both being strongly influenced by 2 and strongly influencing one other variable).

The rest of the variables are buffer variables, with only one or two strongly influencing connections.

The results of the system model revealed a number of dynamics within the agricultural system that were not obvious before. It showed that the relations between the variables are very complex and that therefore changing some aspects of the system can greatly and sometimes unexpectedly influence other parts of the system. With the system grid of direct impacts (figure 2) it was further showed that the variables can be clustered in terms of their activity and passivity values. Impact variables with high activity and low passivity scores (located in the 'active' quadrant) are often of institutional nature. Passive variables (high passivity and low activity scores) could be characterized as indicators of the performance of some aspects of the system, such as environmental impacts or food prices. In the group of the buffer variables (low activity and passivity scores), most of the variables representing natural resources were found, indicating that these are less highly connected within the system (which does not imply that they are not of importance). Within the critical or ambivalent quadrant, variables were located that had both high passivity as well as high activity scores. These variables are highly connected within the system and of critical importance and it could be showed, that the variables most closely linked to society, such as public image, market access (which is greatly defined by demand of the local population) or workforce are found in or close to this quadrant.

3.2 Perception survey

The perception survey was carried out with a total of 239 participating respondents. In this section, its results are presented. The composition and characteristics of the survey sample are discussed in the methods section 2.2.2. Also, the Exploratory Factor Analysis (EFA) conducted and the latent variables found thereby are presented in the methods section, in 2.2.4.

With the presented results in this section it is aimed to *a)* answer the main hypothesis of the agricultural sector being undervalued and not having a good image by analyzing the results descriptively (section 3.2.4) and *b)* answer the sub-hypothesis of different socio-demographic respondent groups being associated with giving different answers to the questions (section 3.2.5).

3.2.1 Image of the agricultural sector

To test the main hypothesis of the agricultural sector's poor image, descriptive results for each of the three main thematic areas A) '*Demand of locally produced food*', B) '*Labour Market: Attractivity and image of working in agriculture*' and C) '*Current image of agriculture in the Seychelles*' of the questionnaire as well for D) the *'Importance ranking'* and *'Additional comments'* are presented in this section. For the areas A) and C), mainly the components found in the EFA are described since they cover these thematic areas. For B), no matching components could be found in the EFA. Therefore single question results are presented. Most of the components and items are described with mean answer and standard deviation thereof, for some additional information to the frequency distribution of answers is given. The detailed frequency distributions of all items and components can be found in Appendix 5.

A) Demand of locally produced food

To assess the demand of locally produced food, in this section the descriptive results of the following components and questionnaire items are described: Component 2 (*Importance ascribed to locally produced food*), Component 4 (*Frequency of purchase of locally produced fruit, vegetables & root crops*), Component 5 (*Frequency of purchase of locally produced chicken and other types of meat*), reasons for buying locally produced instead of imported food products, types of imported products bought regularly and the reasons to do so.

Figure 4: Means and standard deviations shown of Component 2 (C2, *Importance ascribed to locally produced food*) and the items it contains Q1a (*In general I pay attention whether the food I am consuming is locally produced or imported*), Q1b (*I am willing to pay a higher price for vegetables and fruit if I know that it has been produced locally*) and Q1c (*I am willing to pay a higher price for meat if I know that it has been produced locally*). The answers were given in likert scale format from 1 = Not at all agree up to 7 = Strongly agree.

Component 2 was made up of the questions asking about the willingness to pay a higher price for locally produced products compared to imported products as well as the degree to which respondents reported to generally paying attention whether the food they were consuming was locally produced or imported. The mean value of the answers for the component was 5.08, meaning marginally above 'slightly agree'. This can be interpreted such that people actually do tend towards making a difference between locally produced and imported food products. When looking at the three single questions, between 62% and 72% of respondents chose answer options 5-7 (slightly agree, agree or strongly agree) which shows that locally produced food is generally valued. The standard deviations were however quite large, with about 1.6 for the whole component and a maximum of around 2.1 for the willingness to pay a higher price for locally produced meat than imported meat (Q1c).
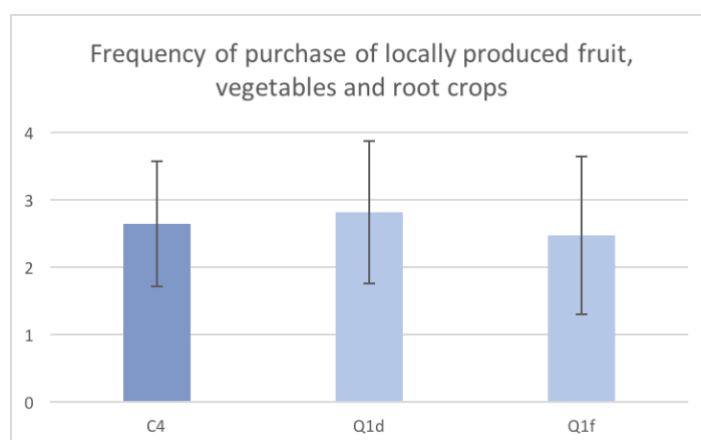
Figure 5: Means and standard deviations shown of Component 4 (Frequency of purchase of locally produced fruit, vegetables and root crops) and the items it contains Q1d (If you buy vegetables or root crops, how often do you choose locally produced products compared to imported products?) and Q1f (If you buy fruit, how often do you choose locally produced products compared to imported products?). The answers were given on a scale from 0 = Never, 1 = Rarely, 2 = Sometimes, 3 = Often to 4 = Very often.

Component 4 consisted of two questions asking about the frequency of buying locally produced fruits, vegetables and root crops, compared to the imported equivalents. The mean value of the answers was 2.64 which is lying between the answer options 2 = Sometimes and 3 = Often. On average respondents stated to less often buy locally produced fruit (2.47) than locally produced vegetables and root crops (2.81) compared to their imported equivalents. The standard deviation for fruit was also a bit higher (1.16) than for vegetables and root crops (1.05). For both vegetables and root crops as well as fruits, the most common reasons for choosing the local variety were 'because it is healthier' (63.2% for vegetables and root crops, 60.9% for fruit) closely followed by 'it tastes better' (54.7% for vegetables and root crops, 57.4% for fruit). More than a third of respondents also answered that they preferred the local varieties since they know where it comes from (41% for vegetables and root crops, 35.7% for fruit) and that they want to support the local farmers (36.3% for vegetables and root crops, 33.9% for fruit). From the provided answer options, for both categories the alternative 'it is cheaper' was least selected with 10.7% for vegetables and root crops and 7.4% for fruit.

Figure 6: Means and standard deviations shown of Component 5 (Frequency of purchase of locally produced chicken and other meat) and the items it contains Q1h (If you buy chicken, how often do you choose locally produced products compared to imported products?) and Q1j (If you buy other meat, how often do you choose locally produced products compared to imported products?). The answers were given on a scale from 0 = Never, 1 = Rarely, 2 = Sometimes, 3 = Often to 4 = Very often.

Component 5 was composed of two questions asking about the frequency of buying locally produced meat (chicken and others) compared to imported meat. The mean answer value of 1.99, which is closest to answer option 2 = Sometimes, was considerably lower than for the fruit, vegetables and root crops component (2.64). Also, the distribution is clearly bimodal with a standard deviation of about 1, so the answer categories that were most frequently chosen were 1 = Rarely and 3 = Often. For both chicken and other types of meat, the most often mentioned reasons for choosing the local variety were 'because it tastes better' (57.8% for chicken, 60.3% for other types of meat) followed by 'it is healthier' (50.5% for chicken, 47.3% for other types of meat). As for component 4, the next most

important reasons are knowing where the products are coming from (43.2% for chicken, 38% for other types of meat) and supporting the local farmers (23.4% and 33.7% respectively). Again, the given reason least selected was a lower price for locally produced meat (8.9% for chicken and 5.4% for other meat).

Besides the three described components, the demand for imported products is presented as a fourth indicator related to demand for locally produced food. When asked about imported products that are bought on a regular basis, 62.1% of people named fruit, followed by 41.4% vegetables, 38.8% meat and 32.3% chicken. Other categories mentioned were rice (10.3%), canned food (9.5%) or potatoes (8.6%). When asked about the reasons to buy imported food, the majority of respondents answered that the locally produced equivalent is neither not available at all (81.3%) or not as easily available as the imported product (35.6%). Only about one in eight respondents mentioned imported products being cheaper as a reason to prefer them over the locally produced equivalents. Reasons least chosen for buying imported food products were better taste (7.1%) or the believe that they are healthier (2.7%).

B) Labour Market: Attractivity and image of working in agriculture

To evaluate attractivity and image of the agricultural labour market, the results from the questionnaire items from the corresponding thematic section are presented. These were likert scale questions asking about the agreement to agriculture being financially lucrative, prestigious, interesting and to not give the opportunity to learn new things. Further, it was asked whether respondents would encourage a young person they know to work in agriculture and if they could imagine working in the sector themselves, as well as the reasons for both of the answers given to these two questions.
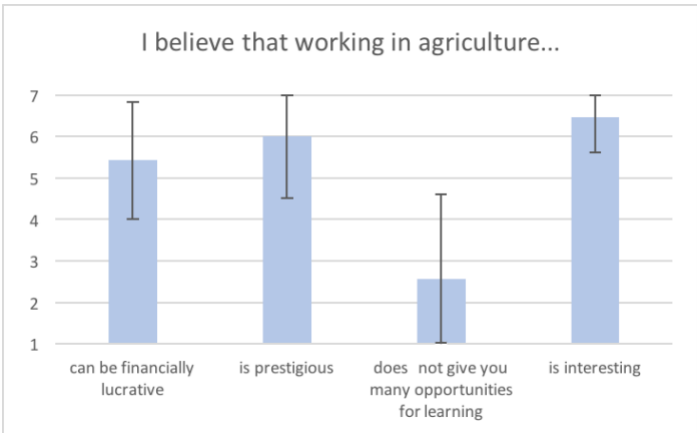
Figure 7: Means and standard deviations shown of the items Q2a (I believe that working in agriculture can be financially lucrative), Q2b (I believe that working in agriculture is prestigious), Q2c (I believe that working in agriculture does not give you many opportunities to learn new things) and Q2d (I believe that working in agriculture is interesting). The answers were given in likert scale format from 1 = Not at all agree up to 7 = Strongly agree.

Respondents agreed most strongly with the statement of agriculture being interesting (mean value of 6.47 and standard deviation of 0.85). They also tended to agree that working in agriculture is prestigious (mean value of 6.01 with standard deviation of 1.50) as well as possibly financially lucrative (mean value of 5.42 between 'slightly agree' and 'agree', with standard deviation of 1.40). The lowest mean of the items had the negatively worded one ('*I believe that working in agriculture does not give you many opportunities to learn new things*') with 2.57, which lies between '*disagree*' and '*slightly disagree*'. Nevertheless, almost half of the respondents (45.2%) strongly disagreed with the statement and an additional quarter (25.5%) disagreed, which indicates that the majority of people think that pursuing a career in the agricultural sector gives you learning possibilities. These results indicate a generally quite positive image of the agricultural sector.
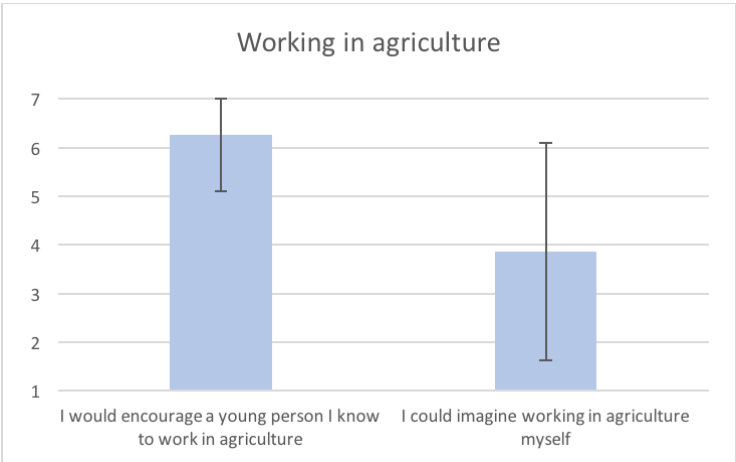
Figure 8: Means and standard deviations shown of the items Q2e (*I would encourage a young person I know to work in agriculture*) and Q2g (*I could imagine working in agriculture myself*). The answers were given in likert scale format from 1 = Not at all agree up to 7 = Strongly agree.

When asked about whether they would encourage a young person they know to pursue a career in agriculture, respondents on average clearly agreed (mean value 6.27 with standard deviation 1.17). As main reason (43.0%) it was mentioned, that there should be more farmers in the Seychelles and local food production should be increased. About a third of respondents named perceived positive working conditions or career options as reason for the encouragement. Further answers included that the current farmers are ageing and need to be replaced by younger people (18.7%) or that working in agriculture would present a possibility for young people to provide for themselves and their families (12.1%). Negative working conditions were least mentioned in total (6.1%) but were the most mentioned reason (44.4%) within the group of respondents that were strongly disagreeing up to being neutral to the question posed about encouragement of a young person.

The item that asked participants about whether they could imagine working in agriculture themselves, the answers received differed clearly from the item before, that asked about hypothetically encouraging a known young person to do so. The mean value of this item was 3.86, which is slightly lower than the neutral position of neither agreeing or disagreeing (value 4). The standard deviation was quite high (2.25) and when looking at the distribution of answers, a U-shape could be observed with answers tending to either disagree or agree and only a few being in the neutral area. Exactly a quarter of respondents not at all agreed with being able to imagine working in the sector, 14.4% disagreed. On the other hand, 22.9% agreed and 12.7% strongly agreed. Also, the reasons for giving these answers differed from the reasons given for the level of encouragement one would give to a young person to work in agriculture. The reason of an increase in local agricultural production needed was most mentioned when asked about encouragement to a young person (43%), but was one of the least mentioned reasons (9.2% of total answers) when respondents were asked about their own willingness to work in agriculture. Instead, for the respondents that were slightly up to strongly agreeing, perceived positive working conditions were the main reason mentioned (53.8%), followed by perceived good career perspectives (23.1%). For respondents not at all agreeing up to being neutral, no interest in agriculture was the most often mentioned reason (39.6%) followed by stating being physically inable to work in agriculture (34%). Only about one in ten participants mentioned perceived negative working conditions as a reason for not being able to imagine pursuing a career in the sector.

Summarized it can be said, that the respondents generally associated rather positive attributes with the agricultural labour market. They tended to agree to working in agriculture being interesting, prestigious, giving you learning opportunities and possibly being financially lucrative. They mostly also agreed with hypothetically encouraging a young person to pursue a career in agriculture, mostly with the underlying reason to increase local food production. However, when asked about being able to imagine working in agriculture themselves, a majority of people denied, mostly because of no interest in the field or because of stated physical inability to do so.

C) Current image of agriculture in the Seychelles

The current image of the Seychelles agricultural sector is represented by the two components 1 (importance ascribed to and image of the agricultural sector) and 3 (current condition of the agricultural sector), their results are described in the following.
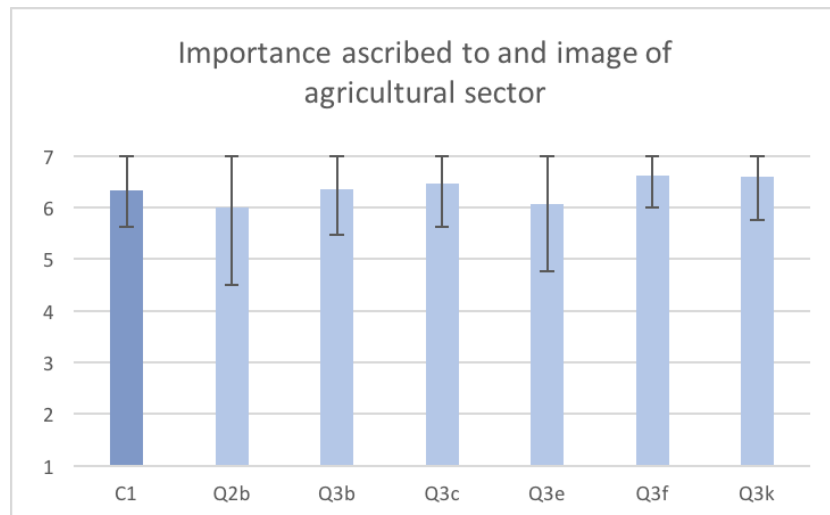
Figure 9: Means and standard deviations shown of Component 1 (Importance ascribed to and image of the agricultural sector) and the items it contains Q2b (I believe that working in agriculture is prestigious), Q3b (Agriculture is an important part of the Seychellois culture and national identity), Q3c (Agriculture plays an important role for food security in the Seychelles), Q3e (Agriculture is a part of the landscape of the Seychelles), Q3f (Seychellois agriculture is a valuable tradition that should be preserved) and Q3k (The government of Seychelles should constantly support farmers financially to guarantee the survival of local food production). The answers were given in likert scale format from 1 = Not at all agree up to 7 = Strongly agree.

The answers gathered within component 1 had both a high mean (6.34) and comparably low standard deviation (0.71), meaning most people see the agricultural sector as important and have a good image of it. For the comprised items, the highest standard deviation was observed for Q2b (*I believe that agriculture is prestigious*) followed by Q3e (*Agriculture is a part of the landscape of the Seychelles*) which also had the lowest mean answer scores. However, even these values were still high with all scores being above 6.
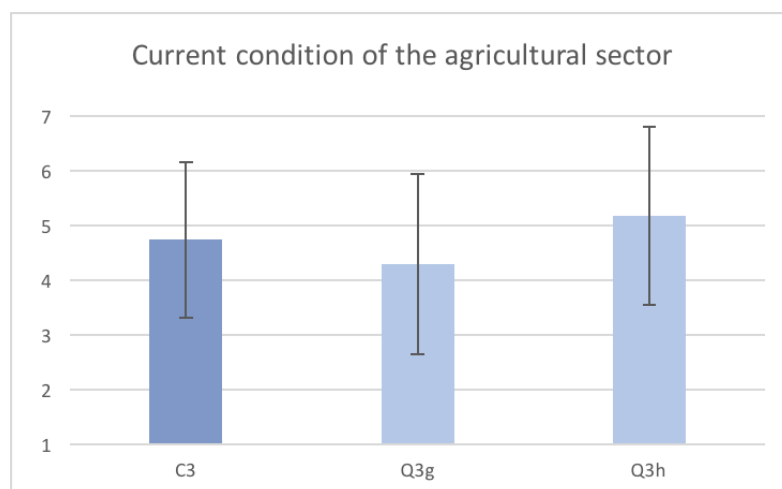
Figure 10: Means and standard deviations shown of responses given to Component 3 (Current condition of the agricultural sector) and the items it contains Q3g (The agricultural sector in Mahé is doing well) and Q3h (The agricultural sector in Mahé is providing fresh and tasty food for the population). The answers were given in likert scale format from 1 = Not at all agree up to 7 = Strongly agree.

When looking at the answers received to items that belonged to component 3, the mean value of 4.74 (with standard deviation of 1.42) could be observed to be clearly lower than component 1. This means that people tended to agree less with the sector currently doing well than with the sector being important and having an overall good image. The agreement to the statement that the agricultural sector currently is doing well was clearly lower (mean value of 4.29, standard deviation of 1.65) than agreement to the sector being able to provide fresh and tasty food for the population (mean value of 5.18, standard deviation 1.63).

D) Importance ranking and additional comments

In order to be able to compare the different thematic sections up to a certain point, a ranking question was included in the questionnaire. Participants were asked to rank four items according to the importance they would personally ascribe to each of them, with 1 being most important and 4 least important. The four items were: '*Food prices are low, so it is easily affordable for everyone'*, *'Food is produced locally instead of imported', 'Food is produced without harming the natural environment in Seychelles'* and *'The government supports farmers so that they are able to compete with imported products'*.
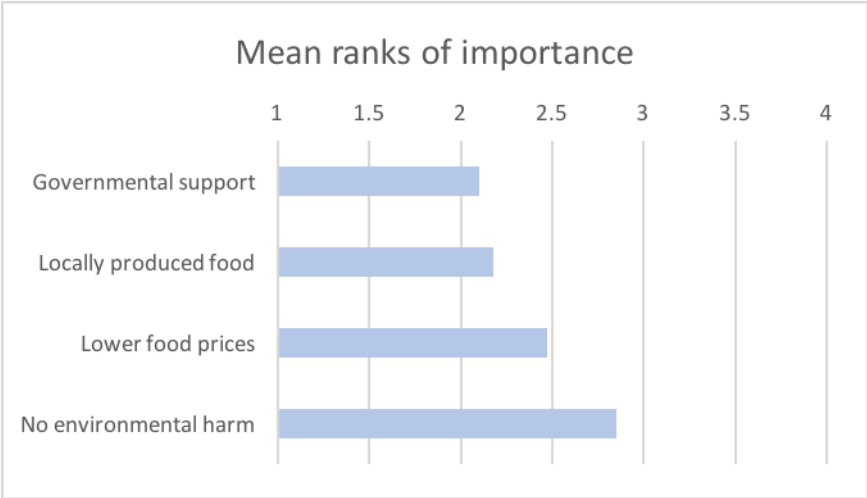
Figure 11: Mean rankings of the four presented items, with 1 = most important and 4 = least important.

When looking at the overall result, it can be noted that the ranks do not differ substantially (from mean rank 2.10 up to 2.85), meaning that respondents stated to have quite diverse importance priorities. Government support was viewed as most important (mean rank of 2.10), followed closely by local production (2.18). Low food prices were stated to be third most important (2.47) and environmental-friendly food production as least important (2.85).
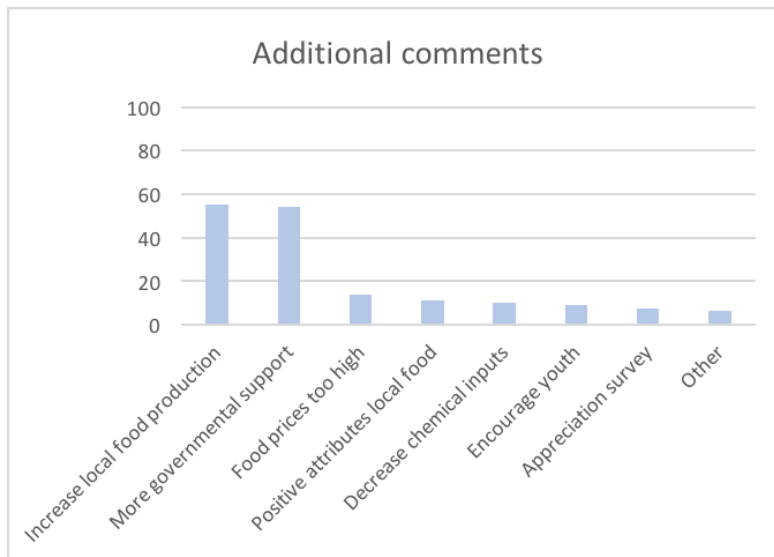
Figure 12: Content of additional comments stated by respondents who did add a comment (44.8% of respondents did). Graph therefore shows how many percentage of total comments made were belonging to a certain category. Many respondents added multiple comments on different subjects, therefore percentages do not add up to 100%.

At the end of the questionnaire, participants were asked whether they had any additional comments or questions. The comments were noted and afterwards categorized. 44.8% of respondents made one or multiple comments. More than half of them expressed their wish for a general increase in local food production (55.1%) and/or for more governmental support towards farmers and the agricultural sector in general (54.2%). These were by far the most common comments, the next most frequent statement was, that food currently is too expensive and prices should be lowered (14.0%), followed by positive comments about locally produced food (11.2%) and that farmers currently use too much chemical input for production (10.3%). Further mentions included a wish for more encouragement towards young people to work in agriculture (9.3%), appreciation for this survey conducted (7.5%) and other comments (6.5%).

In summary, there was evidence that, due to the results described in this section, the hypothesis of the agricultural sector in the Seychelles having a bad image could be rejected. Component 1, which could directly be described as 'importance ascribed to and image of the agricultural sector', had a very high mean value of 6.34, which lies between the answer options '6 = agree' and '7 = strongly' agree, whereby the items within were positively worded, meaning higher values would imply more importance ascribed to and a better image of the sector. Even though the perceived current condition of the sector (component 3) was clearly evaluated to be lower (mean value of 4.74, between being 'neutral' and 'slightly agreeing'), people were on average still tending to agree that the agricultural sector is currently in a good condition.

Furthermore, locally produced food seemed to enjoy a rather good image. Importance ascribed to locally produced food (component 2) had a mean answer value of 5.08 out of 7 and the reasons to prefer locally produced over imported food were mostly that local products were perceived to be healthier and/or tastier. The frequency of buying locally produced food ranged between 'sometimes' (1.99 for meat) and 'often' (2.64 for fruit, vegetables and root crops), but when asked about the reasons to buy imported food, by far the most often mentioned reasons (83.3% of all answers given) were limited or no availability of the local equivalents.

The perception of the agricultural labour market was mixed. On one hand, generally positive characteristics were attributed to it, such as working in the sector being interesting (mean value 6.47), prestigious (mean value 6.01) or possibly financially lucrative (mean value 5.42). Most of the participants would also encourage a young person to work in agriculture, most often due to an increase in farming workforce and local production needed, but also because of perceived good working conditions and career options within the sector. When the statement was directly targeting the respondents themselves, they tended to disagree (mean value 3.86) with being able to imagine working in the sector. The most often mentioned reasons here were having no interest in agriculture or not being physically able to do this kind of work.

The ranking question showed that people care strongest about the government supporting the agricultural sector, followed by food generally being locally produced instead of imported. The additional comments supported these findings, with about half of the respondents sharing one or multiple comments. More than half of these respondents mentioned that they would like to see the government supporting farmers and the sector in general more strongly and/or that there is a general increase in local food production needed, which indicated that many participants cared about the agricultural sector and wished for its continued existence and expansion.

3.2.2 Differences between socio-demographic groups

In order to examine the sub-hypothesis of whether there are differences between answers for the different socio-demographic groups (age, gender, educational level, household income, household size, district of residence and previous agricultural working experience), Kruskal-Wallis Tests for the different components and socio-demographic variables were conducted. Since for part B) in the questionnaire assessing the labour market no components were found, for that thematic area the differences within single questionnaire items were tested:

H₀: There are no differences in the answers given by respondents belonging to different socio-demographic groups.

H₁: There are differences in the answers given by respondents belonging to different socio-demographic groups.

Significance level: p = 0.05

For the variables gender and household size, no significant differences for any component or questionnaire item could be observed. For these socio-demographic variables therefore H₀ was accepted and it was assumed, that there are no differences in answers given by respondents differing in these characteristics. For the variables age, previous agricultural working experience, educational level, household income and district of residence, some significant differences and trends could be observed. These are presented in the following tables. For ordinal variables (age, educational level and household income) in the 'Trend' column, the Jonckheere-Terpstra test statistics are shown if a significant trend could be observed. For the nominal variables (previous agricultural working experience and district of residence) no meaningful trend can be calculated, therefore for these in the 'Trend' column the mean answer values are shown ranked by score.

A) Demand of locally produced food

Component / Item	Socio-demographic variable	Chi-Square value	df	Asympt. Signif.	Trend / Mean answer values
Component 2: **Importance ascribed to locally produced food**	*Educational level*	12.777	4	0.012	no trend
Component 4: **Frequency of purchase of locally produced fruit, vegetables and root crops**	*Educational level*	13.496	4	0.009	Pos. trend: J = 11441.00 z = 3.371 p = 0.001
	District of residence	13.837	3	0.003	Grand'Anse: 2.99 Beau Vallon: 2.72 Saint Louis: 2.65 Anse Royale: 2.31
Component 5: **Frequency of purchase of locally produced chicken and other meat**	*Household income*	13.320	5	0.019	no trend
	District of residence	30.417	3	0.000	Grand'Anse: 2.71 Beau Vallon: 2.05 Anse Royale: 1.82 Saint Louis: 1.51

Table 4: Description of significant differences found in socio-demographic variables for component belonging to thematic section *A) Demand of locally produced food*. For the cases where differences also showed a trend, the following values are shown: The observed J-T Statistic (J), the Std. J-T Statistic (z) and the significance of the trend (p). Negative z values show negative trends while z-values higher than zero indicate a positive trend. For nominal variables were no trends could be calculated, the mean answer values are shown, with the scale being 0 = Never, 1= Rarely, 2 = Sometimes, 3 = Often, 4 = Very often buying the indicated product.

Reading example for Component 4, socio-demographic variable '*Educational level*': The frequency of purchase of locally produced fruit, vegetables and root crops differed significantly between respondents having completed different educational levels. Since the z-value is positive, this means that having completed higher education was associated with more frequent purchases of locally produced fruit, vegetables and root crops**.

The demand for locally produced food differed between respondents having completed different educational levels, belonging to different household income groups and living in different districts. Respondents having completed higher educational levels were associated with stating to more often purchase locally produced fruit, vegetables and root crops than respondents belonging to lower educational level categories. For meat products, no such differences were observed. Generally, respondents from Grand'Anse stated to purchase the highest share of locally produced compared to imported products, followed by Beau Vallon.

B) Labour Market: Attractivity and image of working in agriculture

Component / Item	Socio-demographic variable	Chi-Square value	df	Asympt. Signif.	Trend / Mean answer values
Q2b: **Agreement to the statement 'I believe that working in agriculture is prestigious'**	*Educational level*	16.571	4	0.002	Neg. trend: J = 7684.5 z = -3.405 p = 0.001
	Household income	22.142	5	0.000	Neg. trend: J = 7654.0 z = -4.271 p = 0.000
	District of residence	25.205	3	0.000	Saint Louis: 6.42 Grand'Anse: 6.38 Anse Royale: 6.08 Beau Vallon: 5.48
Q2d: **Agreement to the statement 'I believe that working in agriculture is interesting'**	*Educational level*	19.046	4	0.001	Neg. trend: J = 7382.0 z = -3.611 p = 0.000
	District of residence	9.027	3	0.029	Grand'Anse: 6.70 Saint Louis: 6.63 Anse Royale: 6.38 Beau Vallon: 6.33

	Previous agricultural work experience	10.257	1	0.001	No experience: 6.40 Experienced: 6.70
Q2e: ***Agreement to the statement 'I would encourage a young person I know to pursue a career in agriculture'***	*Educational level*	19.558	4	0.001	Neg. trend: J = 7319.0 z = -3.825 p = 0.000
	Age	7.926	3	0.048	Pos. trend: J = 11420.50 z = 2.651 p = 0.008
Q2g: ***Agreement to the statement 'I could imagine pursuing a career in agriculture'***	*District of residence*	17.215	3	0.001	Beau Vallon: 4.46 Anse Royale: 4.02 Grand'Anse: 3.81 Saint Louis: 2.83
	Age	15.409	3	0.001	no trend
	Previous agricultural work experience	14.770	1	0.000	No experience: 3.56 Experienced: 4.89

Table 5: Description of significant differences found in socio-demographic variables for component belonging to thematic section *B) Labour Market: Attractivity and image of working in agriculture*. For the cases where differences also showed a trend, the following values are shown: The observed J-T Statistic (J), the Std. J-T Statistic (z) and the significance of the trend (p). Negative z values show negative trends while z-values higher than zero indicate a positive trend. For nominal variables were no trends could be calculated, the mean answer values are shown, with the scale being 1 = Not at all agree, 2 = Disagree, 3 = Slightly disagree, 4 = Neither agree or disagree, 5 = Slightly agree, 6 = Agree, 7 = Strongly agree.

For the statement of agriculture being prestigious (Q2b), differences could be found between respondents from different districts, belonging to different household income categories and having completed different educational levels. Higher household income and higher educational level were associated with less agreement for the statement. The same was true for educational level and the belief that working in agriculture is interesting (Q2d). Respondents having had agricultural working experience were also tending to agree more with this, as well as those living in Grand'Anse, followed by Saint Louis. Further it could be observed that older respondents and those having completed lower educational levels were more likely to hypothetically encourage a young person to work in agriculture than younger and better educated respondents. When asked about being able to imagine pursuing a career in agriculture themselves, respondents from Beau Vallon as well as respondents having had agricultural work experience on average agreed strongest, while people from Saint Louis and respondents without previous agricultural working experience agreed least.

Q2f: Reasons given for the level of agreement to the statement Q2e: 'I would encourage a young person I know to pursue a career in agriculture'

No very clear tendencies or differences could be found between the respondents having different educational levels. Similar with age categories; the only noteable differences could be observed with the mentioning of perceived positive working conditions, which were higher for the youngest (15-30) and the oldest (older than 60) as well as slightly more often mentions of the reason that an increase in local food production would be needed by the middle age categories (from 31 up to 60).

Q2h: Reasons given for the level of agreement to the statement Q2g: 'I could imagine pursuing a career in agriculture'

Reasons given for the level of agreement to being able to imagine working in agriculture, were differing between age groups and between respondents living in different districts.

Respondents older than 60 most often (43.2%) mentioned physical inability as a reason to not be able to imagine working in the sector. The youngest respondents (15-30) most often mentioned no interest in agriculture as a reason (39%) and people in the middle range categories most often seemed to have a positive image of working conditions in the agricultural sector (31.3% for age 31-45 and 43.3% for age 46-60).

Respondents living in Beau Vallon were most able to imagine working in agriculture and they also were the ones with the highest share of mentioning positive attributes towards it, like the expectation of positive working conditions and perspectives (59.5%). Respondents from Saint Louis on the other hand, which had the lowest agreement rate for this item, mostly referred to not being physically able to do or not being interested in (both 31% of answers) agricultural work. In Anse Royale, respondents mentioned almost equally often physical inability (25.5%) and no interest (27%) as reasons to not being able to imagine working in agriculture, and on the other hand positive associations with the type of work (23.6%) as reasons to being able to imagine working in the sector. In Grand'Anse, the most often mentioned reasons were perceived positive working conditions (34%) followed by no interest (21.7%) and not having good career perspectives in the sector (17.4%).

C) Current image of agriculture in the Seychelles

Component / Item	Socio-demographic variable	Chi-Square value	df	Asympt. Signif.	Trend / Mean answer values
Component 1: **Importance ascribed to and image of the agricultural sector**	*Educational level*	19.578	4	0.000	Neg. trend: J = 7384.0 z = -3.970 p = 0.000
	Household income	14.052	5	0.014	Neg. trend: J = 8031.0 z = -3.554 p = 0.000
	District of residence	26.334	3	0.000	Saint Louis: 6.60 Grand'Anse: 6.51 Anse Royale: 6.36 Beau Vallon: 6.06
Component 3: **Current condition of the agricultural sector**	*District of residence*	13.974	3	0.003	Grand'Anse: 5.29 Anse Royale: 4.87 Saint Louis: 4.75 Beau Vallon: 4.30

Table 6: Description of significant differences found in socio-demographic variables for component belonging to thematic section *C) Current image of agriculture in the Seychelles*. For the cases where differences also showed a trend, the following values are shown: The observed J-T Statistic (J), the Std. J-T Statistic (z) and the significance of the trend (p). Negative z values show negative trends while z-values higher than zero indicate a positive trend. For nominal variables were no trends could be calculated, the mean answer values are shown, with the scale ranging from the lowest value 1 (for Component 1: Least importance ascribed and having poorest image of the agricultural sector, for Component 3: Having most negative perception of current condition of the agricultural sector) up to the highest value 7 (for Component 1: Highest importance ascribed and having best image of the agricultural sector, for Component 3: Having most positive perception of current condition of the agricultural sector).

Differences between respondents having completed different educational levels, belonging to different household income categories and living in different district could be found. The higher the household income and completed education, the less importance the respondents on average ascribed to the agricultural sector. In Saint Louis respondents ascribed most importance to agriculture, followed by Grand'Anse. Respondents living in Grand'Anse perceived the current condition of the agricultural sector to be best at the moment, followed by Anse Royale. In Beau Vallon, respondents both ascribed least importance to the sector and also perceived the current condition to be worse than respondents from other districts.

D) Importance ranking and additional comments

Importance ranking

Component / Item	Socio-demographic variable	Chi-Square value	df	Asympt. Signif.	Trend / Mean answer values
Q3l: **Importance attributed to 'Food prices are low, so it is easily affordable for everyone'**	*District of residence*	19.177	3	0.000	Saint Louis: 1.94 Beau Vallon: 2.72 Anse Royale: 2.86 Grand'Anse: 3.14
Q3l: **Importance attributed to 'Food is produced locally instead of imported'**	*District of residence*		3		Grand'Anse: 2.12 Beau Vallon: 2.16 Anse Royale: 2.25 Saint Louis: 2.29
Q3l: **Importance attributed to 'Food is produced without harming the natural environment in Seychelles'**	*District of residence*	13.766	3	0.003	Anse Royale: 2.71 Beau Vallon 2.93 Grand'Anse: 3.22 Saint Louis: 3.29
Q3l: **Importance attributed to 'The government supports farmers so that they are able to compete with imported products'**	*District of residence*	26.537	3	0.000	Grand'Anse: 1.52 Anse Royale: 2.18 Beau Vallon: 2.19 Saint Louis: 2.48

Table 7: Description of significant differences found in socio-demographic variables for component belonging to thematic section *D) Importance ranking*. Since for nominal variables (such as district of residence) no trends could be calculated, the mean answer values are shown, with the scale ranging from value 1 = Ascribing highest importance to this aspect within the food system and value 4 = Ascribing lowest importance to this aspect within the food system.

The comparison of the importance ascribed to different aspect of agriculture and food production only differed between respondents living in different districts. Low food prices were most important to respondents from Saint Louis and least important to people living in Grand'Anse. For respondents living in Grand'Anse however, food being produced locally and also government supporting farmers were most important, while these two aspects were least important for respondents living in Saint Louis. While for food prices, government support and local production respondents from Beau Vallon and Anse Royale were ascribing medium importance scores, they ascribed more importance to food being produced environmentally friendly than respondents from Grand'Anse and Saint Louis.

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Additional comments

For additional comments made, no significant differences between the socio-demographic groups could be found.

Summarized it was observed that most differences found between respondents could be ascribed to their according district of residence. Respondents from Grand'Anse on average had highest demand for locally produced products, ascribed most importance to the agricultural sector, had the most favourable image of the current condition and also ascribed the highest importance to food being locally produced instead of imported and farmers getting governmental support. No such clear patterns could be observed for the other districts, were mean answer values differed a lot between the different question categories. Other differences could be observed between respondents having completed different educational levels and belonging to different household income groups, whereby higher education and income classes were mostly associated with a less favourable image of the current condition of the sector and working conditions and less importance ascribed to the sector overall. Last, respondents having had agricultural working experience before on average perceived working conditions in the sector to be better than respondents that had never worked in agriculture before.

4 Discussion

When it comes to food security and agricultural systems, small island developing states (SIDS) are a special case since they share very particular characteristics and challenges, such as smallness, isolated geographic location, and the need to import a high share of domestic foods. This thesis intended to examine the agricultural system in a SIDS with special focus on the opinion and perception of the local population towards this system. The case example of Mahé, the main island of the Seychelles, was chosen for this exploratory approach. In sum, this paper aimed to answer the following research question:

> *What are the characteristics and the challenges of the agricultural system in a small island developing state and how is it embedded in the socio-political context? – The case example of the Seychelles*

As presented in the introduction, this was approached by *a)* characterizing the agricultural system on Mahé in terms of its current state, challenges, and most critical components by conducting a qualitative system analysis (QSA); and *b)* examining the perception of the local population towards the agricultural sector and locally produced food by conducting a perception survey with local residents. In the present section, the findings as well as limitations of the results are discussed, first for the QSA (section 4.1) and second for the perception survey (section 4.2). In the following, these two parts are set into relation (section 4.3) and the discussion is opened up again in order to examine the possibility of generalization of the findings from the case of the Seychelles onto the broader context of SIDS (section 4.4).

4.1 Discussion results QSA

Two aspects are discussed in the main findings of the QSA: first, the most important challenges that the sector is facing today, challenges that became evident in the system description, are reviewed (see results section 3.1.1.2). Second, it is discussed which variables from the system model are associated to these challenges, what role they play in the dynamic of the system (e.g. whether there are distinct groups of 'active' or 'passive' variables) and what implications this has for the agricultural sector in general.

4.1.1 Main findings

As the results of this study show, the agricultural system on Mahé is characterized by mostly small-scale farming structures. Many farmers are still relying on traditional production methods; higher levels of mechanization are restricted to only a couple of larger farming enterprises. Currently, about

70-80% of food consumed is imported, local producers therefore only provide a small part of total food supply. The agricultural sector has been given limited priority by the government over the last 20-30 years. The agricultural sector in the Seychelles is facing a variety of challenges today, such as limited resources, underfunding and a scarcity of local workforce. The QSA showed that these challenges originate from three main underlying aspects: first, the country being a SIDS; second, institutional challenges; and third, the perception of the society. These three aspects are discussed hereafter.

First, there are restrictions that are inherently linked to the country being a SIDS and therefore geographically isolated and of small size by definition. Limited natural resources such as agricultural land and fresh water are restricting local production possibilities. However, many of Mahé's resources are not fully exhausted at the moment. For example, only about half of the agricultural land on Mahé is currently in use for agricultural production (Ministry of Fisheries and Agriculture Seychelles, 2015a). Hence, there is still potential for increasing local production. The island's geography (including its fragile ecosystems) makes the country very vulnerable to climate change. Further, since the island is small, a lot of the inputs for agriculture need to be imported, such as seeds, animal feed or machinery. This is one of the main reasons why the agricultural sector at the moment is not technologically advanced, with many farms still producing in a traditional way and relying mostly on manual labour.

Second, many current challenges are associated with the institutional situation and its ongoing changes. The agricultural sector in the Seychelles has been given very limited priority from the government for over two decades (Government of Republic of Seychelles, 2013; Ministry of Fisheries and Agriculture Seychelles, 2015a, 2015b). The total share of budget allocated to the sector barely reached 3% of the total annual government expenditures between 2007 and 2014 (Ministry of Fisheries and Agriculture Seychelles, 2015a, 2016a). This left the MFAg with very limited funding to create an enabling and supportive environment for local producers. Alongside government policies, the other very important institutional aspect was the trade liberalization. With the gradual decline of trade barriers, more food products were imported. For the already struggling agricultural sector it was hard to compete with the mostly lower prices of imported food products. This was especially evident for the livestock sector, where production between 2008 and 2015 declined by about 60% (Estico, 2017).

The third area that challenges for the agricultural sector emerge from are societal developments. The island's society's perception of the agricultural sector can influence it in three different ways. First, the demand for locally produced food is the main driver of local production. Prior to this study, no data has been collected on how the population values locally produced food or whether people differentiate between locally produced and imported equivalents. However, there certainly is a trend

towards a more westernized diet featuring more meat-based and processed foods, which are almost always imported (Ministry of Fisheries and Agriculture Seychelles, 2015b; Key informant 7). Second, the local population makes up the potential workforce, which is the main production factor of the agricultural sector. This means that the willingness, especially of skilled people, to work in agriculture is a second main driver of local production. The QSA showed that the number of students enrolled in the Agricultural and Horticultural Training Centre, the main education institution for the sector, are currently very low and declining. There are less people willing to work in the agricultural sector and many farmers have to rely on foreign workers. Third, the local population holds a certain amount of political decision power and it is therefore of great importance whether the people are supportive of the agricultural sector in general. Findings from the QSA indicated that there is a general undervaluation and indifference towards the agricultural field.

As described in the methods section 2.1, within the QSA the most important variables that characterize the agricultural system were identified. In a second step, the influences that each variable had on all of the other variables were determined. This means that variables can be passive (heavily influenced by other variables), active (heavily influencing other variables) or both (being heavily influenced by as well as strongly influencing other variables). The group of the most active variables were mostly of institutional nature, such as '*Governmental Support*', '*Loan Availability*' or '*Education and Extension Services*'. This supports the assumption that the overall decline of agricultural production and productivity was to a great part due to declining governmental funding and therefore decreasing institutional support. But it also shows that improving the institutional framework for the sector could have a significant leverage effect to improve the conditions in the agricultural sector. This is because comparatively small developments in the institutional landscape have the potential to positively influence a lot of other variables within the sector.

Another group of variables was characterized by being highly influenced as well as highly influential in the system. These impact-variables were described as ambivalent or critical, since they are at once very sensitive to changes whilst also having a high impact when they change themselves. Within or around this group, variables closely linked to society were found. These were: the public image of agriculture, the available workforce, and market access, which is highly influenced by demand for local food products. This shows that these variables are at the centre of the system and are highly connected; they are therefore of great importance. Since literature on these variables is very sparse, they were examined in detail in the perception survey and will be discussed in section 4.2.

4.1.2 Limitations

In the course of conducting the QSA, a model was created to represent the agricultural system on Mahé. The description of the system through a number of impact variables revealed underlying dynamics and connections that would not have become easily apparent without building this model. One has to of course bear in mind that a model always represents a simplified version of reality. However, by thoroughly checking at different steps in the procedure that the system model represented the agricultural sector on Mahé as well as possible, and by collaborating with experts on this, an over-simplification was prevented.

Since data on some of the aspects of the agricultural system on Mahé was not available in written form, knowledge gaps were filled by interviewing key informants and relying on expert opinions. A certain level of subjectivity cannot be avoided when collecting data through relying on experts. However, this was, as Vester (2013) describes, beneficial for the QSA in many cases, since subjective opinions influence and shape the system itself as well. Actors within the system act according to their own subjective perception and it is therefore of crucial importance to gain insights on how the actors involved see the system. To still be able to recognize subjective opinions and mitigate potential subjectivity bias, experts from different backgrounds and in different positions regarding the agricultural sector were interviewed. In addition, when analyzing the data collected and processing it in the QSA, facts or opinions that were stated more often were prioritized and given a higher importance over those that were mentioned less often. Further, by assuring the anonymity of the experts, social desirability bias could be reduced.

4.2 Discussion results perception survey

The perception survey aimed to explore how the agricultural sector today is embedded in the societal context on Mahé. There is a general understanding of the sector being undervalued, but no concrete research has been done on this subject so far. The goal of the survey was to fill this gap. The survey focused on the three areas in which the local population has the most impact on the agricultural sector. As discussed in the main findings of the QSA (section 4.1.1), these are the general perception of the population towards the agricultural sector, their demand for locally produced food, and the attractiveness of the agricultural labour market. In the following section, these three aspects are discussed in combination with differences found between socio-demographic groups.

4.2.1 Main findings

The main hypothesis regarding the agricultural sector having a bad image and being poorly valuated could clearly be rejected after the analysis of the survey results. Respondents ascribed a high level of

importance to the sector overall and expressed a wish for its continued existence and for more governmental support towards agriculture. This was quite a remarkable finding considering that the few mentions of public perception on agriculture in the Seychelles suggested the exact opposite (Government of Republic of Seychelles, 2013; Ministry of Fisheries and Agriculture Seychelles, 2015). Also, even though the current condition of the agricultural sector was perceived to be rather mediocre, this did not seem to influence the respondents' general attitude towards the sector; rather, it reinforced their opinion that the agricultural sector needs to be strengthened. The fact that the respondents clearly acknowledged this gap between importance of local food production and the current state of the system thereof shows that there must be great sense of support prevalent in the population. People clearly differentiated between overall importance and the current state of the sector. They also seemed to be aware of the challenges that farmers are facing and acknowledged the difficult circumstances that hindered farmers from performing better instead of criticizing them. This indicates that a high share of the residents of Mahé would be in strong favour of political action directed towards strengthening local agriculture and increasing domestic food production.

When comparing the answers given by respondents belonging to different socio-demographic groups, some differences could still be found. There was a tendency for respondents that were likely to be less in touch with agricultural topics to have a less favourable attitude towards the sector. For example, it was observed that respondents belonging to higher educational levels and household income groups were associated with generally ascribing less importance to the agricultural sector. Also, respondents from Grand'Anse, which is notable for having the most agricultural activity out of the four districts, were likely to have a better image of the current state of the sector, ascribe more importance to it overall and to food being locally produced, and ascribe most importance to strong governmental support for agriculture compared to respondents from other, less rural districts. A possible explanation for this could be that this part of the population never cultivated an interest towards agriculture and that some of them tend to associate themselves with less traditional and more 'modern' industries, while the agricultural sector in its current stage on the island of Mahé is seen as very traditional and not modern or technologized at all.

The second part of the survey was dedicated to examining what the population thinks about locally produced food. As mentioned before, the demand of the local population is one of the main drivers for local production. The survey results showed that locally produced food generally has a good image. Most respondents believed it to be healthier and tastier than imported equivalents and had quite a clear preference for buying locally produced food products if they were available (which was often stated not to be the case). On average, respondents reported to sometimes buy locally produced meat and to sometimes or often buy locally produced fruit, vegetables and root crops.

Moreover, the majority of people claimed to buy imported products only because local equivalents were not at all or not as easily available. This again shows the underlying support from the local population towards local food production. Even though they acknowledge that local products often are not (or are not easily) available, they still perceive them as clearly superior over the imported products. This means that demand—which is one of the most important driving forces for supply—from the local population would be there and that the majority of the local community would also be willing to pay a certain price premium for local food products.

A closer look into the data showed that respondents having completed higher educational levels were associated with buying locally produced fruit, vegetables and root crops more often. A study from Mayén et al. (2016) had similar findings. It showed that higher educated Seychellois consume these food categories more often than people who had only completed lower educational levels. It is quite a common finding that higher socio-economic status is associated with higher consumption of fruit and vegetables in general, regardless of a country's general income situation (Ball et al., 2015; Hosseinpoor et al., 2012). The survey did not directly provide reasons for this. A possible explanation would however be that higher educated people are in general more aware of healthy diet options and realize that locally produced food is often of higher nutritional value than imported fruits, vegetables and root crops (as indicated also by key informant 7). In the case of meat, no such differences were observed in the survey. One reason for this could be that for meat, locally produced options are far more limited than for fruits, vegetables and root crops. It therefore probably depends more on the location than on the awareness or mindset of people whether they buy locally produced or imported meat, whereas for fruits, vegetables and root crops, there is more often the possibility to buy both imported as well as locally produced products within a close distance. Further differences were found between districts: Grand'Anse residents reported purchasing locally produced food most often. A reason for this could be that Grand'Anse is the most rural of the four districts, with the most agricultural activity and the highest density of direct selling from farmers. Therefore, in this district locally produced crops are most easily available for the people. Furthermore, it can be assumed that respondents in Grand'Anse were more likely to directly know farmers since there is more farming activity in this district than in the three others. Over a third of respondents stated that a reason for them to prefer locally produced food over imported equivalents was to support local farmers, and it is very likely that this reason is enforced by knowing the producers personally.

The perception of the agricultural labour market yielded the most ambiguous findings within the survey. On one hand, respondents stated to have a positive image of the working conditions and overall agreed to hypothetically encouraging young people to work within the sector. Yet around

40% of respondents disagreed or strongly disagreed when asked whether they could imagine pursuing a career in the agricultural sector themselves, while roughly only a third agreed or strongly agreed. This shows that even though a high percentage of respondents theoretically wished for an increase in agricultural production and a growing sector, they still would not be willing to work in this field themselves. This is in line with the findings of the survey about the image versus the current state of the sector: Respondents seemed to acknowledge in general that there should be a viable agricultural sector and an increase in local food production in theory. However, they also perceived the current state of the sector to be in need of improvement and therefore working conditions to be unattractive.

With regards to the image of the sector, respondents from Grand'Anse again seemed to generally have a rather positive perception of the agricultural labour market. These findings could suggest that a higher exposure to agriculture in general could contribute to having a more positive image of the sector's labour market. For the labour market again it was observed that respondents with higher educational levels and higher household incomes tended to have a more negative perception towards the labour market. An explanation for this could be that with higher education and income, people have more different possibilities for choosing their workplace. They also might want to distance themselves more from traditional labour such as agriculture and tend to rather associate themselves with more 'modern' and 'western' sectors, also because their higher educational level allows them to do so. This is especially problematic, because it means that there not only is a general lack in local workforce but it is especially the highly educated part of the population that is not willing to work in the agricultural sector. These people would however be of crucial importance in order to bring the sector forward, innovate it and make it attractive for young people. Younger respondents in general seemed to be less interested in agriculture. Young age was least associated with encouraging another young person to work within the agricultural sector and respondents between age 15-30 also most often mentioned not at all being able to imagine pursuing a career in agriculture with the most frequent mentioned reason 'not being interested in it'. If the agricultural labor market was attractive to highly educated and skilled Seychellois, this might also change the perception of the youth towards the sector.

The discussion points of the perception survey from the present section can be broken down to two main findings that deserve to be pointed out again. First, respondents reported to be generally supportive of the local agricultural sector, the labour market, and locally produced food. They also acknowledged current difficulties within the sector, however, such as low availability of locally produced food or unfavourable working conditions, which had an influence on their stated actions.

Most respondents stated not to be willing to work in agriculture, even though they considered it to be important that more people work in the sector overall.

Second, there was a clear tendency for respondents less in contact with agricultural topics (i.e., individuals educated to a higher level, as well as respondents living in other districts than Grand'Anse) to have less interest and be less supportive of agriculture overall. Possible explanations for this could be that, as a result of having very little knowledge about and contact with agriculture, the interest of these parts of the island society were simply never cultivated. Moreover, this could be explained by the tendency of higher educated and more well-off people to distance themselves from traditional sectors such as agriculture and instead prefer to associate themselves more with the tertiary sector and western standards.

4.2.2 Limitations

The limitations section for the perception survey is split in two different parts: first, the limitations associated to the survey sample and the implementation of the interviews are discussed (section 4.2.2.1) and second, limitations regarding the analysis of the responses are presented (section 4.2.2.2).

4.2.2.1 Survey sample and implementation of interviews

The survey was conducted with 239 respondents in four different districts, representing the four different regions of Mahé: Anse Royale in the South-Eastern Region, Grand'Anse in the Western Region, Beau Vallon in the Northern Region and Saint Louis in Greater Victoria. It was decided together with an expert from the NBS that a number of around 240 respondents living in these four districts are well suited to represent the population of Mahé.

Some limitations regarding the survey sample and design have to be considered, however. A certain selection bias due to people not being at home when the interviews were conducted was already discussed in the methods section 2.2.2. Another potential bias that should be considered is the bias introduced through interviewers. There were 10 different interviewers conducting different amounts of interviews. To limit this bias as far as possible, the interviewers were thoroughly briefed before going out to the field. Since most of the interviewers worked in only one or two districts, it was difficult to evaluate whether certain differences in answers were occurring due to the different location or due to the interviewer. However, the author was present at around 55% of the interviews in all the four districts. With visual analyzation, no strong differences in answers between interviews conducted by the author in a district and the other interviewers in the same district could be observed, which indicates that the interviewer bias was successfully reduced to an acceptable level.

In direct interviews it should further be considered that some bias can be introduced due to social desirability of answers (Baur & Blasius, 2014). In this case this could have been reinforced by the fact that the interviewers were attached to the MFAg (or the SAA) directly and also because it occasionally happened to be the case that respondents and interviewers were distant acquaintances of friends or family or sometimes even knew each other directly. This could not have been prevented, but was considered when discussing the main findings and analyzing the results.

4.2.2.2 Questionnaire design and analysis of survey responses

The questionnaire was pre-tested twice with a total of 25 respondents. This ensured that it was understandable and would generate the findings that it was designed to obtain. One aspect that was not directly considered was the order in which multiple response options were presented. It is usually assumed that in interview situations where respondents read the answer options they are more likely to choose the first listed options whereas in situations where respondents hear response options from the interviewer they are more likely to choose the last ones mentioned (de Leeuw et al., 2008). However, for the survey conducted this did not seem to have a substantial influence, since the by far most often chosen answer options were the ones listed first, in contrast to what the literature suggests.

Two different aspects related to the statistical analysis of the survey responses have to be considered. The first concerns the EFA: more than half of the components consist of only two or three variables. It is usually suggested that a component should be made up of four or more components (Field, 2009). Also, Cronbach's Alpha values are quite low (below 0.7 for three out of five components). However, for the overall analysis of results in the results section 3.2.4, means and standard deviations are always shown for components as well as all the items they contain, which makes the results transparent. Furthermore, summarizing many items into components was considered necessary to summarize findings and improve clarity. It also helped reduce the amount of statistical tests conducted in order to find differences between the socio-demographic groups in section 3.2.5. With more tests conducted, the probability of finding effects—even if there are none (type I error)—is growing, which represents the second aspect that should be taken into account when interpreting the results. It is possible and often suggested that when a large number of statistical tests is conducted, the significance level should be adapted to acknowledge the higher probability of type I errors occurring. The number of tests conducted for this thesis was considered to be low enough to forgo such an adaption, however. In addition, the majority of differences found between answers of different socio-demographic groups were highly significant, so they still would have been relevant with adapted significance levels.

4.3 Bringing together the qualitative system analysis and the perception survey

As shown already, this study had two parts: first, a qualitative system analysis (QSA) of the agricultural system on the island of Mahé was conducted, and second, a survey was carried out with the goal of examining the perception of the local population towards the agricultural sector and locally produced food. The implementation of the QSA was necessary in order to set the results from the perception survey into the current context of the agricultural system on Mahé. The perception that people have of the sector is inevitably linked to its current condition and vice versa; the mindset that the population has towards the sector is very much able to influence the sector itself. This was shown with the system grid of direct impacts (section 3.1.4, figure 2) where the public image as well as the market access variable belonged to the critical quadrant and also the workforce variable was shown to be highly influenced by, and influential to, many other variables. This shows very clearly how deeply embedded and important the public perception of these different aspects of the agricultural sector is, and how the sector's image is itself shaped by the sector's state and constant development. This was also apparent in many of the results from the survey.

The survey results suggest that the hypothesis that the sector is generally undervalued can be rejected. Indeed, people ascribed high importance to the agricultural sector. As seen in the QSA, the variables that are directly linked to the population's perception ('*Public image*', '*Workforce*' and '*Market Access*') are of critical importance, as they highly influence other variables and therefore the whole sector. This would suggest that with the prevailing support of the public the agricultural sector should be in better shape. So why is this not the case?

For all of the three main variables, the survey shows that there is a gap between the general opinion or perception of the sector and the actual behaviour of the actors, due to variable-specific factors that are hereafter discussed.

For the first main variable, '*Public Image*', the survey showed that people ascribe high importance to agriculture. Yet government spending is low. As key informant 1 mentioned, the decline of financial support from the government and the simultaneous decrease in agricultural production and productivity was a slow and gradual process. It was only after the exogenous shocks of food prices rising during 2008/09 and gradual market liberalization that the importance of local food production became more evident (Government of Republic of Seychelles, 2013). But at this point, more than two decades of underfunding and limited priority given to the sector had taken their toll on the sector, and the resultant challenges and shortcomings could not easily and quickly be reversed.

With respect to the second main variable, '*Market Access*', (which is defined to a large extent by the demand of the local population for locally produced food) the survey showed that people highly value locally produced food and the demand for it exists. According to the system model (and

common sense) this has a great influence on other variables, like '*Local Food Production*'. So, while a strong demand for locally produced food should be a powerful driving force for the supply side, the real situation seems to be a bit more complicated. What became apparent in the QSA was that due to a number of challenges on the farm level, farmers are often not able to consistently supply their products, even if there is a demand for them. This in turn makes many retailing actors, such as supermarkets, hesitant to rely too much on local suppliers; they often prefer to work with food importers instead. This again drastically reduces availability of locally produced food products to consumers, even though they would have a demand for it.

The third variable, '*Workforce*', is more ambivalent in the survey. While people did not ascribe many negative attributes to the agricultural sector as a working place, and would encourage others to work there, most people themselves said they would not want to pursue a career in agriculture. What seems like a contradiction shows what already became apparent before. The population does indeed ascribe high importance to the sector, but people are (for various reasons, such as lower wages or little perspective of succeeding with an agricultural business) not willing to change their current behaviour and actually work in the sector. With the agricultural system being in its poor state, farmers are not able to pay higher wages or to make investments (e.g. in machinery) to improve working conditions and profitability. This in turn leads to less people getting an education in the agricultural field, less availability of skilled workers, and, in the end, lower productivity of the sector. This chain of effects reinforces the decision of the individuals not to work in agriculture—a negative feedback resulting in a downward spiral.

These findings indicate that an intervention from the institutional side would be needed to break these negative feedback effects. As seen in the QSA, if working conditions could be improved, and higher skilled people started working in the sector, this could positively influence other variables and reverse the negative feedback mechanism into a positive one. The same logic can be applied to the supply and demand problem. Even though demand for local food clearly exists, this alone cannot change the fact that on the supply side there are so many challenges that farmers still are very often not able to meet the existing demand. If farmers could be enabled to supply their products more consistently, then retailers would be more willing to work with them and the local population would have more access to local food products. Their demand for it would again improve the market access situation for local producers what would then strengthen them in producing consistently and so on. What has become evident in this discussion of the main variables is that while the survey results suggest that the population supports the sector and ascribes high importance to it, the agricultural sector is in such bad shape that at the moment the actors involved seem unable to individually steer it in a positive direction. This means that some sort of collective effort has to be made in order to give the individuals the incentives to change their behaviour and reverse these negative trends. What

is also clearly shown is that the most suitable tools for intervention with the largest leverage effects are of institutional nature. This means that an improvement in the institutional framework through more governmental support is undoubtedly needed for the agricultural sector. It needs to become profitable for individuals to change their behaviour according to their beliefs to enable them to express their support for the sector via their actions. A possibility for an incentivizing system would be the introduction of a system of subsidies, as found in many other agricultural systems across the world (OECD, 2017). However, within this paper, it has also been shown that the agricultural system on Mahé is complex, and that the institutional framework is not the only aspect shaping the sector. Creating an agricultural sector that is sustainably contributing to national food and nutrition security is clearly not an easy task that will need consolidated effort from all the different actors involved.

4.4 Generalizability of findings to other SIDS

In 1992 the United Nations officially recognized that SIDS are a specific group of countries with specific characteristics that not only originate from their geographic features but also from a similar historical development (United Nations, 2011). In many SIDS, the setup of a plantation industry followed after colonialization, mostly for cash crop production for exportation. Either hand in hand with this or at a later stage, traditional agricultural production for self-sufficiency weakened, the plantation economy decreased, and the share of imported food products rose (Eriksen, 2011; Lowitt et al., 2015). Also recognized in many of the SIDS, however, was that this very low level of self-sufficiency makes the countries vulnerable and puts food and nutrition security at risk, and that therefore local food production should be increased up to a certain level (FAO, 2014).

Consequently, many of the challenges facing these countries today are very similar. All SIDS face challenges regarding agriculture and food and nutrition security, as described in the example of the Seychelles. In general, SIDS have limited land and fresh water resources and fragile environmental systems highly vulnerable to climate change. Furthermore, due to their small size, SIDS usually have to import most of their agricultural inputs. Beyond limitations that are inherent to being a small, isolated island state, there are other challenges, linked to the political and institutional landscape of the islands. Many SIDS' markets are highly embedded in the international trade system and have low barriers to protect domestic agricultural production (Pelling & Uitto, 2001). An increasing share of the domestic food needs in many SIDS is being imported, which leaves the countries dependent and vulnerable to exogenous shocks restricting food imports. Also, many of the societal developments influencing the agricultural and food system evolved similarly and simultaneously in many SIDS. An example is the fast modernization of island cultures and western influences. One result of this phenomenon was that many traditional sectors with generally low profitability, such as agriculture,

lost a lot of their importance (Pelling & Uitto, 2001; Key informant 1). This change also resulted in a shift from traditional towards more 'westernized' dietary patterns, which was enforced by most imported food products being highly processed and energy dense (FAO, 2017; Lowitt et al., 2015).

In this paper, it has been shown that, contrary to the main hypothesis, the population does assign high importance and value to the agricultural system. Mahé inhabitants value local food and are aware of the importance of local production for food security in general. However, factors such as low government funding have led to a situation where the population is not willing or able to bring about significant changes and improvements for the sector. It has been shown that institutional support is necessary for the agricultural system to get back on a sustainable growth path that can contribute to food and nutrition security over the long term. The population's perception of the agricultural system is strongly driven by the sector's state and the challenges it is facing. Since many SIDS are facing the same or very similar challenges, as shown above, this indicates that the perception of the population towards the agricultural system and therefore its embedding into the socio-political context in other SIDS could be very similar as well. This study is a start in providing data for this direction, but more research on this topic would certainly be needed and beneficial to examine the situation on other SIDS and to deepen the understanding of the Seychelles context as well.

5 Conclusion

The agricultural system on Mahé is currently in poor condition and only supplies about 20-30% of food domestically consumed, while the large majority of demand is covered by imported food products. In the past, this has shown to make the Seychelles highly vulnerable to exogenous shocks that restrict import capacities. While research has been conducted on many of the challenges the sector is facing, limited priority has been given to the socio-political context that the agricultural system is embedded in. The goal of this thesis was to contribute to this field and to gain an understanding of the population's influence as well as opinion towards the agricultural sector and locally produced food. Findings showed that the population is of crucial importance to the agricultural sector and influences it on many levels, be it in form of demand, workforce, or political decision force. It has also been found that the local population on Mahé is supportive of the agricultural sector. On average, they highly value locally produced food, acknowledge the importance of local agriculture in terms of ensuring food security, and are in favour of strong governmental support for the sector. It has also been shown, however, that more than two decades of very limited priority and funding from the government towards the sector have taken their toll. Production and productivity for major crops and livestock have been decreasing, and the agricultural system is in strong need of assistance to reverse this trend and increase local food production in the future. Findings from this study point out that even though the public may be supportive of the agricultural sector, with its current condition, the civil society alone has got very limited possibilities for action to support the agricultural field. It is therefore evident that a strong institutional framework and higher funding is needed to strengthen the sector. In this way, a basic environment needs to be created that encourages the different actors, such as farmers and consumers, to cooperate and create an agricultural sector that can sustainably contribute to improving food and nutrition security. Due to many similarities shared between SIDS, these findings can not only be applied to Mahé but should also prove useful for other SIDS in similar situations. Further studies are needed to gain a deeper understanding of the context in the Seychelles as well as the generalizability of this study's findings for other SIDS.

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7 Appendix

Appendix 1: Questions from interview guides used in semi structured expert interviews

Due to confidentiality reasons, the interview guide used in the interview with an expert on agricultural education and extension services is not listed.

A1.1 Interview with farmers

A) *Farmer's Identity & Motivation*

1. Could you please start by telling me a little bit about yourself?

   - How long have you been a farmer for?

   - Did you receive any agricultural education?

   - Why did you decide to become a farmer and what is your motivation now?

   - Age

B) *Farm level*

2. Could you tell me the most important production facts about your business?

   - What and how much of it do you produce?

   - Size of your farm?

   - How would you describe the level of modernization / technology of your farm?

3. Biggest difficulties and challenges for you as a farmer?

   - Do you know of other farmers that have similar problems?

4. How would you describe the situation regarding agricultural employees?

   - Do you need or have any?

   - Is it difficult to find employees?

   - How is the general experience?

5. How is the situation with land ownership or lease?

C) *Market situation (Inputs/Value addition/Selling)*

6. Please tell me a little bit about the inputs you are using?

   - Seeds, fertilizer (manure), pesticides, others?

- If you buy them, who do you buy them from?

- Any difficulties? (e.g. would you prefer others, but not available?

7. What possibilities exist for you for selling your products?

- Difficulties with infrastructure or transportation?

D) Network and Information Flows

8. If you need any information about farming, how would you try to find it?

- How do you think about the current extension services?

9. People or Organizations you are in touch with regularly?

- Other farmers?

- Seychelles Agricultural Agency?

- Seychelles Farmer Association?

E) Agriculture in the Seychelles in General

10. Can you tell me anything about agricultural education in Seychelles?

- Did you receive any?

11. How would you describe the life quality as a Seychellois farmer?

- Have you ever had thoughts about doing some other job instead?

- Any main obstacles or good things?

12. What do you think about general state of agricultural sector?

- What is your personal image of it?

- What would you change and why?

13. Is there anything else you would like to share?

A1.2 Interviews with two different agricultural experts working for the government

A) Expert's identity, motivation & area of expertise

1. Could you please start by telling me a little bit about yourself and your background?

- Age, name

- What is your role and position regarding the Seychellois agricultural sector?

- Special expertise?

- Why and when did you decide to start working in this field and what is your motivation now?

B) *Stakeholders & their influence*

2. *(A preliminary list of stakeholders involved in the agricultural sector is presented to the experts)*
   Would you more or less agree with the listing of these stakeholders? Which of these would you say are the most important ones and why? Would you add any?

C) *Historical Development of Agricultural Sector*

3. History: At the moment 70-80% of food imported. Could you tell me a little about the history and how it came to this? What do you think were the most important milestones in the agricultural development over the last 40 or 50 years?

D) *General state, difficulties, challenges*

4. If you're thinking about the agricultural sector in Seychelles: What's the first things that come to your mind?
   - What is the image of the sector for you? For others?
   - What do you think needs to change?
5. What would you say are currently the biggest difficulties and challenges?

E) *Reasons for low land usage intensity & low modernization*

6. Can you think of any reasons for the rather low degree of modernization in the Seychellois agricultural sector?
7. What do you think are the reasons that only around 50% of agricultural land is being used?
   - What would you see as most important measures to increase this percentage?

F) *Climate & Environment*

8. Are there already problems with climate change? Any forecasts on what the impacts will look like?

9. Are there any difficulties between the agricultural sector and environmental protection aspects? What if agriculture expands (as planned e.g. in SNAIP)?

G) *Market & Trading*

10. What do you think about the current trade policies? Would you see any possibility or need for adjustment in order to support Seychellois farmers?
11. Underdeveloped value chains seem to be a problem in the sector. In which area would you see the greatest potential for building up value chains?
    - E.g. organic, tourism, ...

H) *Other*

12. Can you tell me anything about agricultural education in Seychelles?
13. Is there anything else you would like to share?

A1.3 Interviews with three experts on food consumption; and eating and purchasing behaviour of the local population

A) *Expert's identity, motivation & area of expertise*

1. Could you please start by telling me a little bit about yourself and your background?
   - Age, name
   - What is your role and position regarding the Seychellois agricultural sector?
   - Special expertise?
   - Why and when did you decide to start working in this field and what is your motivation now?

B) *General state, difficulties, challenges*

2. How would you generally describe peoples diets?
3. What would you say are currently the challenges or shortcomings in terms of the peoples diets?

4. What kind of issues or problems do people talk about when it comes to their diet and purchasing food?

C) Historical Development of Diets

5. Can you see any trends and changes in people's diet? Do you think that the rising share of imports influences this?
6. Have the types of challenges people experience in the area of food changed over time?

D) Local vs imported Products

7. Do you think that locally produced food has a different image for the consumers than imported food?
8. Can you see any quality differences in local and imported foods? Or does it depend on the product category?
   - Do you think it would make sense to increase share of locally prod. food in people's diets?

E) Education

9. How are children and the public educated about nutrition and food?
   - Is there a focus on local vs imported or only on what kind of food?

F) Stakeholders & their influence

10. Are you in touch with people or groups from agriculture on a regular basis? If yes, with whom and how?
11. Please comment on this preliminary list of stakeholders.

G) Other

12. Is there anything else you would like to share?

Appendix 2: List of criteria (according to Vester, 2013) to check for systemic relevance and impact variables covering these

Criteria	Variable covering criteria in agricultural system
Area of life criteria	
Participants (Who is acting?)	• Workforce
Activities (What do they do?)	• Agricultural education and extension services • Local food production • Value chains
Space (What happens where?)	• Agricultural land
Mood (How do people feel?)	• Farmer collaboration • Public image
Natural balance (How does resource budget work?)	• Agricultural land • Fresh water availability • Pest and disease pressure
Internal processes (What channels of communication are there?)	• Agricultural education and extension services • Infrastructure and technologies
Internal order (How is this regulated?)	• Government spendings and support • Branding and certification • Loan availability
Variable's physical base criteria	
Matter (Variables having a primarily material character)	• Agricultural land • Fresh water availability • Workforce • Infrastructure and technologies • Local food production • Agricultural inputs • Food imports
Energy	• Workforce

(Variables having a primarily energy-related character)	• Food prices • Government spendings and support • Loan availability
Information (Variables having a primarily information- and communications-related character)	• Agricultural education and extension services • Farmer collaboration • Public image

Variable's dynamic base criteria

Flow size (Variables expressing primarily flows of matter, energy, or information)	• Fresh water availability • Pest and disease pressure
Structure size (Variables serving to determine structure rather than flow)	• Agricultural land • Infrastructure and technologies
Temporal dynamics (Variables at the same location change at a given time or possessing a temporal dynamic)	• External disturbances • Fresh water availability • Environmental impact
Spatial dynamics (Variables that at a given time differ from location to location)	• Fresh water availability • Environmental impact • Market access for agricultural producers

Variable's system relatedness

Opens the system by input (Variables that open the system through influences from outside)	• Fresh water availability • Pest and disease pressure • Workforce • Agricultural inputs • Food imports • External disturbances
Opens the system by output (Variables that open the system through influences from inside the system)	• Environmental impact • Public image
Controllable from inside (Variables that can be controlled by decision-making processes coming from within the system under consideration)	• Agricultural land • Agricultural education and extension services • Value chains

	• Government spendings and support • Loan availability • Branding and certification
Controllable from outside (Variables that are subject to decision-making processes taking place outside the system)	• Fresh water availability • Workforce • Farmer collaboration • Food prices • Agricultural inputs • Food imports • Public image • External disturbances

Perception survey:
How is the agricultural sector in Mahé perceived by the population?

My name is Melina Glimmann and I am a master student in agricultural science from ETH Zürich in Switzerland. For my master thesis I am doing research about agriculture in a small island developing state like Seychelles. The focus of my research and goal of this survey is to find out how the local population perceives the agricultural sector and locally produced food.

Please note the following remarks about the study and its confidentiality:

- The interview will take around 20 minutes.
- We are interviewing about 200 households that have been randomly selected out of the different regions on Mahe.
- Your answers will be completely anonymised.
- The results will be published within my master thesis which will be free to use for the Seychellois Ministry of Fisheries and Agriculture.

Thank you very much for taking your time!

Date of interview: _____

A. DEMAND OF LOCALLY PRODUCED FOOD

1. The following questions are focusing on your eating habits and your preferences regarding locally produced and imported foods. There are no wrong or right answers.

Please state your agreement to the following statements:	Not at all agree 1	2	3	4	5	6	Strongly agree 7
a. In general I pay attention whether the food I am consuming is locally produced or imported.	☐	☐	☐	☐	☐	☐	☐
b. I am willing to pay a higher price for vegetables and fruit if I know that it has been produced locally.	☐	☐	☐	☐	☐	☐	☐
c. I am willing to pay a higher price for meat if I know that it has been produced locally.	☐	☐	☐	☐	☐	☐	☐

Please answer the following questions:

d. If you buy **vegetables or root crops**, how often do you choose locally produced products compared to imported products?

☐ Never
☐ Rarely
☐ Sometimes
☐ Often
☐ Very often

e. If you buy **locally produced vegetables or root crops**, what are the reasons for this choice? (Multiple answers possible)

☐ It is cheaper
☐ It tastes better
☐ It is healthier
☐ It does not spoil quickly
☐ I know where it comes from
☐ It is more easily available for me
☐ I get it from my own garden

☐   I want to support the local farmers

☐   Other:

f. If you buy **fruit**, how often do you choose locally produced products compared to imported products?

☐   Never

☐   Rarely

☐   Sometimes

☐   Often

☐   Very often

g. If you buy **locally produced fruit**, what are the reasons for this choice? (Multiple answers possible)

☐   It is cheaper

☐   It tastes better

☐   It is healthier

☐   It does not spoil quickly

☐   I know where it comes from

☐   It is more easily available for me

☐   I get it from my own garden

☐   I want to support the local farmers

☐   Other:

h. If you buy **chicken**, how often do you choose locally produced products compared to imported products?

☐   Never

☐   Rarely

☐   Sometimes

☐   Often

☐   Very often

i. If you buy **locally produced chicken**, what are the reasons for this choice? (Multiple answers possible)

☐   It is cheaper

☐   It tastes better

☐ It is healthier

☐ It does not spoil quickly

☐ I know where it comes from

☐ It is more easily available for me

☐ I produce it myself

☐ I want to support the local farmers

☐ Other:

j. If you buy **other meat**, how often do you choose locally produced products compared to imported products?

☐ Never

☐ Rarely

☐ Sometimes

☐ Often

☐ Very often

k. If you buy **locally produced other meat**, what are the reasons for this choice? (Multiple answers possible)

☐ It is cheaper

☐ It tastes better

☐ It is healthier

☐ It does not spoil quickly

☐ I know where it comes from

☐ It is more easily available for me

☐ I produce it myself

☐ I want to support the local farmers

☐ Other:

l. Which **imported products** do you buy regularly? (Multiple answers possible)

☐ Vegetables & Root Crops

☐ Fruit

☐ Chicken

☐ Other meat

☐ Other:

m. What are the reasons for you to buy **imported**

products?

- ☐ It is cheaper
- ☐ It tastes better
- ☐ It is healthier
- ☐ It is more easily available for me
- ☐ It is not available locally produced
- ☐ Other:

B. LABOUR MARKET: ATTRACTIVITY AND IMAGE OF WORKING IN AGRICULTURE

2. The following questions are focusing on your perception and opinion about the labour market of the agricultural sector. Please answer according to the indications given (a) or state your agreement for the statements (b-f). There are no right or wrong answers.

	Not at all agree						Strongly agree
	1	2	3	4	5	6	7
a. I believe that working in agriculture can be financially lucrative.	☐	☐	☐	☐	☐	☐	☐
b. I believe that working in agriculture is prestigious.	☐	☐	☐	☐	☐	☐	☐
c. I believe that working in agriculture does **not** give you many opportunities to learn new things.	☐	☐	☐	☐	☐	☐	☐
d. I believe that working in agriculture is interesting.	☐	☐	☐	☐	☐	☐	☐
e. I would encourage a young person I know to pursue a career in agriculture.	☐	☐	☐	☐	☐	☐	☐

f. What are the reasons for this? (Short answers, key words)

_____

_____

	Not at all agree						Strongly agree
	1	2	3	4	5	6	7
g. I could imagine pursuing a career in agriculture.	☐	☐	☐	☐	☐	☐	☐

h. What are the reasons for this? (Short answer, key words)

_____

_____

i. Have you ever worked in the field of agriculture before?

☐ No

☐ No, only backyard farming

☐ Yes (please specify): _____

C. CURRENT IMAGE OF AGRICULTURE IN SEYCHELLES

3. **The following questions are focusing on your personal opinion and perception on the agricultural sector in Mahe. Please answer according to the indications given (a) or state your agreement for the statements (b-f). There are no right or wrong answers:**

   a. Please name the first three things that come to your mind when you hear the words 'agriculture' or 'farmer'

      1. _____

      2. _____

      3. _____

	Not at all agree						Strongly agree
	1	2	3	4	5	6	7
b. Agriculture is an important part of the Seychellois culture and national identity.	☐	☐	☐	☐	☐	☐	☐
c. Agriculture plays an important role for food security in the Seychelles.	☐	☐	☐	☐	☐	☐	☐
d. The Seychelles need a modernised agricultural system.	☐	☐	☐	☐	☐	☐	☐
e. Agriculture is a part of the landscape of the Seychelles.	☐	☐	☐	☐	☐	☐	☐
f. Seychellois agriculture is a valuable tradition that should be preserved.	☐	☐	☐	☐	☐	☐	☐
g. The agricultural sector in Mahe is doing well.	☐	☐	☐	☐	☐	☐	☐
h. The agricultural sector in Mahe is providing fresh and tasty food for the population.	☐	☐	☐	☐	☐	☐	☐
i. To modernize and make the agricultural sector in the Seychelles ready for the future, major governmental support is needed.	☐	☐	☐	☐	☐	☐	☐
j. Currently, about 75% of food in Seychelles is imported. This share should be increased in order to have more imported food products.	☐	☐	☐	☐	☐	☐	☐
k. The government of Seychelles should constantly support farmers financially to guarantee the survival	☐	☐	☐	☐	☐	☐	☐

of local food production.

What do you think is most important when it comes to food production in Seychelles?
Please rank from 1 to 4 (1=most important for me, 4=least important for me). There are no wrong or right answers:

○ Food prices are low, so it is easily affordable for everyone

○ Food is produced locally instead of imported

○ Food is produced without harming the natural environment in Seychelles

○ The government supports farmers so that they are able to compete with imported products

D. PERSONAL DATA

4. Year of birth

_____

5. Gender

	Female	Male
	☐	☐

6. Your highest education completed

☐ Obligatory (primary/secondary) school not completed

☐ Obligatory (primary/secondary) school completed

☐ Vocational school

☐ Polytechnic school, A level or similar

☐ University or equivalent

7. Number of people living in your household   _____

8. Total monthly household income (of all members added together)

☐ Less than 2000 SCR

☐ 2000-4000 SCR

☐ 4000-6000 SCR

☐ 6000-8000 SCR

☐ 8000-10'000 SCR

☐ 10'000-12'000 SCR

☐ 12'000-14'000 SCR

☐ 14'000-16'000 SCR

☐ 16'000-18'000 SCR

☐ 18'000-20'000 SCR

☐ More than 20'000 SCR

9. Your district of residence _____

Are there any additional comments or questions?:

Thank you very much for your participation in the survey!

Resers lo Persepsyon:

Kimanyer lagrikiltir lo Mae I ganny persevwar par popilasyon?

Mon apel Melina Glimmann e mon en etidyan lasyans lagrikiltir nivo master kot ETH Zürich an Switzerland. Dan kad mon letid, mon pe fer en resers lo lagrikiltir dan bann pti leta zil parey Sesel. Lobzektif sa resers se pou dekouver persepsyon popilasyon lokal lo sekter agrikol e bann prodwi lokal.

I byen not sa bann remark swivan konsernan konfidansyalite sa resers:

- Sa antretyen pour pran anviron 20 minit
- 200 lakour dan diferan rezyon lo Mae kin ganny swazir par azar ki pe partisip dan sa resers
- Ou larepons pour konpletmen anonim.
- Rezilta sa resers pou gany pibliye pour mon letid liniversiter e I pou osi lib pour ganny servi par Minister Lapes ek Lagrikilitir Sesel.

Mersi bokou pour ou letan.

Dat: _____

A. DEMANN POUR MANZE/PRODWI LOKAL

1. Sa seri kestyon I viz fer ou ladyet osi byen ki ou prefedrans ant manze lokal oubyen manze enporte Tou larepons I enportan.

Ki nivo agree ou agree avek sa bann deklarasyon swivan:

	Totalman pa agree 1	2	3	4	5	6	Totalman agree 7
a. Zeneralman mon port byen latansyon sis a manze ki mon pe manze I prodwi lokal oubyen enporte	☐	☐	☐	☐	☐	☐	☐
b. Mon pare pour pey en pri pli ser pour fri ek legim si mon konnen I en prodwi lokal.	☐	☐	☐	☐	☐	☐	☐
c. Mon pare pour pey en pri pi ser pour lavyan si mon okouran I en prodwi lokal.	☐	☐	☐	☐	☐	☐	☐

Reponn sa bann kestyon swivan

d. Si ou aste legim ek gro manze, konbyen fwa ou swazir prodwi lokal olye prodwi enporte?

☐ Zanmen
☐ Rarman
☐ Parfwa
☐ Souvann fwa
☐ Tre Souvan

Akoz ki ou pou aste legim ek gro manze ki prodwi lokalman? Kestyon swa miltip.

☐ I pli bon marse
☐ I pli goute
☐ I pli bon pour lasante
☐ I pa gat vitman
☐ Mon konnen kot sorti
☐ Mon ganny pli fasilman
☐ Mon plant kot mon lakour
☐ Mon anvi siport fermye lokal
☐ Lezot rezon:

e. Si ou aste fri, konbyen fwa ou swazir fri lokal olye
   fri enporte?

   ☐ Zanmen

   ☐ Rarman

   ☐ Parfwa

   ☐ Souvann fwa

   ☐ Tre Souvan

f. Akoz ki ou prefer aste fri lokal? Kestyon swa
   miltip.

   ☐ I pli bon marse

   ☐ I pli goute

   ☐ I pli bon pour lasante

   ☐ I pa gat vitman

   ☐ Mon konnen kot sorti

   ☐ Mon ganny pli fasilman

   ☐ Mon plant kot mon lakour

   ☐ Mon anvi siport fermye lokal

   ☐ Lezot rezon:

g. Si ou aste poul,konbyen fwa ou prefer aste poul
   lokal ki poul enporte?

   ☐ Zanmen

   ☐ Rarman

   ☐ Parfwa

   ☐ Souvann fwa

   ☐ Tre Souvan

h. Ki rezon ki ou pou aste poul lokal olye poul
   enporte? Kestyon swa miltip.

   ☐ I pli bon marse

   ☐ I pli goute

   ☐ I pli bon pour lasante

   ☐ I pa gat vitman

   ☐ Mon konnen kot sorti

   ☐ Mon ganny pli fasilman

   ☐ Mon fer elevaz poul kot mon lakour

   ☐ Mon anvi siport fermye lokal

☐ Lezot rezon:

i. Si ou aste lezot kalite lavyann, konbyen fwa ki ou prefer aste lavyann kin prodwi lokal olye lavyann enporte?

☐ Zanmen

☐ Rarman

☐ Parfwa

☐ Souvann fwa

☐ Tre Souvan

j. Ki rezon ki ou pour prefer aste lavyann kin prodiw lokal olye lavyann enporte? Kestyon swa miltip.

☐ I pli bon marse

☐ I pli goute

☐ I pli bon pour lasante

☐ I pa gat vitman

☐ Mon konnen kot sorti

☐ Mon ganny pli fasilman

☐ Mon fer elevaz zannimo kot mon lakour

☐ Mon anvi siport fermye lokal

☐ Lezot rezon:

k. Ki bann prodwi enporte ki ou aste regiklyerman? Kestyon swa miltip.

☐ Legim ek Gro manze

☐ Fri

☐ Poul

☐ Lezot kalite lavyann

☐ Lezot prodwi:

l. Ki rezon akoz ou aste sa bann prodwi enporte?

☐ I pli bon marse

☐ I pli goute

☐ I pli bon pour lasante

☐ Mon ganny pli fasilman

☐ mon pa ganny ditou lokalman

☐ Lezot rezon

B. LOPORTINITE LANPLWA: LATRAKSYON EK LIMAZ TRAVAY DAN LAGRIKILTIR

2. **Sa seri kestyon pe regard ou persepsyon ek ou lopinyon lo travay dan sekter lagrikiltir. Reponn kestyon dapre lendikasyon ki'n donnen (a) oubyen dir ou nivo agree pour sak deklarasyon (b-f). Tou larepons I enportan.**

	Totalman pa agree						Totalman agree
	1	2	3	4	5	6	7
a. Mon kwar ki travay dan lagrikiltir I en travay ki fer ou ganny en ta larzan.	☐	☐	☐	☐	☐	☐	☐
b. Mon kwar ki travay dan lagrikilitr I annan valer.	☐	☐	☐	☐	☐	☐	☐
c. Mon kwar ki travay dan lagrikiltir **pa** donn ou bokou loprotinite pour aprann nouvo keksoz	☐	☐	☐	☐	☐	☐	☐
d. Mon kwar ki travay dan lagrikiltir I enteresan.	☐	☐	☐	☐	☐	☐	☐
e. Mon pou ankouraz en zenn pou pran en karyer dan lagrikiltir.	☐	☐	☐	☐	☐	☐	☐

f. Ki ou rezon pour larepons sa kestyon oparavan? (Larepons kourt, met bann mo kle)

_____

_____

	Totalman pa agree						Totalman agree
	1	2	3	4	5	6	7
g. Mon kapab mazin swiv en karyer dan lagrikiltir	☐	☐	☐	☐	☐	☐	☐

h. Ki ou rezon pour ou repons? (Larepons kourt, met bann mo kle)

_____

_____

i. Eski ou'n deza travay dan okenn sekter lagrikilr oparavan?

☐ Non

☐ Non, mon zis plant kot lakour

☐ Wi (silvouple spesifye ki kalite travay ou ti
fer): _____

C. LIMAZ AKTYEL LAGRIKILTIR DAN SESEL

3. **Sa seri kestyon pe rod ou pwennvi personnel ek ou persepsyon lo sekter lagrikiltir lo Mae. Reponn kestyon dapre lendikasyon ki'n donnen (a) oubyen dir ou nivo agree pour sak deklarasyon (b-f). Tou larepons I enportan.**

a. Nonm trwa (3) premye keksoz ki vin dan ou lespri ler ou tann sa mo lagrikiltir oubyen fermye.

1. _____

2. _____

3. _____

	Totalman pa agree						Totalman agree
	1	2	3	4	5	6	7
b. Lagrikiltir I en par enportan dan kiltir Seselwa e idiantite nasyonal.	☐	☐	☐	☐	☐	☐	☐
c. Lagrikiltir I zwe en rol enportan dan sekirite alimanter dan Sesel.	☐	☐	☐	☐	☐	☐	☐
d. Sesel I bezwen en sistenm lagrikiltir modernize.	☐	☐	☐	☐	☐	☐	☐
e. Lagrikikltir I en parti lanvironnman Sesel.	☐	☐	☐	☐	☐	☐	☐
f. Lagrikiltir Seselwa I en tradisyon presye ki devret ganny preserve.	☐	☐	☐	☐	☐	☐	☐
g. Sekter lagrikiltir lo Mae pe fer byen.	☐	☐	☐	☐	☐	☐	☐
h. Sekter lagrikiltir lo Mae pe ofer popilasyon prodwi fre e goute..	☐	☐	☐	☐	☐	☐	☐
i. Sekter lagrikiltir dan Sesel I bezwen mazer sipor sorti kot Gouvernman pour moderniz e fer pare sa sekter pou lefitir.	☐	☐	☐	☐	☐	☐	☐
j. Ansemoman, 75% manze I ganny enporte Sesel. Sa poursantaz I devret ganny ogmante pour annan plis prodwi enporte isi.	☐	☐	☐	☐	☐	☐	☐
k. Gouvernman Sesel I devret detanzaot siport fermye finansyerman pour garanti legzistanat prodiksyon	☐	☐	☐	☐	☐	☐	☐

lokal.

Kwa ki ou kwar i pli enportan konsernan bann prodiksyon manze dan sesel?
Silvouple ran depi 1 ziska 4 (1=Pli enportan pou mwan, 4= Pa enportan pou mwan). Napa larepons byen ou mal:

○ Pri manze i ba, alors i pli afordab pou tou dimoun

○ Manze i gany prodwir lokalman dan plas enporte

○ Manze i gany prodwir sa andomaz lavironnman Sesel

○ Nou gouverdman i siport farmye pou zot kapab konteste avek bann prodwir enporte

D. LENFORMASYON PERSONNEL

4. Dat Nesans
_____

5. Sex

Femel	Mal
☐	☐

6. Ou pli o nivo ledikasyon

☐ Obligatwar (primer/segonder) pa'n konplete

☐ Obligatwar (primer/segonder) konplete

☐ Lekol Vokasyonnel

☐ Polytechnic, A level oubyen nivo similer

☐ Liniversite oubyen ekivalan

7. Kantite dimoun ki reste dan ou lakaz _____

8. Larzan ki antre kot lakour tou le mwan an total

☐ Mwens ki 2000 roupi

☐ 2000-4000 SCR

☐ 4000-6000 SCR

☐ 6000-8000 SCR

☐ 8000-10'000 SCR

☐ 10'000-12'000 SCR

☐ 12'000-14'000 SCR

☐ 14'000-16'000 SCR

☐ 16'000-18'000 SCR

☐ 18'000-20'000 SCR

☐ Plis ki 20'000 roupi

9. Distrik kot ou Reste _____

95

Eski ou annan okenn lezot komanter adisyonnel ou tya kontan paratze oubyen okenn kestyon ou tya kontan demande?

Mersi bokou pour partisip dan sa resers.

Influence by ↓ to →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Activity
1 Agricultural Land		0	0	2	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	5
2 Water Availability	0		1	2	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	7
3 Pests & Disease Pressure	0	0		1	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	5
4 Environmental Impact	0	0	0		0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	3
5 Agricult. Education & Extention Services	1	0	2	2		3	1	2	0	0	0	2	0	0	1	0	2	1	0	17
6 Workforce	0	0	1	1	0		1	1	1	3	0	1	1	0	0	0	0	1	0	11
7 Farmer Collaboration	0	0	1	0	1	2		0	2	1	1	3	2	0	0	1	0	0	0	14
8 Infrastructure & Technologies	0	3	2	3	0	0	0		0	3	0	2	2	0	0	0	0	2	0	17
9 Food Prices	0	0	0	0	0	0	0	0		0	0	2	3	0	0	0	0	1	0	6
10 Local Food Production	0	0	0	2	0	0	0	0	2		0	3	3	0	0	1	2	3	0	16
11 Agricultural Inputs	0	0	3	1	0	0	0	0	0	3		0	0	0	0	0	1	0	0	8
12 Value Chains	0	0	0	0	2	1	1	1	0	2	1		2	0	1	1	1	2	0	15
13 Market Access for Agricult. Producers	0	0	0	0	0	0	0	0	2	3	0	2		3	0	0	2	1	0	13
14 Food Imports	0	0	0	0	0	0	0	0	3	3	0	1	3		0	0	2	1	0	13
15 Government support & spendings	2	1	0	0	3	2	1	3	1	2	2	1	1	0		1	1	1	0	22
16 Loan Availability	1	0	0	0	0	1	0	3	0	1	3	3	0	0	0		1	1	0	14
17 Branding & Certification	0	0	0	1	1	1	0	1	2	0	1	3	2	0	0	1		2	0	15
18 Public Image	0	0	0	0	2	3	1	0	0	0	0	2	3	0	2	1	1		0	15
19 External Disturbances	0	3	2	2	0	1	0	1	0	2	3	0	0	3	1	0	0	0		18
Passivity	4	7	11	16	9	14	5	13	13	31	14	24	23	8	5	6	13	18	0	234

Appendix 5: Frequency distributions of answers of perception survey

Q1a

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	16	6.7	6.7	6.7
	disagree	11	4.6	4.6	11.3
	slightly disagree	7	2.9	2.9	14.2
	neither agree or disagree	31	13.0	13.0	27.2
	slightly agree	33	13.8	13.8	41.0
	agree	69	28.9	28.9	69.9
	strongly agree	72	30.1	30.1	100.0
	Total	239	100.0	100.0	

Q1b

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	28	11.7	11.8	11.8
	disagree	10	4.2	4.2	16.0
	slightly disagree	11	4.6	4.6	20.6
	neither agree or disagree	25	10.5	10.5	31.1
	slightly agree	28	11.7	11.8	42.9
	agree	68	28.5	28.6	71.4
	strongly agree	68	28.5	28.6	100.0
	Total	238	99.6	100.0	
Missing	System	1	.4		
Total		239	100.0		

Q1c

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	29	12.1	12.6	12.6
	disagree	15	6.3	6.5	19.0
	slightly disagree	13	5.4	5.6	24.7
	neither agree or disagree	29	12.1	12.6	37.2
	slightly agree	26	10.9	11.3	48.5
	agree	56	23.4	24.2	72.7
	strongly agree	63	26.4	27.3	100.0
	Total	231	96.7	100.0	
Missing	System	8	3.3		
Total		239	100.0		

Q1d

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	4	1.7	1.7	1.7
	Never	28	11.7	11.7	13.4
	Rarely	51	21.3	21.3	34.7
	Sometimes	83	34.7	34.7	69.5
	Often	73	30.5	30.5	100.0
	Total	239	100.0	100.0	

$Q1e Frequencies

		Responses		Percent of Cases
		N	Percent	
$Q1e[a]	Q1e_CHEA	25	3.6%	10.7%
	Q1e_TAST	128	18.5%	54.7%
	Q1e_HEAL	148	21.4%	63.2%
	Q1e_SPOI	73	10.5%	31.2%
	Q1e_WHFR	96	13.9%	41.0%
	Q1e_AVAI	49	7.1%	20.9%
	Q1e_GARD	59	8.5%	25.2%
	Q1e_SPFR	85	12.3%	36.3%
	Q1e_FRSH	11	1.6%	4.7%
	Q1e_NOCH	19	2.7%	8.1%
Total		693	100.0%	296.2%

a. Dichotomy group tabulated at value 1.

Q1f

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	5	2.1	2.1	2.1
	Never	59	24.7	24.7	26.8
	Rarely	51	21.3	21.3	48.1
	Sometimes	66	27.6	27.6	75.7
	Often	58	24.3	24.3	100.0
	Total	239	100.0	100.0	

$Q1g Frequencies

		Responses		Percent of Cases
		N	Percent	
$Q1g[a]	Q1g_CHEA	17	2.6%	7.4%
	Q1g_TAST	132	20.4%	57.4%
	Q1g_HEAL	140	21.7%	60.9%
	Q1g_SPOI	62	9.6%	27.0%
	Q1g_WHFR	82	12.7%	35.7%
	Q1g_AVAI	51	7.9%	22.2%
	Q1g_GARD	71	11.0%	30.9%
	Q1g_SPFR	78	12.1%	33.9%
	Q1g_FRSH	2	0.3%	0.9%
	Q1g_NOCH	11	1.7%	4.8%
Total		646	100.0%	280.9%

a. Dichotomy group tabulated at value 1.

Q1h

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	38	15.9	16.2	16.2
	Never	56	23.4	23.9	40.2
	Rarely	46	19.2	19.7	59.8
	Sometimes	57	23.8	24.4	84.2
	Often	37	15.5	15.8	100.0
	Total	234	97.9	100.0	
Missing	System	5	2.1		
Total		239	100.0		

$Q1i Frequencies

		Responses		Percent of Cases
		N	Percent	
$Q1i[a]	Q1i_CHEA	17	3.9%	8.9%
	Q1i_TAST	111	25.7%	57.8%
	Q1i_HEAL	97	22.5%	50.5%
	Q1i_SPOI	25	5.8%	13.0%
	Q1i_WHFR	83	19.2%	43.2%
	Q1i_AVAI	39	9.0%	20.3%
	Q1i_GARD	13	3.0%	6.8%
	Q1i_SPFR	45	10.4%	23.4%
	Q1i_FRSH	2	0.5%	1.0%
Total		432	100.0%	225.0%

a. Dichotomy group tabulated at value 1.

Q1j

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	30	12.6	13.1	13.1
	Never	56	23.4	24.5	37.6
	Rarely	56	23.4	24.5	62.0
	Sometimes	62	25.9	27.1	89.1
	Often	25	10.5	10.9	100.0
	Total	229	95.8	100.0	
Missing	System	10	4.2		
Total		239	100.0		

$Q1k Frequencies

		Responses		Percent of Cases
		N	Percent	
$Q1k[a]	Q1k_CHEA	10	2.4%	5.4%
	Q1k_TAST	111	26.9%	60.3%
	Q1k_HEAL	87	21.1%	47.3%
	Q1k_SPOI	25	6.1%	13.6%
	Q1k_WHFR	70	16.9%	38.0%
	Q1k_AVAI	38	9.2%	20.7%
	Q1k_GARD	6	1.5%	3.3%
	Q1k_SPFR	62	15.0%	33.7%
	Q1k_FRSH	4	1.0%	2.2%
Total		413	100.0%	224.5%

a. Dichotomy group tabulated at value 1.

$Q1l Frequencies

		Responses		Percent of Cases
		N	Percent	
$Q1l[a]	Q1l_VEG	96	19.3%	41.4%
	Q1l_FRUI	144	29.0%	62.1%
	Q1l_CHIC	75	15.1%	32.3%
	Q1l_MEAT	90	18.1%	38.8%
	Q1l_CANS	22	4.4%	9.5%
	Q1l_RICE	24	4.8%	10.3%
	Q1l_POTA	20	4.0%	8.6%
	Q1l_OTHE	26	5.2%	11.2%
Total		497	100.0%	214.2%

a. Dichotomy group tabulated at value 1.

$Q1m Frequencies

		Responses		Percent of Cases
		N	Percent	
$Q1m[a]	Q1m_CHEA	29	9.2%	12.9%
	Q1m_TAST	16	5.1%	7.1%
	Q1m_HEALT	6	1.9%	2.7%
	Q1m_AVAI	80	25.5%	35.6%
	Q1m_NOAV	183	58.3%	81.3%
Total		314	100.0%	139.6%

a. Dichotomy group tabulated at value 1.

Q2a

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	6	2.5	2.5	2.5
	disagree	4	1.7	1.7	4.2
	slightly disagree	6	2.5	2.5	6.7
	neither agree or disagree	46	19.2	19.3	26.1
	slightly agree	36	15.1	15.1	41.2
	agree	85	35.6	35.7	76.9
	strongly agree	55	23.0	23.1	100.0
	Total	238	99.6	100.0	
Missing	System	1	.4		
Total		239	100.0		

Q2b

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	5	2.1	2.1	2.1
	disagree	12	5.0	5.1	7.2
	slightly disagree	3	1.3	1.3	8.4
	neither agree or disagree	11	4.6	4.6	13.1
	slightly agree	18	7.5	7.6	20.7
	agree	63	26.4	26.6	47.3
	strongly agree	125	52.3	52.7	100.0
	Total	237	99.2	100.0	
Missing	System	2	.8		
Total		239	100.0		

Q2c

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	69	28.9	29.1	29.1
	2.00	155	64.9	65.4	94.5
	7.00	13	5.4	5.5	100.0
	Total	237	99.2	100.0	
Missing	System	2	.8		
Total		239	100.0		

Q2d

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	2	.8	.9	.9
	slightly disagree	1	.4	.4	1.3
	neither agree or disagree	5	2.1	2.2	3.4
	slightly agree	13	5.4	5.6	9.1
	agree	67	28.0	28.9	37.9
	strongly agree	144	60.3	62.1	100.0
	Total	232	97.1	100.0	
Missing	System	7	2.9		
Total		239	100.0		

Q2e

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	2	.8	.9	.9
	disagree	4	1.7	1.7	2.6
	slightly disagree	2	.8	.9	3.4
	neither agree or disagree	14	5.9	6.0	9.4
	slightly agree	13	5.4	5.6	15.0
	agree	63	26.4	26.9	41.9
	strongly agree	136	56.9	58.1	100.0
	Total	234	97.9	100.0	
Missing	System	5	2.1		
Total		239	100.0		

$Q2f Frequencies

		Responses N	Responses Percent	Percent of Cases
$Q2f[a]	Q2f_JOB	22	8.4%	10.3%
	Q2f_POS	69	26.3%	32.2%
	Q2f_INCR	92	35.1%	43.0%
	Q2f_SELF	26	9.9%	12.1%
	Q2f_YOUT	40	15.3%	18.7%
	Q2f_NEG	13	5.0%	6.1%
Total		262	100.0%	122.4%

a. Dichotomy group tabulated at value 1.

Q2g

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	59	24.7	25.0	25.0
	disagree	34	14.2	14.4	39.4
	slightly disagree	11	4.6	4.7	44.1
	neither agree or disagree	23	9.6	9.7	53.8
	slightly agree	25	10.5	10.6	64.4
	agree	54	22.6	22.9	87.3
	strongly agree	30	12.6	12.7	100.0
	Total	236	98.7	100.0	
Missing	System	3	1.3		
Total		239	100.0		

$Q2h Frequencies

		Responses N	Responses Percent	Percent of Cases
$Q2h[a]	Q2h_NEGW	10	4.9%	5.2%
	Q2h_NEGP	6	2.9%	3.1%
	Q2h_INAB	39	18.9%	20.1%
	Q2h_NINT	44	21.4%	22.7%
	Q2h_INCR	19	9.2%	9.8%
	Q2h_POSW	59	28.6%	30.4%
	Q2h_POSP	24	11.7%	12.4%
	Q2h_OTHE	5	2.4%	2.6%
Total		206	100.0%	106.2%

a. Dichotomy group tabulated at value 1.

Q3b

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	1	.4	.4	.4
	disagree	1	.4	.4	.8
	neither agree or disagree	9	3.8	3.8	4.6
	slightly agree	13	5.4	5.5	10.1
	agree	89	37.2	37.6	47.7
	strongly agree	124	51.9	52.3	100.0
	Total	237	99.2	100.0	
Missing	System	2	.8		
Total		239	100.0		

Q3c

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	disagree	2	.8	.8	.8
	neither agree or disagree	9	3.8	3.8	4.6
	slightly agree	9	3.8	3.8	8.4
	agree	72	30.1	30.3	38.7
	strongly agree	146	61.1	61.3	100.0
	Total	238	99.6	100.0	
Missing	System	1	.4		
Total		239	100.0		

Q3d

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	6	2.5	2.5	2.5
	disagree	5	2.1	2.1	4.6
	slightly disagree	5	2.1	2.1	6.7
	neither agree or disagree	21	8.8	8.8	15.5
	slightly agree	21	8.8	8.8	24.4
	agree	64	26.8	26.9	51.3
	strongly agree	116	48.5	48.7	100.0
	Total	238	99.6	100.0	
Missing	System	1	.4		
Total		239	100.0		

Q3e

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	5	2.1	2.1	2.1
	disagree	4	1.7	1.7	3.8
	slightly disagree	5	2.1	2.1	5.9
	neither agree or disagree	9	3.8	3.8	9.7
	slightly agree	19	7.9	8.1	17.8
	agree	84	35.1	35.6	53.4
	strongly agree	110	46.0	46.6	100.0
	Total	236	98.7	100.0	
Missing	System	3	1.3		
Total		239	100.0		

Q3f

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	neither agree or disagree	4	1.7	1.7	1.7
	slightly agree	5	2.1	2.1	3.8
	agree	71	29.7	29.8	33.6
	strongly agree	158	66.1	66.4	100.0
	Total	238	99.6	100.0	
Missing	System	1	.4		
Total		239	100.0		

Q3g

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	15	6.3	6.4	6.4
	disagree	24	10.0	10.3	16.7
	slightly disagree	26	10.9	11.2	27.9
	neither agree or disagree	61	25.5	26.2	54.1
	slightly agree	50	20.9	21.5	75.5
	agree	34	14.2	14.6	90.1
	strongly agree	23	9.6	9.9	100.0
	Total	233	97.5	100.0	
Missing	System	6	2.5		
Total		239	100.0		

Q3h

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	6	2.5	2.5	2.5
	disagree	14	5.9	5.9	8.5
	slightly disagree	16	6.7	6.8	15.3
	neither agree or disagree	43	18.0	18.2	33.5
	slightly agree	31	13.0	13.1	46.6
	agree	68	28.5	28.8	75.4
	strongly agree	58	24.3	24.6	100.0
	Total	236	98.7	100.0	
Missing	System	3	1.3		
Total		239	100.0		

Q3i

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	1	.4	.4	.4
	disagree	2	.8	.9	1.3
	slightly disagree	1	.4	.4	1.7
	neither agree or disagree	3	1.3	1.3	3.0
	slightly agree	9	3.8	3.8	6.8
	agree	62	25.9	26.4	33.2
	strongly agree	157	65.7	66.8	100.0
	Total	235	98.3	100.0	
Missing	System	4	1.7		
Total		239	100.0		

Q3j

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	139	58.2	58.6	58.6
	2	60	25.1	25.3	84.0
	3	12	5.0	5.1	89.0
	4	13	5.4	5.5	94.5
	5	2	.8	.8	95.4
	6	9	3.8	3.8	99.2
	7	2	.8	.8	100.0
	Total	237	99.2	100.0	
Missing	System	2	.8		
Total		239	100.0		

Q3k

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all agree	1	.4	.4	.4
	disagree	2	.8	.8	1.3
	neither agree or disagree	4	1.7	1.7	2.9
	slightly agree	9	3.8	3.8	6.7
	agree	50	20.9	21.0	27.7
	strongly agree	172	72.0	72.3	100.0
	Total	238	99.6	100.0	
Missing	System	1	.4		
Total		239	100.0		

Component1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3.00	1	.4	.4	.4
	3.67	1	.4	.4	.8
	4.00	3	1.3	1.3	2.1
	4.67	4	1.7	1.7	3.8
	4.83	3	1.3	1.3	5.0
	5.00	3	1.3	1.3	6.3
	5.17	2	.8	.8	7.1
	5.33	9	3.8	3.8	10.9
	5.50	4	1.7	1.7	12.6
	5.67	8	3.3	3.3	15.9
	5.80	1	.4	.4	16.3
	5.83	11	4.6	4.6	20.9
	6.00	22	9.2	9.2	30.1
	6.17	19	7.9	7.9	38.1
	6.33	17	7.1	7.1	45.2
	6.40	1	.4	.4	45.6
	6.50	19	7.9	7.9	53.6
	6.60	1	.4	.4	54.0
	6.67	17	7.1	7.1	61.1
	6.80	1	.4	.4	61.5
	6.83	27	11.3	11.3	72.8
	7.00	65	27.2	27.2	100.0
	Total	239	100.0	100.0	

Component2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	4	1.7	1.7	1.7
	1.33	3	1.3	1.3	2.9
	1.67	3	1.3	1.3	4.2
	2.00	5	2.1	2.1	6.3
	2.33	1	.4	.4	6.7
	2.67	9	3.8	3.8	10.5
	3.00	14	5.9	5.9	16.3
	3.33	6	2.5	2.5	18.8
	3.50	1	.4	.4	19.2
	3.67	8	3.3	3.3	22.6
	4.00	8	3.3	3.3	25.9
	4.33	6	2.5	2.5	28.5
	4.50	1	.4	.4	28.9
	4.67	15	6.3	6.3	35.1
	5.00	27	11.3	11.3	46.4
	5.33	11	4.6	4.6	51.0
	5.67	23	9.6	9.6	60.7
	6.00	32	13.4	13.4	74.1
	6.33	12	5.0	5.0	79.1
	6.50	2	.8	.8	79.9
	6.67	10	4.2	4.2	84.1
	7.00	38	15.9	15.9	100.0
	Total	239	100.0	100.0	

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Component3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	4	1.7	1.7	1.7
	1.50	7	2.9	3.0	4.6
	2.00	5	2.1	2.1	6.8
	2.50	8	3.3	3.4	10.1
	3.00	9	3.8	3.8	13.9
	3.50	15	6.3	6.3	20.3
	4.00	38	15.9	16.0	36.3
	4.50	20	8.4	8.4	44.7
	5.00	34	14.2	14.3	59.1
	5.50	35	14.6	14.8	73.8
	6.00	37	15.5	15.6	89.5
	6.50	6	2.5	2.5	92.0
	7.00	19	7.9	8.0	100.0
	Total	237	99.2	100.0	
Missing	System	2	.8		
Total		239	100.0		

Component4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.50	3	1.3	1.3	1.3
	1.00	18	7.5	7.5	8.8
	1.50	23	9.6	9.6	18.4
	2.00	42	17.6	17.6	36.0
	2.50	30	12.6	12.6	48.5
	3.00	67	28.0	28.0	76.6
	3.50	14	5.9	5.9	82.4
	4.00	42	17.6	17.6	100.0
	Total	239	100.0	100.0	

Component5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	13	5.4	5.6	5.6
	.50	11	4.6	4.7	10.3
	1.00	52	21.8	22.2	32.5
	1.50	27	11.3	11.5	44.0
	2.00	37	15.5	15.8	59.8
	2.50	18	7.5	7.7	67.5
	3.00	51	21.3	21.8	89.3
	3.50	9	3.8	3.8	93.2
	4.00	16	6.7	6.8	100.0
	Total	234	97.9	100.0	
Missing	System	5	2.1		
Total		239	100.0		