SUBSISTENCE AGRICULTURE IN CURAÇAO: CHALLENGES AND POTENTIAL FOR BOOSTING FOOD AND NUTRITION SECURITY

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Abstract

The Coronavirus pandemic has exacerbated current issues Curacao is facing when it comes to Food and Nutrition Security. The decline of tourism has inflicted job-losses and steps are being taken to increase resiliency. The Donut Economy Taskforce has been formed to work towards a circular economy. Subsistence agriculture is seen as one way of achieving a circular economy and Food and Nutrition Security. This research investigates the influence of COVID-19 on the pillars of Food and Nutrition Security and aims to evaluate the benefits of subsistence agriculture are on current and future Food and Nutrition Security. Currently, little is known of who practices subsistence agriculture, what motivates them, and how subsistence agriculture has affected their Food and Nutrition Security.

During the research, respondents were asked to fill in a survey with open-ended and quantitative questions regarding their own experiences and opinions. Data findings showed that COVID-19 worsened Food and Nutrition Security of the respondents, as lack of funds made it harder to access the right quantity and quality of food and imports decreased due to price increases. Personal agency over circumstances seems to have decreased among many practitioners since the pandemic. This has given rise to alternatives in securing Food and Nutrition Security. Subsistence agriculture seems to have a positive influence on the production and utilisation of food, and has proven to improve Food and Nutrition Security of the respondents, specifically regarding the utilisation of nutritious food at a lower price. However, contribution is meagre due to productivity limits. Soil characteristics of Curaçao make it hard to make full use of potential. Currently subsistence agriculture has developed among more affluent people, but not so among lower-income people, according to findings. Still, according to respondents, there is promise and opportunity in subsistence agriculture for everyone, but stakeholders must take responsibility in educating the people of Curaçao and creating a favourable environment to practice it, in Curaçao's strive for an environmentally stable future. A larger focus on agricultural practices could boost local Food and Nutrition Security and decrease dependency on other countries. For the sake of development, it would be interesting to find out more about the sustainable character of subsistence agriculture, in order to secure Food and Nutrition Security for future generations and benefit from all that it has to offer, whilst at the same time expanding current knowledge on Food and Nutrition Security on the island.

Keywords: Subsistence agriculture, COVID-19, Food and Nutrition Security, Curaçao, Circular Economy

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Abbreviations

CARICOM – Caribbean Community

DET – Donut Economy Taskforce

FAO – Food and Agriculture Organisation

GDP – Gross Domestic Product

IFAD – International Fund for Agricultural Development

IMF – International Monetary Fund

MEO – Ministry for Economic Development

SIDS – Small Island Developing States

SDG's – Sustainable Development Goals

UN – United Nations

WFP – Word Food Programme

WHO – World Health Organisation

1. Introduction

1.1 Context

Curaçao is a Small Island Developing State (SIDS) in the Antilles and is part of the Caribbean. Due to the semi-arid climate and its deterioration due to climate change, Curaçao is highly dependent on other countries for the import of food commodities (Sambeek, Eggenkamp & Vissers, 2000; Goede, 2020). According to the report by Goede (2020), Curaçao relies on import for 95% of its food. In 2021 Curaçao imported approximately 266 million US$ of food products and live animals into the country (CBS, 2022), making up roughly 25% of all imported goods. Exported goods that year were good for a meagre 12 million US$.

Curaçao relies mainly on tourism for 83,8% of their Gross Domestic Product (GDP) and only 0,7% of it comes from agriculture. As of 2019 about 13% of the of all workers were directly employed in the tourist sector (International Labour Organization, 2020). Thus tourism plays a big role in in securing peoples' livelihood in Curaçao (The World Factbook, 2017). The COVID-19 pandemic has had and still has a big socio-economic impact on Curaçao, as tourism has decreased since and unemployment rates have increased (Central Bureau of Statistics Curaçao (CBS), 2021). Even worse, inflation in 2020 was 2.2% whereas inflation in 2021 was 3.8%. This strikes mainly the poor and unemployed, as prices on basic needs like food, gas and electricity rise (CBS, 2021). High imports of food commodities in combination with inflation and the effects of COVID-19, exemplify the dependency Curaçao has on other countries for securing food products (Fredrick, 2018).

The supply and consumption of sufficient and adequate types of food products to feed the population, is known as *Food and Nutrition Security* (Kelman & West, 2009). More awareness concerning Food and Nutrition Security has grown since the start of the COVID-19 pandemic (Goede, 2020). Unemployment and inflation have resulted in many people becoming *food insecure* (CARICOM, 2020), the reason being that people lack the financial means to buy food (CARICOM, 2020). This exacerbates the need for both economic diversification and Food and Nutrition Security reinforcement (ZonMW, 2020).

In 2017, the Curaçao government established a policy towards a sustainable development of agriculture, livestock, and fisheries. According to the policy memorandum, the agricultural program comprises replacing imported food with locally produced food at a pace of 5% each year for the following five years. Locally cultivated foods include high-quality fruits and vegetables. These can be grown in Curaçao using any technology and sold at low prices indefinitely (What's Cooking In Curaçao, 2022). However, this goal has not yet been reached and new policies have been set in place (MEO, 2021).

There is a growing awareness that the current economic model needs to be reconsidered, therefore the Curaçao Donut Economy Task force (CDE) emerged (MEO, 2021). The donut in *donut economics*, is a visual framework for sustainable development that combines the concept of planetary boundaries with the complimenting concept of social boundaries, after the work of Kate Raworth (2017). The task force's goal is to be the first island-donut in the world. The change and turnaround that CDE wants to initiate is called a circular economy. The

foundation of the circular economy is the sustainability and innovation of production processes and the underlying business models (MEO, 2021).

Kelman and West (2009) state that Small Island Developing States often entail tight kinship networks, a very strong sense of identity and community and tend to have creative solutions to create sustainable livelihood, due to local knowledge by dealing with environmental changes. Concerning the threatened Food and Nutrition Security of Curaçao, many creative initiatives have arisen (MEO, 2021). The Ministry of Health, Environment and Nature of Curaçao facilitated workshops on *syntropic agroforestry* in 2019 (ZonMw, 2020). Syntropic agroforestry in the form of food forests have been largely employed in backyard gardens and small-scale farms, but are becoming increasingly popular around the world (Schauder, 2021). Besides syntropic agroforestry, there are more initiatives arising on the island promoting self-sufficiency, where people are growing their own food in order to provide for themselves, also known as *subsistence agriculture* which entails growing food crops to meet the requirements of themselves and their family (Bisht et al., 2014). People from different demographic backgrounds are practicing subsistence agriculture. Ownership of small parcels or non-irrigated cultivable land, as well as sharecroppers or renters and their family, are common characteristics of subsistence farmers (Onakuse, 2012). Subsistence agriculture has different outputs, as is discussed further below. Aside from providing food, a variety of additional benefits of this type of farming are also essential, such as neighbourhood oxygen production, reduction of the 'heat island effect' (i.e. more district cooling), biodiversity promotion, and greenhouse gas storage (Samyama Advies, 2021).

1.2 Research question and objective

The prevailing issues on food security, COVID-19 and economic hardship, pose the following question that is researched in this thesis:

*What is the **potential** of **subsistence agriculture** in addressing **current and future Food and Nutrition Security** during **COVID-19** for the **practitioners of subsistence agriculture** in **Curaçao**?*

The issues described above concerning poverty, food insecurity, unemployment and global warming give relevance to more research on alternative pathways. In order to achieve a more prosperous population, but also a more prosperous world according to the Sustainable Development Goals, it is important that policy makers know where the hitch lies, and how problems can be solved. Also people themselves, and non-government institutions must know where action can be taken.

Since the outbreak of the COVID-19 pandemic, there have been few studies conducted in Curaçao to measure the effect of COVID-19 on Food and Nutrition Security (ZonMw, 2020; CARICOM; 2020). The MEO (2021) has published a report on the donut economy Curaçao strives to be, in which they reiterate the positive influence agriculture can have on Food and Nutrition Security. Still the influence of subsistence agriculture has remained underexposed, and is unmeasured. There is a need for additional context-specific food security research, according to a number of studies on food security in the Caribbean and small island developing states (SIDS). Due to the great level of variety within and among Caribbean SIDS, context-specific research is required (Lowitt et al., 2015). Therefore, I want to fill a knowledge gap in academia with this thesis. There has not yet been a research published on Curaçao specifically, where practitioners have been mapped and questioned how subsistence agriculture influences their Food and Nutrition Security, how it was influenced by COVID-19, what moves them to practice, and how they see the future of Curaçao.

The research conducted here will contribute to the ZonMw research group, who are researching the influence of COVID-19 on Food and Nutrition Security in Curaçao, whilst looking at agricultural practices as an alternative way forward in prosperity and provision. Questions will be asked out through a survey. More about methods will be discussed in the methodology.

1.3 Thesis outline

This thesis is composed of 9 chapters. Chapter 2 presents the theoretical framework, which departs with theories on food and nutrition security as stated by the FAO. The chapter concludes with a conceptual scheme, which visualizes the concepts and relationships that are empirically explored in this thesis. Chapter 3 outlines the methodological approach of the thesis, including a reflection on my own positionality and ethics, the quality of the research and its limitations.

The research context is introduced in Chapter 4, which describes the research location Curaçao from a geographic, socioeconomic and political point of view. The analysis of the data is included in Chapters 5 and 6. Chapter 5 evolves around characteristics and motives of the respondents, who are practitioners of subsistence agriculture. Chapter 6 deals with the questions regarding the influence of COVID-19 on Food and Nutrition Security and subsistence agriculture, as well as the influence of subsistence agriculture on current and future Food and Nutrition Security. The concluding remarks to the main question are given in Chapter 7, including a theoretical reflection, implications of findings, suggestions for further research and recommendations for policy and practice. The bibliography and appendices are comprised in chapter 8 and 9.

2. Theoretical framework

2.1 Introduction

The theoretical framework serves as a base for the research. In this chapter key concepts are defined and relevant theories are discussed based on a thorough literature review. The concept of Food and Nutrition Security is discussed in section 2.2, including Food and Nutrition Security under the COVID-19 pandemic and related to the concept of the Donut Economy. This is followed by a section on agriculture and the emergence of subsistence agriculture in 2.3. This section also includes theories on the influence of subsistence agriculture on Food and Nutrition Security, and what effect COVID-19 has had on subsistence agriculture, according to the scholarly debate thus far. Section 2.4 presents the conceptual model, which offers a schematic visualisation of concepts and the relationships between them. The chapter concludes with section 2.5.

2.2 Food and Nutrition Security

2.2.1 Theories and concepts

Food security is a complex phenomenon that scholars define in a variety of ways. One of them, which is also one of the earliest, is Thomas Malthus's food availability concept, which he popularized in 1789 (Burchi & De Muro, 2012). Amartya Sen, a Harvard University professor, proposed a component of food security in the early 1980s that was connected to accessibility rather than availability (Burchi & De Muro, 2012). Over the past decades, there are many scholars and organizations that have tried to redefine food security, and have left the dimension of nutrition disregarded due to the fact that energy intake was seen as sufficient, whereas nutrients are maybe even more important (Burchi & De Muro, 2012).

The Food and Agriculture Organization better known as the FAO, defined food security based on four pillars, namely availability of food, stability of supply, accessibility to food and utilization of food by the body (Thompson, Amoroso & Meerman, 2009). The *availability* of food commodities simply questions if there is enough food available due to import, production, stocks and potential food aid. It does not consider fairness in distribution (Thomposon, Amoroso & Meerman, 2009). The *stability* of food supplies and goods captures the dynamic aspects; if the flow of food commodities is steady over time (Thomposon, Amoroso & Meerman, 2009). Even if current food intake is adequate, one is deemed food insecure if they have insufficient access to food on a regular basis, putting the nutritional status at danger (FAO, 2008). Weather extremes, political unrest, pandemics and economic issues like unemployment and inflation all have the potential to affect food security (FAO, 2008)

The *accessibility* to food comes from certain entitlements (Burchi & De Muro, 2012). The FAO categorised these entitlements, namely purchasing power and income as the economic access dimension (i.e., affordability), and transport and market infrastructure, being the physical access dimension (FAO, 2008). Last of the four pillars is *utilisation*. Utilisation comprises the energy and nutrient intake by a person through consumption of food (Thompson, Amoroso & Meerman, 2009). Utilisation of enough nutritious foods is important in order to be *food secure* (Burchi & De Muro, 2012). This is elaborated on further in the remainder of the theoretical framework. Although there are also other scholars that define utilisation otherwise, more in a sense of safety and social utilisation, the concepts by Thompson et al., (2009) and Burchi and De Muro (2012) are adopted for the latter of this research.

The recent decades have seen a growing awareness of widening food system inequities characterised by unequal power dynamics and worsening global climatic and ecological catastrophes. These findings raise serious doubts about whether the four-pillar approach to food security adequately reflects the full spectrum of factors that affect food security (Clapp et al., 2021). Clapp et al., (2021) believe that we need to broaden our understanding of food security and include the broader processes that influence hunger and malnutrition. Incorporating two new dimensions into food security policy and analysis frameworks – specifically, agency and sustainability – can offer interesting insights in further research (Clapp et al., 2021). While some food security literature has clear links to agency and sustainability, formal food policy frameworks at the international level have not explicitly recognized these elements in a systematic way. A formal adoption of a six-dimensional conceptualization of food security in policy settings is still lacking (Clapp et al., 2021).

The definition of *agency* as defined by Clapp et al. (2021) comprises the ability of people and groups to exert some influence over their own circumstances and provide meaningful input into governance processes, which is commonly seen as a key part of addressing growing disparities in food systems today (Clapp et al., 2021). At the Food Systems Summit in 2021, agency was featured as a critical component of promoting egalitarian livelihoods in a long-term food system (Clapp et al., 2021). Better food security and nutritional results are stated to arise from increased collective agency at the community level, as a result of increased voice and participation in shaping food and agriculture development programs and food system governance (Crocker, 2009; Bezzner Kerr et al., 2019). *Sustainability* refers to food-system practices that contribute to the long-term regeneration of environmental, social, and economic systems, ensuring that current generations' food needs are addressed without jeopardizing future food needs (Clapp et al., 2021). Food security is influenced by the quality of food systems, and a food system's sustainability can be measured in a variety of ways, by focusing on soil health indices, agrobiodiversity indicators, water quality, market fluctuations, social conflict, supply chains etcetera, of which several are already being tracked (FAO, 2008).

Locally, the Curaçao government is also working on monitoring change and striving for a more sustainable nation, expressed in the Donut Economy Taskforce document which was shortly mentioned in the introduction. The document that the DET published is essentially a compass towards economic prosperity, aiming to have humans and the environment flourish. To determine the extent to which Curaçao satisfies social demands while respecting planetary boundaries as expressed in the Donut Economy Taskforce document (DET), numerous official sources were consulted by the MEO (2021). The donut is fashioned like a lifebelt (Raworth, 2017). The model's central hole represents the percentage of people who lack access to life's necessities (healthcare, education, equity, and so on), while the crust represents the ecological ceilings (planetary bounds) that life depends on and must not be exceeded (Raworth, 2017). The donut consists of two concentric rings: an inner ring and an outer ring. The outer ring represents the Earth's nine ecological boundaries (Raworth, 2017). These go far beyond the ecological aspects of the SDGs. The inner ring represents 12 social foundations, derived from the Sustainable Development Goals (SDGs), which are necessary for a society to develop prosperously. On the inner ring *food* is situated as a social foundation. In the case of Curaçao there is a shortfall in food according to the DET. Their goal is to decrease diseases related to malnutrition, as obesity is highly prevalent in Curaçao and ultimately make Curaçao more food secure (MEO, 2021). The donut applied to Curaçao is included in Figure 2.1, the ecological and social indicators coloured red are reasons for concern. It was created by the DET (MEO, 2021).

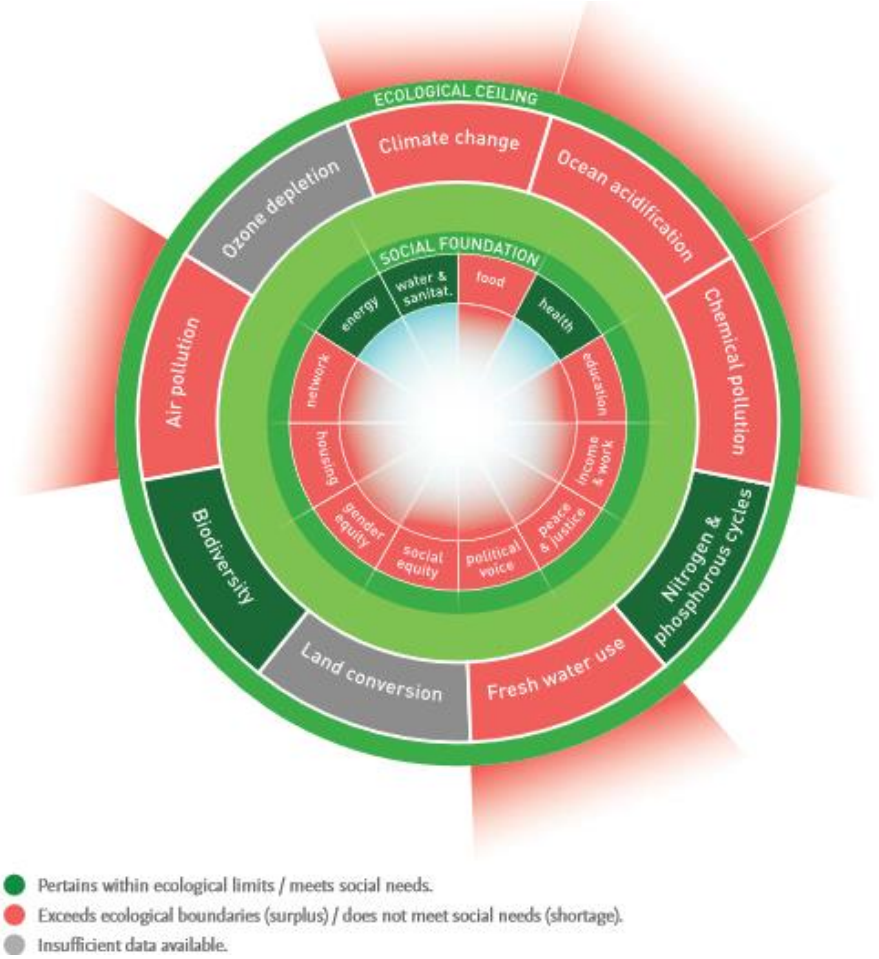

FIGURE 2.1: THE DONUT ECONOMY MODEL OF KATE RAWORTH APPLIED TO CURAÇAO (MEO, 2021)

Besides gathering statistical information regarding socio-economic and environmental indicators of the donut concept, the DET analysed local initiatives for three principles, namely inclusiveness, regeneration and distribution (MEO, 2021). Among these initiatives are at least 50 agricultural projects that strive for increased self-sufficiency through subsistence agriculture and replacing import by local agriculture (MEO, 2021), such as Samyama Energy transition, a company designing permaculture through urban food forests, and Soltuna, a non-profit organisation promoting local production by building alliances with local farmers (MEO, 2021). According to an article by Medium (2019), the doughnut economic model will reward and promote trends and efforts that are focused on sustainability. For instance, there may be a preference for food that is produced ethically and locally, supporting biodiversity and reducing climate change. It can promote home food production while also increasing openness and digital evidence throughout the food supply chain (Medium, 2019).

In the annual report of the FAO, IFAD, UNICEF, WFP and the WHO (2021), Food and Nutrition Security is defined as follows: "Food and Nutrition Security is when all individuals have reliable access to sufficient quantities of affordable, nutritious food to lead a healthy life". Although *Food and Nutrition Security* covers all dimensions described within the six pillars, putting emphasis on food *quality* and *quantity* (Thompson et al., 2009), sustainability, which is the sixth pillar of Food and Nutrition Security, is left out of the research. This is because measuring sustainability through soil health, water quality, land use and biodiversity is a complex practice,

and is a study in itself. This is elaborated on further in the recommendations for further research in the conclusion of the thesis. However, the Donut Economy concept is discussed further in the research context as well as the conclusion. The next sub chapter elaborates on the quality element of Food and Nutrition Security.

2.2.3 A baseline for nutritional needs

Nutrition includes parts of health services like a healthy environment and caring activities, and is included in our food , which is typically described as edible things that people eat and drink to preserve life and growth (Pangaribowo, Gerber & Torero, 2013). However, each of these six pillars described include nutrition issues and components that are critical to food economies (Thompson, Amoroso & Meerman, 2009), hence why the term nutrition was added into the concept of Food Security (Pangaribowo, Gerber & Torero, 2013). The next part of this theoretical framework will elaborate further on nutrition, and what guidelines are used in academic literature and policy making to define nutrition and nutritional needs for humans.

Given the complexity of human nutrition and the reality that food has both quantity and quality dimensions, the phrase "sufficient quantities of affordable and nutritious food" as mentioned in the previous section must be qualified. The FAO method was founded based on the assumption that the most important feature to monitor is dietary energy requirement (DER), and that 'enough' should be measured against a normative standard defined by nutritionists as dietary energy requirement (Wanner et al., 2014). According to the WHO (2020), the base diet is referred to as the *energy sufficient diet*, which is similar to the daily energy requirement from the FAO (Wanner et al., 2014). This basically means "the calories going out must be the same as the calories going in", for women this is usually around the 2000 kcal per day, for men usually around 2500 (WHO, 2020), depending on factors like age and level of activity. Of course, because of the many unobservable factors impacting individual requirements, normative dietary requirement criteria may only be stated as averages valid for groups of persons (Wanner et al., 2014).

However, nutritional value is just as important when discussing a sufficient diet. Consumption of specific food groups is critical for macronutrients and micronutrients, including the quality of dietary protein and lipids, as well as food properties like fibre and antioxidants (Lele et al., 2016). The *nutrient adequate diet,* according to the WHO (2020) consists of adequate proportions of carbohydrates, fats, proteins, minerals, vitamins and health-promoting substances. These food groups are a way of categorising food, to give an example of what balanced eating looks like (WHO, 2020). The "ultimate" diet they discuss is the *healthy diet,* which contains more diversified and desirable food groups than a nutrient adequate diet (WHO, 2020). Figure 2.2 below (WHO, 2020) shows the quantity of food per food category available in different world regions, according to income categories. The difference between low-income countries and high-income countries is noticeable. While the food categories are balanced in the high-income countries, there is a prevalence of cereals and roots, also known as starchy foods, in the pie charts representing low-income countries. The share of fruits vegetables, dairy, proteins (like fish and meat) and pulses is much smaller than for all the other country types, whereas, remarkably, their share in sugars and fats is larger than for any other country type (WHO, 2020).

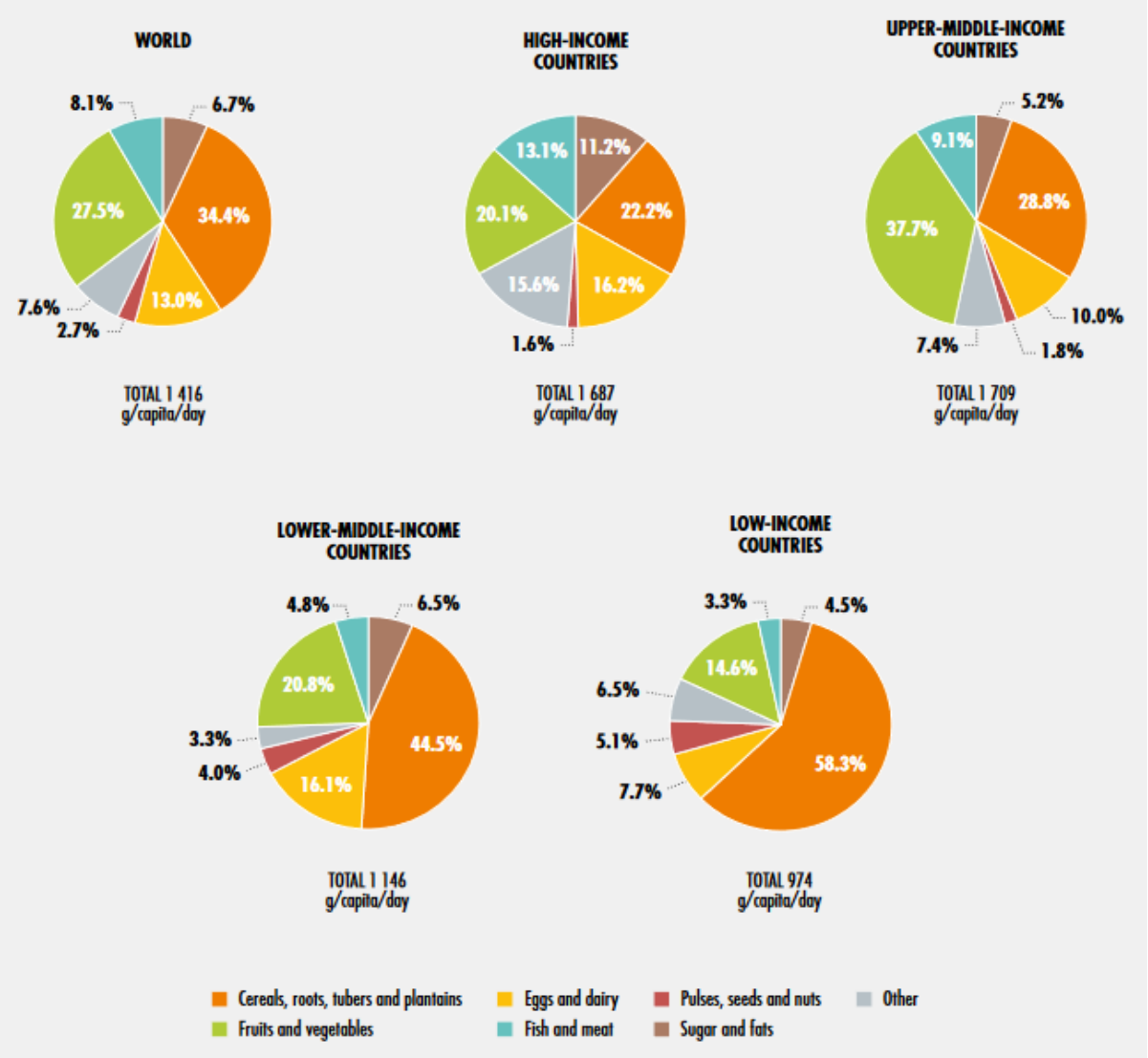

Figure 2.2: quantity of food per food category available in different world regions

This is interesting, as indigenous diets are based on the food that is physically most available and has the highest nutritional, qualitative, and social value. However, diets influenced by globalization are driven by trends and based on a mix of cultural values, lifestyles, and rationalities that may or may not be appropriate for every location and lifestyle (Garcia and Albisu, 2001). Both consumers and the actors who control what people consume through the food supply defined by imports, are to blame for the nutrition shift of the last 50 years, which has resulted from the 'Westernization' of diets (Ingram, 2011). Diets have shifted to include more high-fat meals and sweets, as well as less cereals and vegetable fibres. Excess consumption of refined carbohydrates, sugar-sweetened beverages and sodium has led to high rates of obesity, not only in lower-income countries but all over the world (Lele et al., 2016).

Nutrition in this respect thus also takes into account over-nutrition. The duality of nutrition is known as the *dual burden* (Clark & Nicholas, 2013) and has become evident in rising prices for nutrient-dense foods like fruits and vegetables, as well as the widespread availability of low-cost, energy-dense foods from intensive farming and subsequently fast- and processed foods (Clark & Nicholas, 2013). Following that, studies have shown that as people in all parts of the world become wealthier, they switch from starchy roots and cereal grains to more varied meals that include leguminous grains, vegetables and fruits, dairy products and eggs, as well as meat

and fish. These more varied diets are often linked to higher dietary sufficiency and better health outcomes (Lele et al., 2016).

The WHO (2020) has elaborated further on the relation between affordability of food and nutrition, in their *State of the World* report on Food and Nutrition Security back in 2020. Their affordability research reveals that while the majority of the world's poor can afford an energy sufficient meal, they cannot afford a nutritionally adequate or healthy diet (WHO, 2020). A good diet is significantly more expensive than the full value of the international poverty line, which is USD 1.90 PPP (purchasing power parity) per day. More than 3 billion people cannot afford healthy meals that follow worldwide norms and include foods from various groups as well as increased diversity within food groups (WHO, 2020). The majority of these people live in Asia (1.9 billion) and Africa (965 million), but there are also millions in Latin America and the Caribbean (104.2 million), The United States (38 million) and Europe (18 million) (WHO, 2020). Moreover, more than 1.5 billion people cannot even afford a diet that satisfies required amounts of vital nutrients (WHO, 2020). An analysis of the percentage share of total cost of each food in a healthy diet reveals that the most nutritious foods are the most expensive: dairy, fruits, vegetables, and protein-rich foods (plant-based and animal source), with regional variations (WHO, 2020).

2.2.4 Food Security and Small Island Developing States

Small Island Developing States (SIDS) are a diverse group of countries, but they have many things in common, like being small, having little available land, being vulnerable to natural disasters, and having a strong linkage to the global market. Therefore, SIDS are more susceptible to global environmental and economic changes (Lowitt et al., 2015). Small island nations like Curaçao have legitimate concerns about food security.

Several variables influence the *availability* of food in SIDS. Due to their unique economic characteristics, SIDS are more vulnerable to external shocks than larger nations. For instance, because agriculture is still underdeveloped, people frequently rely on economic activity like tourism or fishing (Barlagne et al., 2015). Cheaper imports also put local production in direct competition, driving small-scale farmers out of the agricultural industry and jeopardizing island states' ability to meet their own food demands. Due to their heavy reliance on imports, SIDS are seeing a nutritional shift away from their traditional diets and toward more western diets. Finally, SIDS sometimes have little food stores. Supermarkets and food wholesalers frequently lack storage silos, and they typically only have a few weeks' worth of food stockpiled on their shelves and in their warehouses (FAO, 2016).

Poverty and unemployment in SIDS severely restrict people's *access* to food (FAO 2016). The majority of SIDS experience severe poverty. The majority of SIDS have greater youth unemployment rates than the global average. This is partly because there aren't many jobs for young people in rural and agricultural areas. As a result, a large number of young people move to urban areas either domestically or internationally. SIDS are characterized by the *utilisation* of nutrient-poor foods. Less nutrient-dense foods are becoming more prevalent in small island states, which is causing a rise in the prevalence of chronic, non-communicable diseases (FAO, 2016). A large portion of the imported food on the market is heavy in calories, fat, and sweeteners. Because they are less expensive than healthier foods like lean meats, fish, fresh vegetables, and fruit, the poor are more likely to consume higher levels of these items. These

unhealthy, high-fat, high-sugar diets contribute to overweight, obesity, and the emergence of chronic illnesses (FAO, 2016).

Because of their susceptibility to natural disasters, initiatives to improve the *stability* of the food supply and access in Caribbean SIDS are frequently hindered. Landslides, earthquakes, droughts, floods, storms, and hurricanes are just a few examples of how natural catastrophes hurt the economy and obstruct the flow of goods and services (FAO, 2016). Curaçao shares all the traits of SIDS that pose a threat to food security. More contextual information on Curaçao specifically is included in the context chapter.

2.2.5 Challenges for Food and Nutrition Security: COVID-19

As mentioned in the introduction of this thesis, the impact of COVID-19 on Food and Nutrition Security has not gone unnoticed (Goede, 2020). Béné et al., (2021) conducted research on the impact of COVID-19 on global food security across 62 countries in the first 12 months of the pandemic. They focussed on the first four pillars of food security, namely availability, accessibility, stability and utilisation. According to their analysis, food accessibility has been the most affected feature of people's food security, with relatively substantial evidence demonstrating that food affordability has been adversely impacted by losses in purchasing power of most households in low and middle income nations (Béné et al., 2021). Besides affordability, physical accessibility seems to have been heavily affected, especially in the first months of COVID-19 when there were strict measures like lockdown (Béné et al., 2021). In contrast, aside from some initial disruptions due to panic buying, there is no strong indication that food availability was impacted in the early phase of the pandemic, and there is insufficient data to draw firm judgments regarding the pandemic's effects on the utilisation dimension (food safety or quality) (Béné et al., 2021). However, those different disruptions in access (or even temporary availability) could also be interpreted as disturbances in the stability dimension of the food security concept (Béné et al., 2021). Moreover, the COVID-19 pandemic has exposed how vulnerable global food supply chains are (O'Hara & Toussaint, 2021).

2.3 The emergence of subsistence agriculture

2.3.1 Monoculture

If we look at prehistoric times, hunters and gatherers collected different types of food and had diverse diets (Sunderland et al., 2019). A couple of thousand years ago this started to changed due to an ever-growing population in need of being fed (Sunderland et al., 2019; Burchi & De Muro, 2012). Currently our global food system is defined by its strong reliance on livestock and a small number of crops, cultivated in the form of monocultures (Sunderland et al., 2019). As mentioned in the previous sub-chapter, diets have moved from being mostly plant-based with complex carbs and low fats to being high in fats and oils, meats, and refined carbohydrates all across the world (Sunderland et al., 2019). As a result, about 2 billion people worldwide are undernourished, while roughly the same number are overfed (Sunderland et al., 2019).

Goal 2 of the Sustainable Development Goals (SDGs) is to "end hunger, ensure food security and nutrition, and promote sustainable agriculture" (United Nations 2015). This requires sustainable food production systems and resilient agricultural practices (United Nations, 2015). However, monoculture is far from sustainable as it has many environmental drawbacks, for instance, monocultures degrade biodiversity as only one crop is planted per season (Sunderland et al., 2019). The use of fertilizers also inflicts a reduction in biodiversity. Chemical

fertilizers can become air born or infiltrate into deeper water levels, polluting air and water (Sunderland, 2019).

2.3.2 Subsistence agriculture and the benefits for Food and Nutrition Security

On smallholdings, farmers can also practice subsistence agriculture, which involves growing food crops to meet the requirements of themselves and their family with potentially some surpluses (Bisht et al., 2014). Planting decisions are made primarily with an eye toward what the family will require in the next year, with market prices coming in second (Bisht et al., 2014). Traditional subsistence agriculture has shown to be somewhat resilient, having the capacity to contribute to important pillars of food security, particularly access and stability, however poor productivity limits its contributions to food availability beyond the household availability (Adhikari et al., 2021).

Rankoana (2017) also researched the influence of subsistence agriculture on Food and Nutrition Security. According to the data gathered, subsistence crops grown in household gardens provide grain, vegetables, and legumes (Rankoana, 2017). These goods are acquired to assure household food availability and accessibility. Most significantly, the foods have health potential for primary health care preventive and curative care (Rankoana, 2017). The foods utilised through subsistence agriculture are essential for human health and development (Rankoana, 2017).

According to the FAO, developing subsistence agriculture is the best approach for developing nations to ensure food security, according to data collected by Ambagna, Kane and Oyekale Abayomi (2012). The authors conducted research in Cameroon, Africa and applied Pesaran, Shin, and Smith's (2001) ARDL (Autoregressive Distributed Lag) cointegration approach for the empirical investigation of a long-run relationship and dynamic interactions between the variables. The ARDL approach was used to develop a cointegration model between food availability and the subsistence farming index. The correlation test that was conducted calculated the long-run elasticity of the subsistence agriculture index which was 0.38. Elasticity here is the elasticity of food availability compared to the subsistence farming production index. This finding supports the long-term benefits of subsistence farming production for food security. It is larger than the short-run elasticity (0.27) (Ambagna et al., 2012). These findings demonstrate that subsistence farming productivity has a positive impact on food security mainly in the long-run, albeit a small one (the elasticity remains lower than 1). As the world's population grows, food availability decreases, thus masking the benefits of subsistence farming. As a result, it would be required to analyse a scenario in which the increase of subsistence farming productivity is always greater than the expansion of the population (Ambagna et al., 2012). Conventional agriculture is not considered in this research, and not used as a comparison.

In the short and medium term, the contribution of subsistence agriculture can be integrated in policy response to food crises, but it has received insufficient attention and is poorly understood by governments and development agencies (De Jenvey & Sadoulet, 2011). Subsistence agriculture can be a viable and more cost-effective way of ensuring the food security of many vulnerable, impoverished people in low-income countries where markets fail, administrative capacity is limited, and fiscal burdens are high (De Janvry & Sadoulet, 2011). Because subsistence farmers have ready access to land, extra labour, and poor productivity, the economics of preventive crisis response via subsistence agriculture makes sense (De Janvry & Sadoulet, 2011).

For smallholders with sufficient productive assets and access to efficient markets, successful productivity advances in subsistence farming can pave the way for eventual entry into commercial farming (De Janvry & Sadoulet, 2011). Based on competitive advantage, this process begins with the selling of a marketed surplus of food and can progress to the development of more lucrative food or non-food high-value cash crops. Eventually, focusing on competitive advantages and trading in efficient markets is a more efficient strategy to achieve food security than producing food for personal consumption, however subsistence agriculture in its current form is essential for a huge portion of humankind to achieve food security (De Janvry & Sadoulet, 2011).

Moreover, subsistence agriculture is not only feasible for rural areas, but also seems to have potential in urban areas (Clark & Nicholas, 2013). In both industrialized and developing countries, urban agriculture is one of the most extensively employed ways for increasing food security and nutrition (Clark & Nicholas, 2013). Many modern cities, such as Shanghai, China, which produces 60% of the vegetables and 90% of the eggs consumed by the city's residents have implemented urban agriculture. Amsterdam is also paving the way for urban agriculture, and has already over 350 hectares of land dedicated to urban allotments (Clark & Nicholas, 2013). Subsistence agriculture is thus a gradient concept as it is nowadays not only seen in the classical sense of providing for oneself and family, but that it is also a way of providing extra sources of food (Aliber & Hart, 2009). Low productivity of subsistence agriculture is therefore not rendered obsolete, as it is not solely seen as complete replacement for food commodities for all practitioners (Aliber & Hart, 2009).

2.3.3 Agricultural practices under subsistence agriculture

As subsistence agriculture is on such a gradient scale, there are different ways of practising subsistence agriculture. For example, food forests are neighbourhood gardens where food is grown by the local community, for self-sustainment. The crops are diverse in order to provide in diversification of the local diet (Samyama Advies, 2021). Aside from providing food, a variety of additional benefits are as essential, such as neighbourhood oxygen production, reduction of the 'heat island effect' (i.e. more district cooling), biodiversity promotion, and greenhouse gas storage ('CO2 abatement function') (Samyama Advies, 2021). The idea of food forests is to cultivate like a forest, by having smaller plants and larger ones with bigger roots like trees in the same place (Riolo, 2019). As they seem to each have a positive impact on the environment (Norton et al., 2013), you will find trees and plant planted in harmony, often known as a *guild*.

Besides planting straight in the soil, which is still very common, planting fruits and vegetables in pots is also very popular (Saisupriya & Saidaiah, 2021). It apparently has similar environmental effects as food forests. According to Saisupriya and Saidaiah (2021) potting vegetables and fruits also reduces the heat island effect and is a good way to grow produce free of pesticides and fertilizers. Leafy vegetables (like coriander and spinach), root vegetables (carrot, beetroot, radish), and bulb crops like garlic and onion are all excellent candidates for pot gardening (Saisupriya & Saidaiah, 2021).

There are more intensive ways of performing subsistence agriculture, that require more materials and labour. Greenhouse gardening is an example. Plants require moisture, warmth, and light in order to thrive. The growing environment is stabilized by a greenhouse, which buffers

the ambient temperature and protects the plants from extreme cold or draught (Freeman, 1998).

Hydroponics and aquaponics are agricultural practices that are soilless, by using water-based mineral nutrient solutions in aqueous systems (Pantanella et al., 2010). This is an environmentally friendly production system due to its full reuse of waste and nutrients (Pantanella et al., 2010). Hydroponically grown plants can be grown all year. Traditional soil-based systems consume more water than hydroponics (Pantanella et al., 2010). Traditional soil-based growing systems allow for slower growth and lower yields. Hydroponic gardening allows for rapid growth and higher yields. Aquaponics is a food-production technology that combines aquaculture with hydroponics by feeding nutrient-rich aquaculture water (from fish farming) to hydroponically-grown plants (Pantanella et al., 2010). Aquaponics thus makes use of nutrient-rich water, which makes growing more effective. Former methods of practicing show the scale in which one may perform subsistence agriculture, which may differ between certain economic groups. This special element will be touched upon further in the research limitations in the methodology chapter.

2.3.4 Challenges for Subsistence agriculture: COVID-19

According to the study by Lopez-Ridaura et al., (2021) conducted in Mexico and Central-America, smallholder or subsistence farming systems with a strong focus on self-sufficiency and little reliance on external inputs were less impacted during the pandemic and showed greater adaptive capacity than medium and small entrepreneurial farming systems that rely on agriculture as their primary source of income.

The research done by Adhikari et al., (2021) in Nepal also showed the resilience that subsistence agriculture can have during shocks due to climate change or pandemics. In Nepal, the COVID-19 pandemic demonstrated the importance of identifying, collecting, conserving, and researching indigenous species of crops, animals, and other useful plants, as well as promoting the resilience aspects of subsistence farming (Adhikari et al., 2021). However, policy-makers and governments do not always seem to recognize the full potential of subsistence agriculture. Although the case for Nepal shows resilience, farming systems like subsistence agriculture have low output and an insufficient ability to provide comprehensive livelihood security (Adhikari, 2021). Increased output could have been aided by land consolidation, the utilisation of fallow/barren land, irrigation and the promotion of specialized markets (Adhikari et al., 2021).

While COVID-19 has exacerbated inequality of many kinds in some nations, the pandemic appears to have had the reverse effect in Fiji. Through the ideas of self-reliance, cooperation, and 'sharing locally produced food,' it has brought people from various social sectors together (Randin, 2020). In Fiji, a group of islands in the South-Pacific, the government responded rather differently than many other nations, with *Farm Support Packages*. This encouraged the population to engage in subsistence agriculture as an effective response to COVID-19 in case a second wave hit (Randin, 2020).

From the brief examples given in this sub chapter, it is apparent that there are many different approaches to subsistence agriculture. Although outputs are low, resilience seems to be high (Lopez-Ridaura et al., 2021; Adhikari et al., 2021). Whether this is the same for Curaçao, must be seen through quantitative and qualitative data analysis. The following conceptual model and the next chapter on methodology entail more detail about the research design.

2.4 Conceptual model

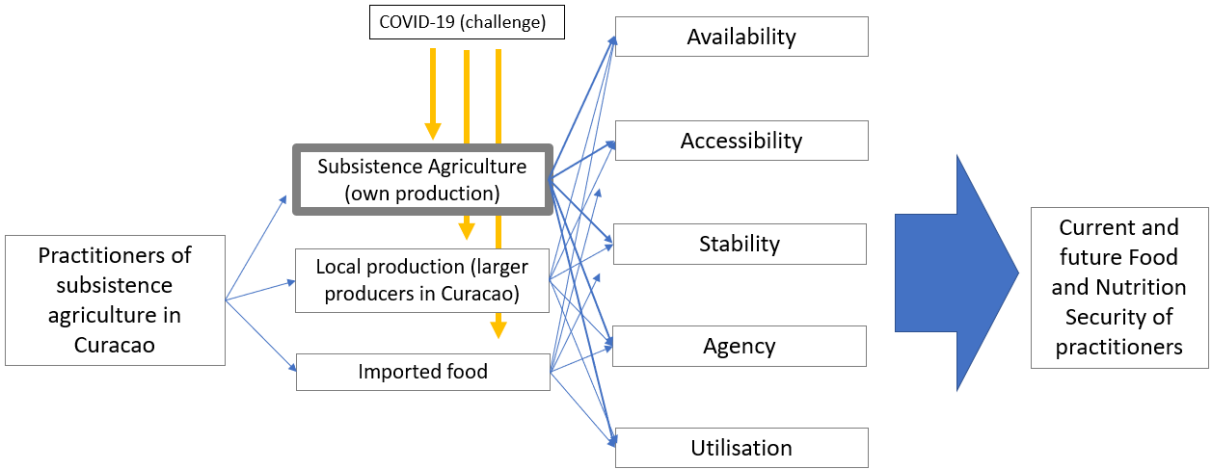

Figure 3.1: Conceptual scheme of relations between concepts and theories of the research design

The conceptual scheme above gives a clear overview on the relations between the concepts in this research. In the left of the model, we find the people of Curaçao who practise subsistence agriculture, as in the end this research will try to explore what influence subsistence agriculture has on their Food and Nutrition Security.

The three food systems are connected to the *practitioners of subsistence agriculture of Curaçao*. COVID-19 has had an influence on all food systems. Prices on imported goods have risen, unemployment and poverty have increased immensely and Food and Nutrition Security is being jeopardized. Subsistence agriculture has potential in providing cheaper, local food. Therefore, it is interesting to research the influence of COVID-19 on Food and Nutrition Security prior to and since the pandemic, and what influence it has had on the emergence of subsistence agriculture.

As the conceptual model shows, subsistence agriculture, local production and imported foods all have links to elements of Food and Nutrition Security, known as the five pillars of Food and Nutrition Security (as used in this research). Subsistence agriculture as a concept is highlighted in the model, as the focus lies mainly on this concept. However, food systems like local production and import of food commodities also relate to the pillars of Food and Nutrition Security, and are touched upon shortly in data and analysis. The arrow between Food and Nutrition Security and the practitioners concerns the potential of subsistence agriculture in facing future challenges regarding Food and Nutrition Security, according to the practitioners themselves.

2.5 Conclusion

The FAO (2008) formed four pillars of Food and Nutrition Security, namely availability, stability, accessibility and utilisation. Clapp et al., (2021) added the concepts *agency* and *sustainability*. According to these scholars, we need to broaden our understanding of food security and include the broader processes that influence hunger and malnutrition. According to the Donut model that was applied to Curaçao, there are serious concerns regarding indicators (MEO, 2021), of which *food* is one concern. The WHO (2021) now defines Food and Nutrition Security as "when all individuals have reliable access to sufficient quantities of affordable, nutritious food to lead a healthy life". Sustainability as a pillar is left out of the research, due to its complexity.

The WHO (2020) established a baseline for a nutrient adequate diet, in order for a person to be food and nutrition secure, and contains all the five food groups in balance. According to the WHO (2020) low- and middle-income countries generally tend to eat more starchy foods than fruits and vegetables, and their share in sugars and fats is higher. The excess consumption can lead to overweight and obesity and is known as the dual burden (Clark & Nicholas, 2013). Westernisation of the diet (Ingram, 2011) and the availability of low-cost unhealthy food has exacerbated the problem. More than 3 billion people cannot afford healthy meals that follow worldwide norms and include foods from various groups as well as increased diversity within food groups (WHO, 2020). According to Béné et al., (2021) this problem has worsened due to the COVID-19 pandemic, especially accessibility to food commodities has worsened. This is the same for the SIDS which share a high susceptibility to environmental and economic change (Lowitt et al., 2015).

Our current global food system is characterized by a heavy reliance on livestock and a small number of crops deriving from monocultures (Sunderland et al., 2019). This has made many people undernourished, and different agencies like the UN are striving to undo the damage (UN, 2015). Agricultural practices like subsistence agriculture seem to be a promising part of the solution to Food and Nutrition Security, which involves growing food crops to meet the requirements of families, but has also become popular as a way to supply extra food commodities (Bisht et al., 2014). Subsistence agriculture has resilience potential (Adhikari et al., 2021) and data shows a positive correlation between subsistence agriculture and the long-run effects on food security (Ambagna et al., 2012). It can pose as a good response in food crises like COVID-19. However, policy-makers and governments do not always seem to recognize the added potential of subsistence agriculture, mainly due to the fact that productivity is often limited (Adhikari et al., 2021). All these concepts and theories and the underlying relationships are expressed in the conceptual model.

3. Methodology

3.1 Introduction

This chapter presents the methodology employed in this thesis. It starts with the ontological and epistemological position of the conducted research (3.2). This is followed by the operationalisation of the main concepts (3.3) and the units of analysis (3.4). Furthermore, the research location is discussed in sub chapter 3.5, followed by the research methods in 3.6. Reflections on ethical considerations and the general quality of the research are discussed in 3.7 and 3.8, followed by a conclusion in sub chapter 3.9.

3.2 Ontological and epistemological approach

Ontology is concerned with the nature of reality and what is true or real (Bryman, 2012). Epistemology is more concerned with the nature of knowledge and the many ways to acquire it (Bryman, 2012).

The foundations of this study is a constructivist ontology and interpretivist epistemology.
Constructionism is an ontological position (also known as constructivism) that maintains that social realities and their meanings are constantly achieved by social actors. It indicates that social phenomena and categories are not only created through social interaction, but also constantly revised. In recent years, the phrase has grown to encompass the idea that researchers' views of the social world are constructed. In other words, rather than presenting a definitive version of social reality, the researcher always provides a specific version of social reality (Bryman, 2012). Food and Nutrition Security, in my opinion, is a very context specific concept in terms of its construction, meaning, and perception. As a result, the research strives to contribute to a better understanding of the particular setting.

Interpretivism is a social science method that believes that deciphering the meaning of data collected surrounding a phenomenon requires understanding the beliefs, motives, and reasoning of persons in a social environment (Bryman, 2012). Qualitative and quantitative research approaches are used by interpretivists (Bryman, 2012) as they can lead to unique insights by combining both methods to a *mixed-method approach*.

3.3 Sub-questions and operationalization

The research question included in the introduction of this thesis is as follows:

*What is the **potential** of **subsistence agriculture** in addressing **current and future Food and Nutrition Security** during **COVID-19** for the **practitioners of subsistence agriculture** in **Curaçao**?*

In order to answer this research question the next sub questions have been formed:

1. *What are the characteristics and motives of the practitioners of subsistence agriculture in Curaçao?*
2. *How has COVID-19 affected Food and Nutrition Security and the use of subsistence agriculture for the practitioners of subsistence agriculture in Curaçao?*
3. *How has subsistence agriculture influenced current Food and Nutrition Security for the practitioners of subsistence agriculture in Curaçao?*
4. *What is the potential of subsistence agriculture in addressing future Food and Nutrition Security challenges as perceived by the practitioners of subsistence agriculture in Curaçao?*

The operationalisation discusses the dimensions, variables and questions used for each research question. Through different variables, questions are formed to answer the four sub questions written above. The operationalization can be found in appendix 9.1. The practitioners of subsistence agriculture, subsistence agriculture itself and the five pillars of Food and Nutrition Security discussed in the theoretical framework make up the main concepts of the operationalisation table. the five pillars, namely availability, stability, accessibility, utilisation and agency are researched regarding the influence of COVID-19 and subsistence agriculture on them. COVID-19 is seen as an independent variable that influences the concepts, as is also seen in the conceptual model. Subsistence agriculture is influence by COVID-19, as it is seen as a node of food supply. As it has certain health outputs, is it known to be able to influence the dual burden of malnutrition.

3.4 Units of analysis

The unit of analysis in this research is as follows: The state of Food and Nutrition Security of people practicing subsistence agriculture in Curaçao and how COVID-19 and subsistence agriculture have affected it. The influence of subsistence agriculture on Food and Nutrition Security is measured by surveying the practitioners, therefore the units of observation are the same as the units of analysis, as the people practicing are also the people being surveyed. Methods on sampling are discussed further in this chapter.

3.5 Research location

For this research, the whole of Curaçao formed the research location in an attempt to find a broad array of respondents, but also to gather enough respondents to be able to collect enough data.

As shortly established in the introduction chapter, Curaçao is an island in the Dutch Caribbean region, approximately 40 miles north of the Venezuelan coast. It is one of the Netherlands' constituent countries, the national official languages are Dutch, Papiamentu and English (World Population Review, 2022). It is 444 square kilometres and as of 2022 the population is 165.529 people (World Population Review, 2022).

The majority, roughly 75%, is of Curaçao descent, but also many Dutch people live in Curaçao (6%) (World Population Review, 2022). Furthermore, the island is home to other Caribbeans like Arubans, Haitians and Dominicans, but also to many Hispanics from Colombia, Surinam and Venezuela (World Population Review, 2022). The crisis in Venezuela has made for a large amount of usually unregistered Venezuelans fleeing to Curaçao (Amnesty International, 2022).

Curaçao has a hot, semi-arid climate with a dry period from January to September and a wet season from October through December (Meteorological Department Curaçao, n.d.). Rainfall is sparse, with about 450 millimetres (12 inches) falling per year; the rainy season in particular, is drier than it is in other tropical climates and it almost never rains during the dry season. The environment of Curaçao is arid due to a lack of rainfall, particularly on the island's north shore (Meteorological Department Curaçao, n.d.). Growing crops for agricultural output is therefore fairly difficult (De Vries, 2000).

3.6 Research methods

The thesis includes one survey that addresses all four sub questions. The data was gathered among users of subsistence agriculture in Curaçao, from now on referred to as the *practitioners*. For triangulation purposes, but also as it adds value to this research, I chose to conduct both quantitative and qualitative research. Webb et al. (1966) first proposed triangulation as a way for developing concept measures in which more than one method is used in the production of the measures, resulting in higher confidence in the findings. The method per sub question is listed in Table 3.1.

Research Question	Data collection method	Survey Questions
What are the characteristics and motives of the practitioners of subsistence agriculture in Curacao?	Self-completion questionnaire 1 including open-ended questions about demographics of motives of the practitioners	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14
How has COVID-19 affected Food and Nutrition Security and the use of subsistence agriculture for the practitioners of subsistence agriculture in Curacao?	Self-completion questionnaire 1 including open-ended questions on the influence of COVID-19 on the different pillars of FNS	15, 16, 17, 18, 21, 22, 23, 24, 25, 26, 29, 30, 31, 32, 33, 34, 38, 39, 40, 43, 44, 45, 48, 49, 50, 51, 52, 53, 55, 58
How has subsistence agriculture influenced current Food and Nutrition Security for the practitioners of subsistence agriculture in Curacao?	Self-completion questionnaire 1 including open-ended questions on the influence of subsistence agriculture on FNS	19, 20, 27, 35, 36, 41, 46, 60, 61, 62, 63
What is the potential of subsistence agriculture in addressing future Food and Nutrition Security challenges as perceived by the practitioners of subsistence agriculture in Curacao?	Self-completion questionnaire 1 including open-ended questions about ideas and thoughts that practitioners share on facing future challenges regarding FNS	28, 37, 42, 47

Table 3.1: methods and questions used per sub question

Table 3.1 shows that every research question requires the same type of method, as every question is answered through the survey. Each question contains quantitative and qualitative elements that is elaborated on below. For instance, for the first question about characteristics and motives of practitioners of subsistence agriculture in Curaçao, descriptive statistics were used through quantitative data, but also qualitative data were used to find out what the motives for practising subsistence agriculture are.

Eventually, five questions were not included in data analysis. The first two questions, 12 and 13, were not used as they were outside of the scope of the research, and still belonged in the old design where sustainability and water usage was incorporated in the research. Question 54 was not relevant as it did not involve a personal opinion, but a speculative question. Question 56 and 57 were left disregarded because they are outside of the research scope. These questions were included in the survey as the local supervisor was interested in outcomes, so the results will be shared with him anonymously for future research.

3.6.1 Sampling

The type of sampling used in this research is a combination between purposive and convenience sampling. Purposive sampling is a non-probability sampling method in which the researcher does not select research participants at random (Bryman, 2012). Purposive sampling's purpose is to strategically sample cases or participants so that those sampled are relevant to the research questions being asked (Bryman, 2012). In this research, the unit of analysis is the state of Food and Nutrition Security of people practising subsistence agriculture in Curaçao and how Curaçao has affected it, therefore only people practising subsistence agriculture are relevant in cooperating in this research.

After the purposive sampling was done, convenience sampling was performed. As the group of respondents was established through purposive sampling, I looked for groups on Facebook, LinkedIn and Whatsapp and became a member. The groups were about gardening in Curaçao, *Sustainable Community Curaçao* and *Curaçao Syntropic Farming*. These groups are run by admins who control the type of messages. The key goal of these groups is to exchange knowledge on farming, syntropic agriculture and sustainability. People share pictures, articles, information on their own planting and sometimes advertise selling or give-aways of their seeds and crops. The groups include hobbyists but also many professionals, that guide others to planting in their own gardens.

This is regarded as convenience sampling because the sample is readily available to the researcher due to its location, like for instance the internet (Bryman, 2012). In this case, the groups were easily accessible, had a lot of members (around 1000 people per group) and were an easy way to spread the research to many people with just a few clicks.

3.6.2 Mixed methods

This research contained mixed methods, in striving for *completeness* (Bryman, 2012). What is meant by this, is that one method can compliment the other. Quantitative data can form a basis, and qualitative data can add more depth to findings (Bryman, 2012). In response to study questions or hypotheses, mixed methods researchers collect both qualitative (open-ended) and quantitative (closed-ended) data (Creswell & Creswell 2017). This method is seen as an efficient way to have a better understanding of the adjustments required for a small research population by combining qualitative and quantitative data (Creswell & Creswell, 2017).

In this research, the data collection of the mixed methods was done concurrently. The following sub-chapters discuss the quantitative and qualitative elements of this research.

3.6.3 Quantitative data collection: the survey

The survey is a type of quantitative method for conducting research and consists of the structured interview and the self-completion questionnaire (Bryman, 2012). Structured interviews are done face to face or over the telephone, whereas self-completion questionnaires are done via the post, supervised or the internet (Bryman, 2012). A self-completion questionnaire allows respondents to answer questions by filling out the form themselves (Bryman, 2012). Because there is no interviewer present throughout the administration of the self-completion questionnaire, the research instrument must be extremely simple to understand and answer (Bryman, 2012). The advantage of self-completion questionnaires conducted over the web is that it is an efficient way of targeting large online groups (Sheehan & Hoy, 1999). The web survey has a significant advantage over the email

survey in terms of aesthetics (colour, formatting and response styles) (Bryman, 2012), but also in terms of ethics, which is discussed later on in this methodology in the ethical reflection.

For this research, the survey was issued using a survey application named Qualtrics. The survey was made manually, sometimes using formats from Qualtrics for certain types of questions. The survey addressing users of subsistence agriculture and the influence it has on Food and Nutrition Security has 63 questions. Some questions included the Likert scaling technique. The Likert scale is a multiple-indicator or multiple-item measure of a group of views about a specific topic. The purpose of the Likert scale is to determine the intensity of feelings regarding a topic. It usually takes the form of a succession of statements (called 'items') that focus on a specific subject or theme (Bryman, 2012). After that, each respondent is asked to rate how much they agree with the statement. A five-point scale ranging from "strongly agree" to "strongly disagree" is commonly used to indicate level of agreement (Bryman, 2012). Other questions where respondents were asked to score a certain phenomenon contained a 1-10 point scale, to easily calculate an average score. The distribution of scoring was also given, as extreme outliers in scoring can be meaningful findings. 1 corresponds with a negative score, and the higher it goes, the more positive the score is. Other questions were formed into a conventional forced-choice format, like yes/no questions, but also questions that state "tick all that apply", giving the opportunity to tick multiple options. The survey was distributed online in English and Papiamentu, to ensure that most people on the island were able to fill it out. The survey was online for three consecutive weeks, from the middle of March 2022 until the beginning of April 2022.

3.6.4 Qualitative data collection

Beside the closed-ended questions asked in the questionnaire, there were also open-ended questions included, making this a mixed methods research. Although the questions were asked concurrently, they were incorporated mainly to compliment the quantitative data and ask more in-depth following closed-ended questions. Of the 63 questions in the survey, 25 are open-ended questions. Some are more descriptive, but many are follow-up questions, like elaborations or own ideas and solutions that are asked out. The web survey used for data collection is added in appendix 9.2.

3.6.5 Field notes

Ethnographers must take notes based on their observations due to the limitations of human memory (Bryman, 2012). I gathered Field notes during the study process, detailing specific observations or early reflections. I had weekly meetings with my local supervisor, which formed the survey and research question to what it is now. Also, my meetings with the Dutch supervisors brought clarity which gave direction to my research. During these meetings, I took thorough notes and processed them later. During surveying I did not take any fieldnotes, as surveying was done online.

3.6.6 Data analysis method

61 people filled out the survey in English or Papiamentu. As I do not speak Papiamentu, I was able to have the survey answers translated by a student from the University of Curaçao. She was paid from funds from the larger ZonMw research project. The data was exported from Qualtrics into a table stored in Google Drive, to have a clear overview of the data. When that was done, the non-response forms, where people had just scanned trough the questions without answering a few to none questions and hitting send, were taken out.

The research was mainly quantitative, so a few statistical tests were carried out in Excel. As 61 respondents is a rather small population, testing is not elaborate. The significance was tested

through a *one-tailed paired T-test*. Statistical significance is the likelihood that the difference in change between a given variation and the baseline is not due to random chance (Baarda et al., 2014). The significance is then tested by formulating a 0-hypothesis, which always states that there is no effect measured (Baarda et al., 2014). A significance level of 95% is used, meaning that a finding has 95% chance of being in agreement with the 0-hypothesis. Therefore, when findings have a significance below 0.05 (5%), the 0-hypothesis is rejected, and the alternative hypothesis is accepted (Baarda et al., 2014). The significance is expressed in *p*. To measure the effect size, Cohen's d test was used, dividing the difference in means over the pooled standard deviation of the scores. Cohen's d gives practical relevance to the relationship between the variables according to the 0-hypothesis. In contrast to a research result's statistical significance, the reporting of effect sizes makes it easier to interpret the importance of a research result (Baarda et al., 2014). Cohen's d can arrange from -2 to +2. Classically speaking, a *d* of 0.20 corresponds with a small positive effect, a *d* from 0.50 and up with a middle-large positive effect, and a *d* of 0.80 or higher with a large positive effect (Baarda et al., 2014).

Excel also provided calculations for averages and sums. Figures and tables were made using Word Graphs. With the questions that were followed by an open-ended question (qualitative) the quotes were used to back up the quantitative data, when it was relevant to the data. No coding programmes were used and the quotes used were put in a table which is included in the appendix.

3.6.7 Research limitations and possible bias

It is important too, to touch upon possible bias in research, as it can affect the outcome of research. The first bias that needs to be considered is that of distributing and carrying out a survey online, also known as sampling bias. On websites like LinkedIn or Facebook, there can be an overrepresentation of older respondents. Potentially younger people are not as active online as they used to be. This can paint a different picture of the respondents. Moreover it is important to note that not everyone might have access to these platforms, as they do not own the devices necessary, like a phone or a computer due to lack of funds. This can influence the representation of economic groups in the research, as it may appear that the research population is more affluent and educated than is the case in reality. It must be mentioned however that even though I wanted to go into the field and find people to fill in my survey that I might not have reached online, COVID-19 made it unsafe and unethical to do so. I also suffered from COVID-19 during the field research.

The second bias has to do with the concept of subsistence agriculture. It is evident that in order to perform subsistence agriculture, one needs space. In places like Curaçao, where many live in poverty, close to one another, space is not natural to everyone. Therefore there are many excluded from the research that cannot possibly perform subsistence agriculture. It is important to discuss this bias, as it may also affect outcomes in the research regarding economic status and other factors. For the people practicing, different practices are prevalent due to the constraint of space.

3.7 Research ethics and positionality

3.7.1 Ethical considerations

First and foremost, it is critical to safeguard the safety and privacy of participants, guided by the principle of doing no harm, and provide sufficient information for participants to give their

voluntary and informed consent to participate in the research (Bryman, 2012). The major guiding principles for building trust and ensuring ethical, safe, and transparent handling of participants and data throughout the research process were safety in participation, voluntary participation, informed consent and confidentiality.

At the time of data collection, the COVID-19 pandemic was still very prevalent in Curaçao, and many people on the island were testing positive. Because of the pandemic, but also in an attempt to gather as many respondents to participate in the survey, I distributed my survey online. This way, the participants' safety was ensured without putting them at risk of contracting COVID-19.

Participants were invited to participate through Facebook groups that I had joined or a LinkedIn message posted to the Donut Economy Taskforce's LinkedIn page by one of my Curaçao contacts. As a result, the participants were offered the option of participating in the study or not. The caption of the link to the survey included a summary of the research. In research where you are questioning if people are well-nourished or how much their disposable income is, it is important to gain trust from the respondents, as they are sharing personal information with you, even if it is anonymous. People can feel very vulnerable online when sharing data over the internet. Therefore, I think that explaining what the research is about, who you are, and what university you are affiliated with gives people an idea of legitimacy, which really has helped me. Besides that, I also had the survey translated to Papiamentu by a university student so that people who did not speak English were also able to fill it out in Papiamentu.

A header was put in place in the survey with an informative paragraph about ethical concerns and consent. Lastly, I included my own contact information, asking participants to contact me if they had questions, comments and inquiries during the study. One of the ethical concerns discussed in the header concerned confidentiality. The survey is entirely anonymous, as no names were asked in any question. Also, as a researcher, I am not able to see who filled out the survey; I can only see the sex, age and part of Curaçao that the respondent lives in. These are not specific streets, but areas.

In terms of secure and dependable data storage, I made sure that all survey data was saved to a Google Drive that only I had access to so that I could access it at all times and avoid losing the data if the computer was stolen or broken during the thesis process. The data was also immediately saved within the Qualtrics account, where the survey was created and published and was only accessible by me through a password.

3.7.2 Ethical dilemmas

Although writing up the survey and distributing it went relatively smoothly, I faced a. Asking people to state their disposable income can be sensitive, even if a survey is anonymous. Questions like that at the beginning of the survey can be off-putting, therefore I gave the option to "not share" so people would not feel uncomfortable and continue with the survey.

3.7.3 Positionality

The researcher's ethics and ontologies matter, as do their identity, perspective, subjectivity, or positionality. Ability, class, gender, colour, and sexuality all play a role in researchers' identities

(Holmes, 2020). There is no such thing as a neutral or objective observation, according to this notion (Holmes, 2020). During the analysis, I attempted to uncover practitioners' perspectives and sentiments, in keeping with the constructivist spirit of this study. Because the data displays several separate realities, "reality" becomes a difficult notion to grasp. Triangulation based on numerous research methodologies, on the other hand, was employed to confirm my interpretations.

My positionality in regard to the study context was an essential topic that required continual reflection throughout the research process. I am a young, white, female student from a wealthy nation, which can have an impact on how I conduct research and how participants perceive me, their faith in me, and how they answer to my questions. Studying International Development Studies at the UvA might also influence my positionality, as the focus in this Master Programme is to look at theories and practices in development studies. I don't intend to be a *white saviour* but realise that we are being taught to think in solutions and best practices.

During the research I tried to reflect on my own position on numerous occasions, and made sure that I discussed my concerns or dilemmas with my local supervisor.

3.8 Quality of the research

During the research on the influence of subsistence agriculture on Food and Nutrition Security in Curaçao, 61 people responded to the survey that I set out among people actively involved in subsistence agriculture. The method primarily used was quantitative data collection, however complimented with qualitative data. The goal of this section is to go over the qualitative and quantitative methods utilised in this study in order to better establish the validity and reliability of the data and to reflect on them, as well as to look at the study's overall potential.

3.8.1 The quality of the quantitative research

The consistency of measures is crucial to the trustworthiness of quantitative data, which may be seen through the data's validity and reliability (Bryman, 2012). *Reliability* consists of three pillars, namely stability, internal reliability and inter-observer reliability. Internal reliability concerns measures with multiple indicators. When you have a multiple-item measure where each respondent's answers to each question are combined to generate an overall score, the risk of the indicators not relating to the same thing is increased; in other terms, they lack coherence (Bryman, 2012). The issue of internal reliability is less important because the survey was not meant for data aggregation; yet, consistent phrasing between questions and orderly sequencing of questions provides a high level of reliability (Bryman, 2012).

Given that the survey was issued to all respondents at the same time, determining the research's stability can be difficult. The amount of time that the survey was open to response, was approximately 4 weeks. There were no evident changes occurring between the publishing and closing of the survey, regarding academic findings, politics or physical changes in Curaçao. The weather could have influenced the outcome of the survey over time, but as the rain season was still a month away, the weather has been very steady during the time the survey was online.

Reliability is linked to the concept of *validity*. If a measure of a notion fluctuates and hence is unreliable, it usually cannot be providing a valid measure of the concept in question. Validity relates to the question of whether an indicator (or combination of indicators) designed to measure a concept actually does so. The text examines several methods for determining validity, including face validity, concurrent validity, predictive validity, construct validity, and convergent validity (Bryman, 2012).

Face validity was ensured by constantly consulting experts. There were multiple experts present in the field, like my local supervisor who is also an academic researcher, but also random experts that I got in touch with that had no dependency on my research. To examine the validity a little more, *construct validity* is also relevant in this research. The researcher is encouraged to deduce hypotheses from a theory that is applicable to the notion when using construct validity (Bryman, 2012). For instance, the term *Food and Nutrition Security* in this research is known to be based on six pillars, elaborated on in multiple academic pieces and policy reports. In order to measure this term, each construct can be examined separately making up eventually what Food and Nutrition Security entails. The influence of subsistence agriculture on Food and Nutrition Security, stems from a notion that subsistence agriculture does indeed have an influence on Food and Nutrition Security, making this once again valid based on the idea of constructs. Convergent, concurrent and predictive validity do not apply in this research.

3.8.2 The quality of the qualitative research

As the qualitative research does not make up the greater part of the research, it is still a very important component. In Bryman (2012) two essential criteria were coined, namely *trustworthiness* and *authenticity*.

Trustworthiness has multiple indicators, like establishing *credibility*, which is essential for ensuring that the researcher's observations and the theoretical ideas developed are consistent (Bryman, 2012, p. 390). This study's credibility was boosted by good practice. As the qualitative questions were incorporated into the survey and I did not do interviews, I had an introduction of myself and the study I am doing, as well as my contact information and qualifications, at the beginning of the survey. Before a thread of questions, I explained concepts and theories. Triangulation was another method in which the research approach improved credibility and reliability. Data was collected using both quantitative and qualitative methods. When both strategies are used simultaneously, the limitations of each method are compensated. By triangulating the data, the internal validity of the results is improved (Bryman, 2006).

Regarding *transferability,* given the context particular character of this study, the findings are only partially transferrable. However, some of the more general findings, such as how respondents view methods to improve Food and Nutrition Security, can be transferred and used in action.

In order to increase and ensure *dependability*, which is the third indicator of trustworthiness, auditing is usually applied (Bryman, 2012). This entails the upkeep of records of every phase of the research. I constantly shared preliminary results with my local supervisor and Dutch supervisors.

Conformability as the last indicator, is connected to the auditing that takes place when reviewing dependability (Bryman, 2012). As no one can ever be completely objective, personal values must be left out of the research. I believe I succeeded at this, as the qualitative elements of the research were placed in the survey, which left little space to influence respondents with personal values and opinion.

Authenticity is a way of reviewing research quality to evaluate the wider political impact of the research (Bryman, 2012, p. 393). Authenticity entails changing from concerns about study's reliability and validity to issues about useful research, as well as considering its influence on individuals of the culture or community being studied. As a result, authenticity is considered as a critical component of creating trustworthiness in qualitative research in order for it to be useful to society (Given, 2008). As the qualitative part of the research was relatively small, indicators of authenticity were not always applicable to this research. Ontological authenticity is not applicable here, as there is no active discussion in the research, like there is in an interview. Educational authenticity is present in the form of activating people to think about the life they live. This also closely links to catalytic authenticity and tactical authenticity, which refer to the extent to which the research has prompted research participants, both individually and collectively, to take some type of action (Given, 2008). I hope that with questions concerning how respondents think they can change their own circumstances with certain actions, these types of authenticity are present in the research. I desire this, as the issues many people face concerning Food and Nutrition Security on Curaçao are bad and getting even worse for some, especially after two years of COVID-19. They need to come together as a community of subsistence agriculturalist and hobbyist and form an alliance to tackle the issue.

3.9 Conclusion

To summarize, this thesis followed a constructivist interpretivist approach, which facilitates the use of both qualitative and quantitative methods, also known as mixed methods. The use of mixed methods is a complimentary way of doing research. This was particularly relevant in answering the main question in this thesis, how COVID-19 has influenced subsistence agriculture and Food and Nutrition Security, but also how subsistence agriculture influences Food and Nutrition Security. This could best be done with a survey including open-ended questions. To gather respondents for the survey, purposive and convenience sampling was applied, and respondents were gathered through Facebook, LinkedIn and Whatsapp. After translating, analysis of the data was done by using Qualtrics and Excel. The sampling bias and the bias on space are important to keep in mind, when analysing data outcomes, as they can influence the outcome and give a false representation.

There was special attention paid to ensuring safety of respondents, voluntary participation, informed consent and confidentiality of the respondents. Positionality is also important to consider, as a researcher's ethics and ontologies matter, as do their identity, perspective, subjectivity, or positionality. During research, I was well aware of these elements. Regarding quality of the quantitative research, reliability was ensured through investigating the stability of the research through looking at the context, to see if there were any evident changes, which there were not. Validity was ensured through face validity, also known as the consulting of experts, but also construct validity, which is done by deducing hypotheses from a theory that is applicable to a notion. The quality of qualitative research was investigated by looking at trustworthiness and authenticity.

4. Research context

4.1 Introduction

This chapter provides contextual information on Curaçao that can contribute to the findings of this study. The research is based on current research performed by ZonMw called "COVID-19, Food Security and Economic Diversity in Curaçao, Aruba and Sint Maarten", and started in 2021 following the COVID-19 pandemic. These three different countries form the Caribbean part of the Kingdom of The Netherlands, all people that are born or raised in the Dutch Antilles are thus of Dutch nationality. These countries within the Dutch kingdom have their own government (Ministerie van Binnenlandse Zaken en Koninkrijkrelaties, 2020). Due to the fact that I was linked to Curaçao through family friends, the choice of going there was rather straightforward.

This chapter first discusses its socio-economic state (4.2) including information on Food and Nutrition Security on the island, followed by a section on agriculture on the island (4.3). It also elaborates on current initiatives and actors (4.4) and has a short conclusion (4.5).

4.2 Socio-economic characteristics

4.2.1 Socio-cultural characteristics

Curaçao, as a small island state, has a great deal of promise, but it is lagging behind (Luidens, 2018). In Curaçao today, recent empirical evidence points to a conflict dynamic that is rejected at the macro-level of society with an air of 'everything is fine,' while the conflict persists at the lower and micro-levels (Luidens, 2018). According to the research conducted by Luidens (2018), the colonial trauma and unequal ambiguous connections inside the Kingdom of the Netherlands substantially impact the compounding causality of all these potential polarities in Curaçao. Since 2000, the number of violent robberies, drug use, and drug-related crime has increased dramatically (Roggeveen et al., 2015). According to Weenink (2009) this had to do with economic reforms that The Netherlands were imposing on Curaçao, that resulted in unemployment and corruption, and ultimately increased crime rates.

4.2.2 Economic decline under COVID-19

Curaçao has had a slow economic growth rate of 1% on average for the past two decades, compared to a regional average of 3% (IMF 2017). As already pointed out in the introduction of this thesis shortly, inflation in 2020 was 2.2% whereas inflation in 2021 was 3.8% (CBS, 2021). The COVID-19 pandemic has exacerbated many problems that Curaçao is dealing with. The COVID-19 pandemic has had, and still has, a big socio-economic impact on Curaçao (CBS, 2021). Borders were soon closed, but still health institutions that were underfunded and under resourced struggled. Reduced access to health care was a result of falling revenues, particularly after tourism declined, due to the fact that Curaçao is largely dependent on tourism (The World Factbook, 2017). Attempts to revive tourism via other routes were ineffective (Campbell & Connell, 2021). After a brief decline, remittances increased. However, as urban unemployment and food insecurity rose, many individuals moved back to rural areas, resuming farming and fishing. Traditional practices such as bartering were used by local social groups to cope, and make sure they had enough and diverse amounts of food (Campbell & Connell, 2021). Death rates were greater on islands like Curaçao, that have great global connections and rely on other countries for their imports (Campbell & Connell, 2021).

4.2.3 Food and Nutrition Security

Hunger has increased in Latin America and the Caribbean in recent years, with the number of undernourished individuals rising by 9 million between 2015 and 2019 (WHO, 2020). In 2019 the prevalence of undernourishment (PoU) was 7.4% of the population, totalling to 48 million undernourished people (WHO, 2020).

Specifically, for Curaçao, the tendencies discussed before like Westernization of the diet in combination with a generally low-activity lifestyle, are resulting in increased rates of obesity and other diet-related diseases (Hawkes, 2006; CARICOM, 2010). Malnutrition was a major issue in Curaçao 50 years ago, but the trend has now flipped, with worrisome rates of overweight and obesity on the island (Koek, 2017). Findings from research done back in 2015, showed that one in three children attending school were obese (Ministerie van Gezondheid, Milieu en Natuur, 2017). There are certain health benefits in subsistence agriculture, that can change the trend and make it such an important research topic (Rankoana, 2017), however the demand for increasingly Western-oriented meals is growing, widening the gap between domestic supply and consumption. This has so far increased reliance on imports and a decrease in competitiveness on the global food market (Walters and Jones, 2006). As is "normal", the heavily marketed and low-quality meals are consumed in greater quantities during the early stages of development (Hawkes, 2006). People must proceed to the next stage of development before they are driven to spend more on high-quality food, develop concern and understanding about health and diets, according to Hawkes (2006).

4.2.4 Food and Nutrition Security during COVID-19

In October of 2020 CARICOM carried out research on the impact of COVID-19 on food security and livelihood impact. After surveying 171 of the islanders it turned out that almost three out of ten people claimed they had more than a week's worth of food on hand, but one out of every ten people said they had no food at all. In the week leading up to a June study in 2020, two-thirds of respondents said they had no trouble eating enough food, compared to 44% in the Caribbean region. A tenth of those polled, skipped meals or ate less than usual, a lower proportion than throughout the region (27%) (CARICOM, 2020). According to the research, many respondents said food security decreased due to the rising prices of food, or the lack of diversity due to decreasing imports (CARICOM, 2020). This is interesting, as a year later in 2021, of the total import sum of 1.908 million US$, 25.7% comprised food commodities, live animals and fats, which were both higher than ever before (CBS, 2022). Also growth can be observed in 2021, as exports of food commodities and live animals grew in comparison with the previous year. The growth of exported food commodities and live animals in Curaçao was +22,6% in 2021, showing growth in production (CBS, 2022). Still growth is slow as total imports are about 12 times bigger than total exports (CBS, 2022).

It is safe to say that high dependency on imports in time of crises, has exacerbated challenges that Curaçao has been facing since the emergence of COVID-19 (Sambeek et al., 2000; Goede, 2020). Over the last century, the global food system has increased production faster than population expansion. Productivity gains are passed on to consumers in various parts of the world, who now have access to more food at lower prices than ever before (UNIDO, 2021). Nonetheless, such expansion has resulted in significant trade-offs, including a reliance on relatively cheap fossil fuels for food production, biodiversity loss, farmland degradation due to intensive practices, monoculture and increased pathogen susceptibility, eco-system destruction, unsustainable water usage and last but not least a decrease in nutritional values per unit mass due to intensification of production (UNIDO, 2021).

4.3 Agriculture in Curaçao

4.3.1 Soil quality

The availability of food is influenced by the quality of the soil. In Curaçao, the majority of the land is devoid of soils of sufficient quality to be used for agriculture. The issue is caused by four main factors. Crops cannot be grown in large parts of the island because the soil is too shallow and rocky (De Vries, 2000). Salinity is the second factor to consider. Many of the soils of Curaçao are too saline to support crop growth, and this is a concern for many of them (De Vries, 2000). The third issue is that many soils have extremely low organic content. Soil texture and water retention capacity are improved by organic matter in the soil. However, due to the island's arid climate, organic matter levels in the soil are often low (De Vries, 2000). The availability of nutrients in the soil is the final consideration. Because of the aridity and strong resistance to weathering of the native parent material, most of the soils on the island lack the necessary nutrients (De Vries, 2000). Concerning the pieces of land that do qualify for agriculture, there is the problem of mismanagement in the past. Due to overworking the land, erosion and salinity, the quality has diminished thus lowering productivity (Wells et al, 2018).

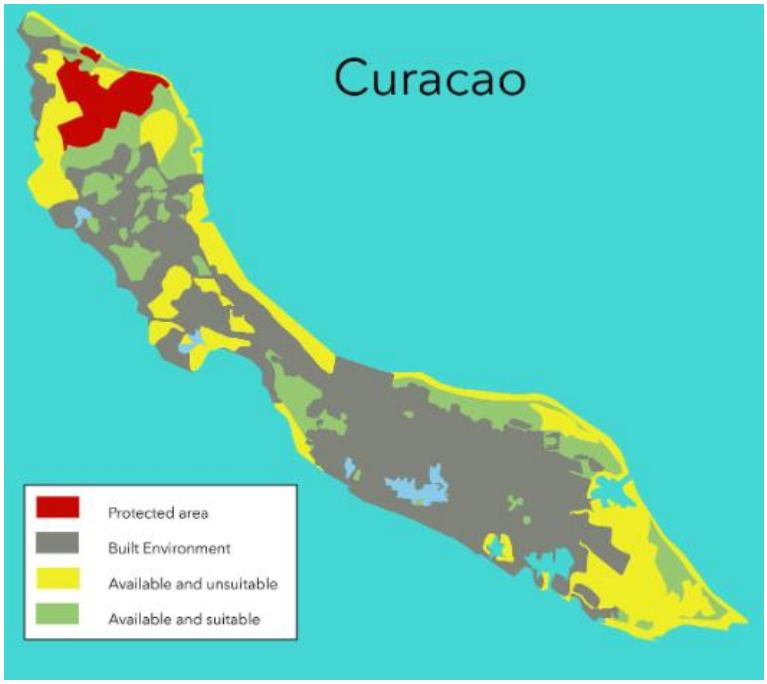

Figure 4.1: Land use of Curaçao (Hugen, 2018).

Figure 4.1 depicts the large areas of land that are unavailable for agriculture as a result of the aforementioned factors, with the yellow sections indicating areas that are available but unsuitable for agriculture and the green sections indicating areas that are available or already in use for agriculture. Tourism, the country's major economic sector, is driving the expansion of the built environment, which is expressed in the grey areas (Scheyvens & Momsen 2008). The expansion of tourism regions diminishes the amount of land accessible for agriculture while also boosting demand for the food that these areas used to offer (Scheyvens & Momsen, 2008). As Curaçao is highly dependent on tourism, the built environment is growing and taking up useful land, in order to facilitate tourists in resorts and other types of accommodation. It must be said though, that built environment also comprises personal housing, where there is room for subsistence agriculture.

4.3.2 Nutrient availability

Many of the soils that are in theory suited for agriculture are also polluted by fertilizers and pesticides (Murray & Hoppin, 1992; Wells et al., 2018). This is projected to rise as demand shifts as a result of an influx in tourism. The demand for non-native items in the region is projected to rise. These crops will be unsuited to the island's climate and will almost certainly necessitate a lot of fertilizer and pesticides to thrive. This will almost certainly exacerbate the current pollution situation. Excessive use of fertilizers and pesticides can also have the unintended consequence

of entering the soils and damaging the island's already scarce groundwater resources (Murray & Hoppin, 1992; Wells et al., 2018).

4.3.3 Water quality

Water scarcity is an issue for the island, which lacks adequate groundwater resources (Mekonnen et al., 2015) and relies heavily on precipitation for agricultural purposes (Gamble et al., 2010; De Vries, 2000). As tourism grows, so does the demand for drinking water, putting even greater strain on an already stressed water supply. The price of water is very high, says Harold Schoop (spokesman of the Agrarian Cooperative Association (AKV)), which is one of the reasons that owning an agricultural or livestock business is barely profitable (Hendriksen, 2020).

4.4 Actors involved and initiatives

Although inflation, slow economic growth and COVID-19 have hindered Curaçao in its struggle for prosperity, there are many initiatives coming from the government, but also from organisations and individuals.

In 2012 the Ministry of Health, Environment and Nature (GMN) wrote an agricultural policy plan for 2018 – 2023. This plan places a greater emphasis on changing dietary patterns and habits (particularly among young people) and reducing poverty by encouraging kitchen and horticultural cultivation, as well as imparting knowledge about healthy nutrition and self-sufficient fruit and vegetable cultivation (Ministerie van Gezondheid, Milieu en Natuur, 2017). This changing vision shows an interesting shift towards a more inclusive form of ecological and economic development. The Donut Economy Taskforce (DET) followed up on this vision of sustainable development and was published by the Ministry of Economic Development (MEO) in 2021, shortly after the outbreak of COVID-19. Curaçao's economy is undergoing significant changes. Until recently, the island's economy was based on financial services, the oil refinery, tourism, trade, and logistics. These pillars require a more long-term strategy than was previously planned (MEO, 2021). Coronavirus-related government actions have reduced the island's tourism and service economy to a bare minimum as of March 2020 (MEO, 2021). Simultaneously, the measures have highlighted which sectors (health and education) contain crucial occupational groups necessary to keep our society running. These changes highlight the necessity for a thorough examination of Curaçao's economic model (MEO, 2021).

Following the donut economy policy, a total of ten workshops were organized, with four open to the public and six targeted at specific groups. Participants heard about the donut economy's concepts and developed ways to implement a circular economy in Curaçao throughout the sessions (MEO, 2021). The participants' thoughts were mostly on cooperation, education, training, sustainability, and employment. Curaçao's residents understand that there is no society without a social base (MEO, 2021). There were also brainstorming sessions in the context of the donut economy where entrepreneurs and individuals could share their thoughts and ideas on a circular economy (MEO, 2021).

According to Harold Schoop (AKV) however, the government does not bear sole responsibility. He believes that the agricultural industry must improve its own organization. “Many people in our sector don't work in an organized way, we meet regularly, make a list of action points, but

these actions are not carried out. Many people lack a long-term vision," says Schoop, "which is a shame, because agriculture is a sector with enormous potential" (Hendriksen, 2020).

According to the donut economy policy study, the snapshot of Curaçao offers an unsettling picture of the Curaçao economy, both socioeconomically and environmentally (MEO, 2021). Curaçao fails to meet the donut model's requirements on multiple fronts. Five of the nine ecological indicators and nine of the twelve socioeconomic indicators give cause for concern. The lack of a social foundation on Curaçao has an impact on the climate. More research is needed to determine how this social foundation may be established on a long-term basis (MEO, 2021).

The ZonMw research project aims to learn more about how the pandemic has impacted local food systems, as well as how sustainable agriculture production may contribute to diversification measures that will help the island become more resilient to future pandemics. The involvement of local stakeholders and citizens in the design of data collecting and interpretation is crucial to this initiative (ZonMw, 2020). Since the emergence of the COVID-19 pandemic, Work Package (WP)1 of ZonMw has been measuring the impact of COVID-19 on the sustainability of food systems and community responses to food security. The research consortium comprises of a research team from each of the three islands, with institutional support from the University of St. Maarten, the University of Curaçao Research Institute (UCRI), and the University of Aruba (SISSTEM) (ZonMw, 2020).

4.5 Conclusion

Curaçao has struggled under COVID-19. Besides bearing the "curse" of being an island, their laissez-faire attitude is exacerbating current economic struggles. Crime rates are still increasing, and sluggish economic growth is not conducive to these developments. COVID-19 and economic decline have resulted in job loss and poverty. Food and Nutrition Security has also seen great decline, especially during COVID-19. Although there is a plethora of food being imported, people are not able to access it due to lack of funds.

Due to its barren lands, Curaçao also does not provide a favourable island for agriculture. Salinity, soil fertility, aridity and shallow, rocky soils form the four main reasons the soil is generally not suitable for agriculture. There is little land suitable for agriculture. Water scarcity also plays a big role in the practice of agriculture, as tourism puts a great strain on water supplies. Despite the somewhat grim prospects on agriculture, the government and other actors are trying to implement policies and projects to encourage farmers and locals to produce more locally, by giving training, education and subsidies to promote agriculture. The idea is to strive for a donut economy. The ZonMw research, on which this thesis is based, is an initiative arising from the universities of all three Dutch-Caribbean islands.

5. Characteristics of practitioners of subsistence agriculture in Curaçao

5.1 Introduction

This first analytical chapter answers sub-question 1: What the characteristics and motives are of the practitioners of subsistence agriculture in Curaçao? The data that are used to answer this question include quantitative and qualitative data from the survey. This chapter begins with an overview of general demographics to portray who the people are practicing subsistence agriculture in Curaçao and where they live (5.2). It will then discuss the motives of the practitioners; why do they practice subsistence agriculture, and how do they do it (5.3)? The quotes from respondents are also in a table in appendix 9.4. The chapter ends with a short conclusion (5.4).

5.2 General demographics

5.2.1 Age & Sex

In Figure 5.1 (appendix 9.3) the distribution of age of the respondents is given. As is visible in the figure, a little more than half of the 61 respondents is in the age category of 46 to 65 years old. The second largest group is that of the 26- to 45-year-olds, the third largest is the 65+ group with 15% of all respondents. These three age groups make up roughly 89% of all respondents, whereas the groups ranging from 18 years of age to 35-year-old, make up only 11%, with the group of 18 – 22 containing zero respondents. It is important to consider potential bias in age groups, as platforms on which the survey was distributed might have a prevalence of older users. Therefore it is not safe to say if the people practicing subsistence agriculture in Curaçao are generally of older age groups.

Of the respondents, 66% are female, coming to a total share of 40 women. 19 respondents are male, and 2 respondents preferred not to disclose their sex (Figure 5.2, appendix 9.3).

5.2.2 Nationalities

Among the 61 respondents the majority is of Dutch nationality. Of the 61 respondents, only two have a different nationality, one Surinam and one Chinese respondents. As said before, the Dutch Antilles are part of the Kingdom of The Netherlands, all people that are born on the island have the Dutch nationality. There is no distinction made between Dutch Antilleans and migrated Dutch.

5.2.3 Place of residence

In Figure 5.3 place of residence of the respondents is indicated on a map. From the 61 respondents, the majority lives around Willemstad, the capital of Curaçao. In Figure 4.1 which shows the land use of Curaçao (Hugen, 2018), the built environment is mainly in and around Willemstad. The majority of the practitioners inhabit the built environment. According to Scheyvens and Momsen (2008) dependence on tourism is increasing the built environment, taking up space that could be used for agriculture. It appears to be the case that practitioners living in houses in the built environment still have enough space to practice subsistence agriculture. When we look at the same map by Hugen (2018), the north area of Curaçao which is suitable and fertile, is where some practitioners live. However, as De Vries (2000) said, these areas may seem fertile on paper, but even these soils struggle due to salinity, bad soil texture, lack of nutrients and rocky and shallow textures.

Figure 5.3: Place of residence of the practitioners

5.2.4. Employment & disposable income

Regarding the employment status of the respondents, 31 of 60 respondents claimed to be unemployed, which is a little over half of all respondents. Retirement was not asked out, but given the age groups, retirees will also make up a part of the respondents. Figure 5.4 shows the disposable income of the respondents. Almost half of the respondents are in the categories of a disposable income ranging from 2000 NAF to 5000 NAF per month (the national currency of Curaçao). 2000 NAF – 5000 NAF is the equivalent of €1050 – €2600 per month in disposable income. About 20% is above this large group, with a disposable income ranging from 5000 NAF per month to over 7000 NAF per month. 16% of the respondents range from less than 1000 NAF to 2000 NAF maximum. 10% of the respondents did not want to disclose their disposable income.

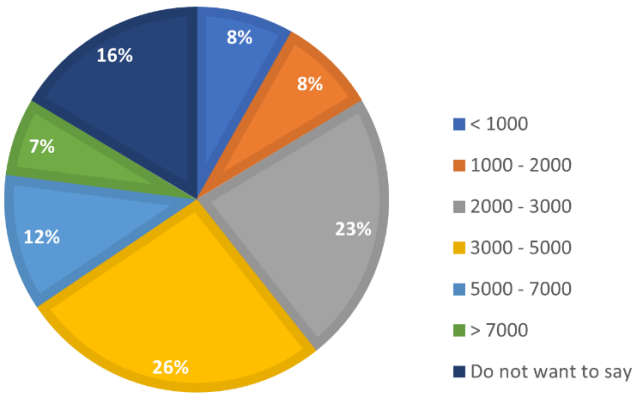

FIGURE 5.4: DISPOSABLE INCOME IN NAF (ANTILLEAN GUILDERS) PER MONTH (N=61)

These findings are interesting, as subsistence agriculture in general is a way of meeting the needs of oneself and families, but what is to be concluded here is that rather prosperous people are also practicing, regardless of the fact that they are financially capable to acquire food commodities without subsistence agriculture. The reason this economic affluent group is represented quite largely, could be due to the fact that there is a bias in sampling which was

discussed in the methodology, however, subsistence agriculture is also gaining interest among other economic groups, that do not view it as a livelihood, but more as an extra (Bish et al., 2014). Although there are also representations of other less affluent economic groups of Curaçao performing subsistence agriculture, people with a better economic status might have more time and resources like phones or computers to fill in a survey like this one.

5.3 Motives for subsistence agriculture

It is important to learn why people are practising subsistence agriculture in Curaçao, because policy makers can learn from these reasons and act upon them. Motives for subsistence agriculture among practitioners are shown in Figure 5.5. The outcomes in the Figure were derived from open questions. The larger part of the respondents practices subsistence agriculture as a hobby, with many (more than half) respondents using gardening as a way to relax and amuse oneself. This shows that it is not used by everyone to provide for themselves or kin, as they do not need to. This aligns with former data from Figure 5.4, showing that the disposable income of many respondents is sufficient enough to not need subsistence agriculture to provide for oneself or kin.

However, self-sufficiency is also an important reason to many as one respondent said: "sometimes fruits and vegetables are simply not available… or not available fresh and simply extremely expensive (R19)", which also shows that the price of foods is an important reason as is also visible in Figure 5.5. Another respondent elaborates further on that saying "from the moment that Venezuela closed its borders to us, there was no fresh fruit and vegetables coming into our country any longer (R49)". Another important reason seems to be to produce more healthy and organic food. For instance, one respondent said "I would rather eat vegetables of which I know that they haven't been sprayed with pesticides or fertilizers (R17)", another respondent added that "growing my own food enables me to feed my direct surroundings with healthy and organic foods, as I know where it is coming from (R58)".

Some respondents named decrease of carbon emission as an incentive, as for instance one of the respondents said "we should be more sustainable on the island and import less, most people do not have an idea about their footprint related to food (R1)". Furthermore, similar relevant motives for subsistence agriculture are apparently to educate the next generation on nutrition and agriculture.

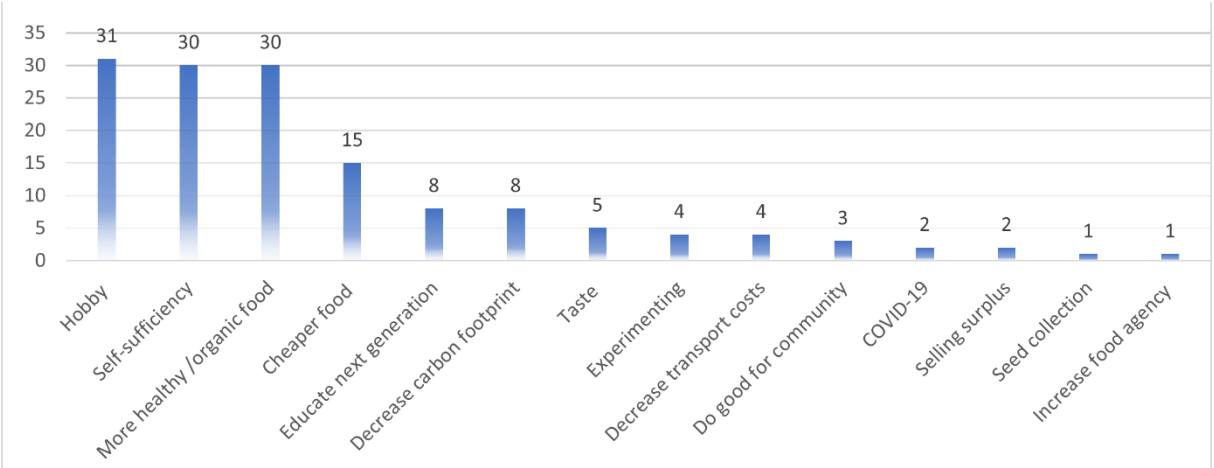

Figure 5.5: Motives for subsistence agriculture (N=61) – multiple responses were possible

Subsistence agriculture takes different forms (Figure 5.7). There are many different ways of practicing agriculture. Most practices of subsistence agriculture are the planting of fruit trees, planting of vegetables and herbs in pots but also in the garden soil. Almost three quarters of all respondents are involved in that type of agricultural production. A lesser part produces food commodities through food forests, but also a few use greenhouses, hydroponics and some even aquaponics. As some might not have the room to perform such intensive and scaled types of subsistence agriculture, it is necessary to reiterate that once again economic backgrounds play a role in how people tend to practice. Figure 5.6 shows a compilation of pictures of examples of subsistence agriculture, sent in by respondents.

Figure 5.6: M. Berends Bustamente., B. de Lannoy & R. Vermeulen. (12th of June 2022). Examples from practitioners of subsistence agriculture. Retrieved from Facebook.com (private page).

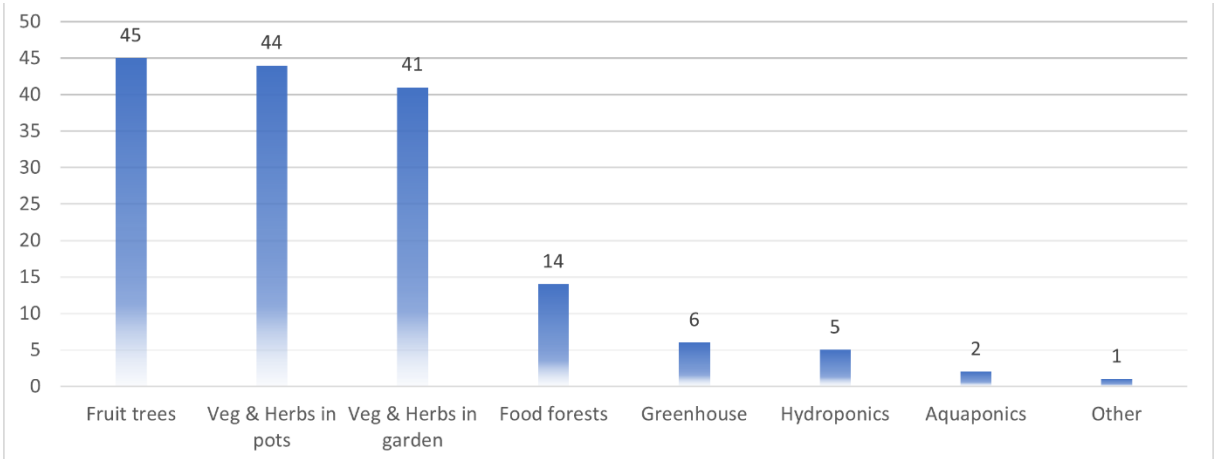

Figure 5.7: Type of agriculture practiced by respondents

The larger part of the research population has been practicing these types of subsistence agriculture for over 10 years. Figure 5.8 (appendix 9.3) shows the duration in years that the respondents have been practicing subsistence agriculture for. Some have been planting since they were small, in order to provide for their family. This explains why a lot of information on subsistence agriculture is passed on via family and friends. The respondents were asked where they gathered their information from, these different channels are shown in Figure 5.9

(appendix 9.3). This figure shows that the internet is the primary source for gathering information on subsistence agriculture. Families and friends form the second most used channel for gathering information followed by courses, like the ones facilitated by the government of Curaçao, but also through local initiatives. However, some also gathered information by doing, reading books or by studying in relevant fields like biology or agricultural studies.

As described above, there are different ways of practicing subsistence agriculture. Each practitioner works on different scales. Some have bigger allotments, whereas some prefer working a small piece of land. Most people have relatively small allotments ranging from one to 500 m2, as the element of space might constrict them of farming greater lands. A few are between 500 and 1000m2, and even less have a piece of land bigger than a hectare (Figure 5.10). This is partly in line with Onakuse (2012), who found that a common characteristic of subsistence farmers is that they are usually in ownership of small parcels or non-irrigated cultivable lands, and sometimes even share pieces of land. As subsistence agriculture entails growing food crops to meet needs of one person or perhaps some family members too, it is not necessary to have large pieces of land for agricultural purpose (Bisht et al., 2014), however findings show that there are already practitioners that are practicing on relatively large parcels, aligning with findings on how people of different economic groups perform subsistence agriculture, even if it is just as a hobby.

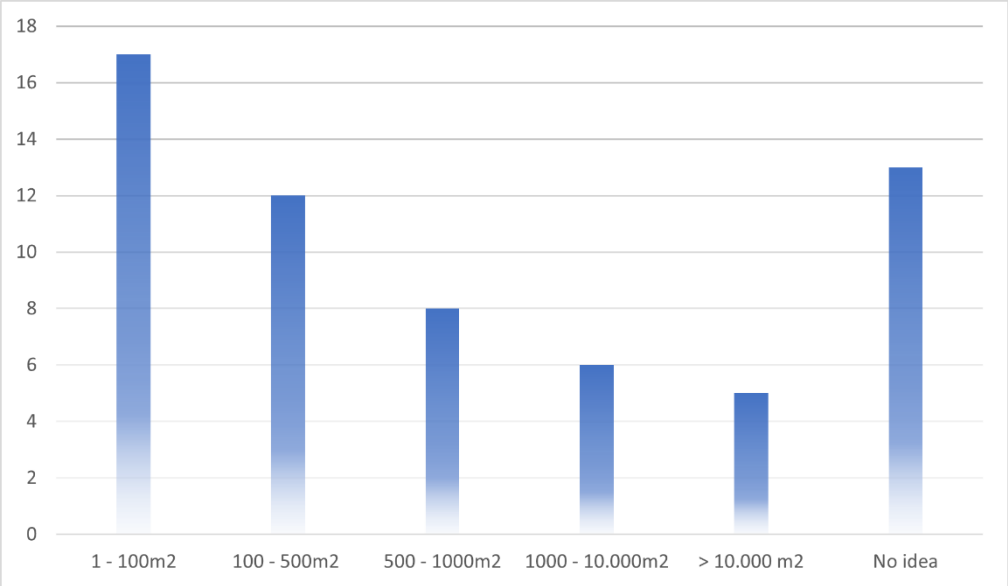

Figure 5.10: Allotment size per category of practitioners

The respondents were also asked how much of their land was actually used for subsistence agriculture, in order to calculate what percentage of current land was being used, and how much was not. Each percentage was used to express an average percentage of usage, this totalled to an average of 57,4% of the respondents' land that is currently used for subsistence agriculture. As many people seem to live in and around Willemstad as seen in Figure 5.3, and thus live in the built environment, that could possibly explain why a little more than half of available land for subsistence agriculture is in use. As the soil quality is poor in Curaçao (De Vries, 2000) and there is a lack of adequate groundwater resources (Mekonnen et al., 2015), it may take quite bit of effort to work the land, financially and physically.

5.4 Conclusion

This chapter explores what the characteristics are of the practitioners of subsistence agriculture in Curaçao. Most of the people are between the age of 36 and 65+, the majority of them is female. The common nationality remains Dutch, only a few have other nationalities. Although the practitioners seem rather affluent, with an average monthly disposable income between 1050 – 2600 euros, a bias in sampling through online surveys can misrepresent who these practitioners are. Still, these findings are interesting, as subsistence agriculture in general is a way of meeting the needs of oneself and their families, and what is to be concluded here is that rather prosperous people are also practicing, regardless of the fact that they are financially capable to acquire food commodities without subsistence agriculture. This can be an indication that subsistence agriculture is gaining widespread popularity, for different reasons. Motivations for subsistence agriculture can clarify reasons for practicing. Findings show that for most it is just a hobby, however for some it is an important channel for healthy and organic fruits and vegetables at a lower price. For people that have more resources to acquire certain commodities, subsistence agriculture seems to be more of a way of relaxing and fun. Many of the practitioners have been planting for longer than two years and have not started because of the pandemic, however some claim the pandemic was indeed an instigator for practising subsistence agriculture. To conclude, people practicing subsistence agriculture in Curaçao cannot be lumped together in a certain economic group, as they all differ from one another, and all have their reasons on practicing subsistence agriculture.

Although most respondents live in the built environment around Willemstad, they are able to practice subsistence agriculture. The acreage they do this on is however quite small which is a general characteristic of subsistence agriculturalists and can explain why they are able to practice in an area that is dominated by buildings for the tourism industry. Still it seems that a small amount of practitioners is practicing on larger parcels. On average, only little over a half of all available land available to the practitioners is used for subsistence agriculture, which shows that there is more potential for current practitioners to expand their practices. Only a few practitioners live in the outskirts of the built areas of Curaçao on lands that have more space due to lack of built areas. They have potentially more fertile lands, although they also struggle with salinity and aridity and perhaps also larger plots.

6. Subsistence agriculture: challenges and potential for Food and Nutrition Security

6.1 Introduction

This second and final analytical chapter presents the main findings from the data that was gathered to answer SQ2: "How has COVID-19 affected Food and Nutrition Security and the use of subsistence agriculture for the practitioners of subsistence agriculture in Curaçao?", SQ3:" How has subsistence agriculture influenced current Food and Nutrition Security for the practitioners of subsistence agriculture in Curaçao?" and SQ4: "What is the potential of subsistence agriculture in addressing future Food and Nutrition Security challenges as perceived by the practitioners of subsistence agriculture in Curaçao?".

First the influence of COVID-19 on Food and Nutrition Security is discussed by looking at the five pillars that make up Food and Nutrition Security in the scope of this research, in sub chapter 6.2. Then, the influence of COVID-19 on the role of subsistence agriculture is discussed in 6.3. The third sub question that is analysed is how subsistence agriculture has influenced current Food and Nutrition Security for the practitioners of subsistence agriculture in Curaçao, in 6.4. This is followed by the fourth sub question, which discusses the potential of subsistence agriculture in battling future challenges with Food and Nutrition Security, in 6.5. This is done by using both qualitative and quantitative data from 61 respondents in the survey linked to material from the theoretical framework and research context. The quotes from respondents are also in a table in appendix 9.4. The conclusion is chapter 6.6.

6.2 The influence of COVID-19 on Food and Nutrition Security

6.2.1 Availability

Availability as the first pillar of Food and Nutrition Security (2008) focuses on the quantity of food available, the fair distribution is of food is not taken into account.

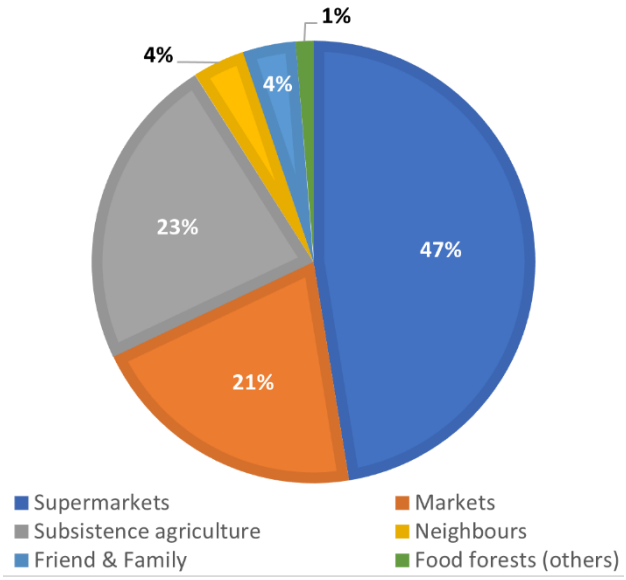

Figure 6.1: Where is food available for respondents (N=61)

Figure 6.1 shows where food is mainly available for the respondents of the survey. Supermarkets are their primary place of food availability. However, markets and subsistence agriculture also make up a relatively large part of availability channels to the respondents, which is rather interesting and contrasts with the research of Adhikari et al. (2021) who states that subsistence agriculture has limited contribution to availability due to poor productivity, as quantities are limited. The influence of subsistence agriculture on the different pillars of Food and Nutrition Security is discussed further on in this chapter.

Before addressing the influence of COVID-19, it is important to break down what respondents buy weekly, in order to analyse how that might have changed due to COVID-19.

In Table 6.1 the average of each food group is presented, giving an average of what the respondents buy every week. The share of proteins is highest of the different food groups in the Table, with an average of 12.52 KG per week. The share of dairy is the lowest, with a share of 5.41 KG a week. Although available food and the food bought is something different, it is interesting to notice the prevalence of fruits, vegetables and proteins in the weekly shopping. According to WHO (2020) in lower-middle income countries, there is a prevalence of starchy foods, sugars and fats, and a relatively small share of dairy, proteins and pulses, which is the opposite of these findings. However, a small sample is not representative, and cannot be simply generalised for the whole of Curaçao. An explanation for this difference could be the prevalence of affluent respondents, who have a generally high disposable income, thus capable of acquiring food that does not align with the buying behaviour of a lower-middle income country (WHO, 2020). Perhaps a bigger sample with respondents through different communication channels will show different results.

Food Group	Number of respondents	Average amount in KG	Total in KG
Fruits & Vegetables	30	9.97	299
Starchy foods	26	6.81	177
Dairy	22	5.41	119
Proteins	27	12.52	338
Fats	26	5.73	149

Table 6.1: Weekly shopping per food group among the practitioners in kilograms (N=61)

Regarding the influence of COVID-19 on the availability of the users of subsistence agriculture in Curaçao, a little more than half (51.2%) of all respondents found that COVID-19 had an influence on their personal availability of food commodities. In October 2020, research was conducted in the Caribbean that showed that people's food security decreased due to the prices rising, and they were not able to buy all the food they needed (CARICOM, 2020). One respondent said "you need to check every week, prices increase sometimes and are not reasonable and outside your budget (R5)", which another respondent seemed to experience, too, saying "now you stop to think if you really need something before you buy it (R37)". Prices are, however, apparently not the only problem, but also stocks seem to be a problem. "All prices have increased drastically, but sometimes there is also no stock of what you normally buy (R18)". As imports of food commodities, livestock and fats in 2021 were higher than ever before (CBS, 2022), the lack of stock and high price of food commodities comes as a surprise, as usually when supply is high, accessibility and availability are positively valued. Potentially, hoarding could be a reason that even though there was enough food, as smaller groups of people were buying up bulks of food commodities.

Some even seemed to make more drastic changes in the consumption of foods, with the following respondent saying "my partner has also reduced his consumption and his diet, by eating less meat and rice (R40)", with another saying that "when you don't have enough money, you just eat less (R39)". In the research conducted by CARICOM (2020) a tenth of the respondents polled had indeed also skipped meals or cut back on portions, due to the effects of COVID-19. 48.8% seemed to have experienced no change or influence on their availability of food commodities, with a few claiming nothing changed and one saying "I have a steady job, so I don't see any change in my personal availability (R59)". Béné et al. (2021) showed no strong indication either in their research over 62 countries in the first 12 month of the pandemic,

that COVID-19 was of strong effect on availability. There were only minor disruptions in availability, due to panic buying (Béné et al., 2021). A respondent said the following:

> *I myself have not noticed that the availability of food has changed as a result of the Covid-19 outbreak. I don't know anything about the decrease of foodstuffs in supermarket aisles. The products may have become more expensive, but they are still available (R5).*

The respondents were asked to score their availability to food commodities from 1 to 10 prior to the COVID-19 and since the COVID-19 pandemic. 1 means low (bad) personal availability, 10 means high (good) personal availability. The score distribution prior to and since COVID-19 are shown in Figure 6.2. This figure shows a difference in availability score in the period prior to and since COVID-19. Before COVID-19 none of the respondents scored their availability of food commodities lower than a 5, but since the COVID-19 pandemic, a few respondents even scored their availability with a 3 or a 4.

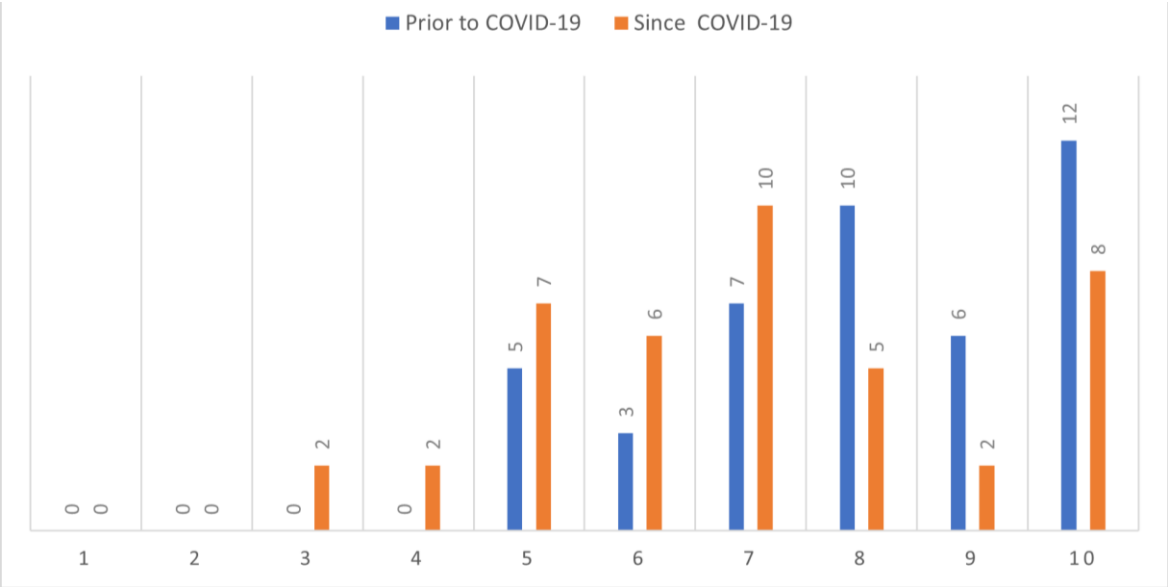

Figure 6.2: Distribution score availability of food commodities low (1) to high (10) prior to and since COVID-19 (N=61)

The average score on availability among the respondents prior to the pandemic was 8.05, whereas the score since the pandemic is more than a point lower, 6.98.

To measure the significance of the effect of COVID-19 on availability of food commodities, a one-tailed paired T-test was performed in Excel using the following hypothesis:

H_0: *There is no effect measured since COVID-19 on availability of food commodities*

H_1: *There is an effect measured since COVID-19 on availability of food commodities*

Calculation results in Table 6.2 show a significant effect of COVID-19 between the scores given by practitioners regarding their availability of food commodities prior to the pandemic and since the pandemic. This is not in agreement with the 0-hypothesis, therefore, with 95% confidence H1 is accepted which states that there is an effect of COVID-19 on availability of practitioners. The Cohen's d shows a small effect however, which means that although there is statistical significance, the effect is small.

Variables		**Pooled Standard Deviation**	**Significance (*p*)**	**Cohen's d**
"Availability" prior to COVID-19	*"Availability" since COVID-19*	SD_{pooled} = 3.38	.000196 $p < 0.05$	0,316

TABLE 6.2: STATISTICAL CALCULATIONS OF SCORES ON AVAILABILITY GIVEN BY PRACTITIONERS PRIOR TO AND SINCE COVID-19 (N = 61)

This indicates that, although small, COVID-19 did have a negative effect on the availability of food as evidenced by the difference in the mean prior to and since the outbreak.

When asked to elaborate on the scoring one respondent said "it was always a bit of a gamble going shopping and hoping to find the right stuff, now going out with a shopping list can mean 25% is not in store (R20)" with one respondent even saying "before Covid you could find what you were looking for on a near regular basis. During and after Covid I had to apply a complete adjustment to my diet (R9)". This is in line with research done by Béné et al., (2021) who claimed that problems regarding availability of food commodities during the pandemic were mainly due to panic buying, resulting in empty supermarkets. However, some respondents also claimed nothing had significantly changed, with quite a few saying that they had no problem buying the food they needed, and that COVID-19 had been of no influence on the availability of food commodities. There is a wide range in scoring and appreciation of personal availability, which could be imputable to the various economic groups partaking in the research.

6.2.2. Stability

Stability describes the access to food commodities on a regular basis (FAO, 2008). During the pandemic, the vulnerability of global food supply chains was shown (O'Hara & Toussaint, 2021), as access disruptions were resulting in stability issues (Béné et al., 2021). The respondents were asked if there were times before and since the pandemic where they did not have an adequate and stable flow of food commodities. Before the pandemic a little under half experienced no trouble acquiring a stable amount of food, and a rough 30% rarely experienced issues. However, 10% of all respondents experienced issues constantly (Figure 6.3). The respondents were asked to rate their stability in flows of food commodities from 1 to 10, 1 being low stability, 10 high stability. The score prior to COVID-19 was an average 8.23, whereas the score since COVID-19 was more than a point lower, 7.18. the distribution is shown in Figure 6.4.

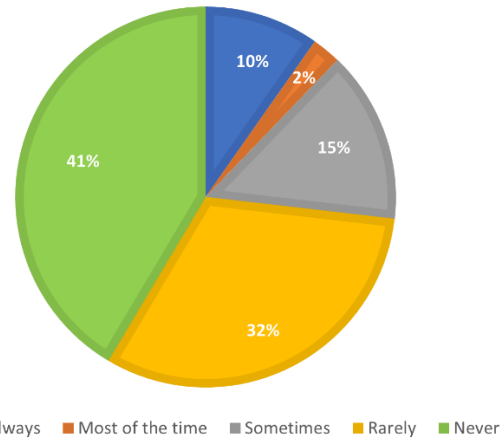

Figure 6.3: Inadequate and stable supplies prior to the pandemic (N=61)

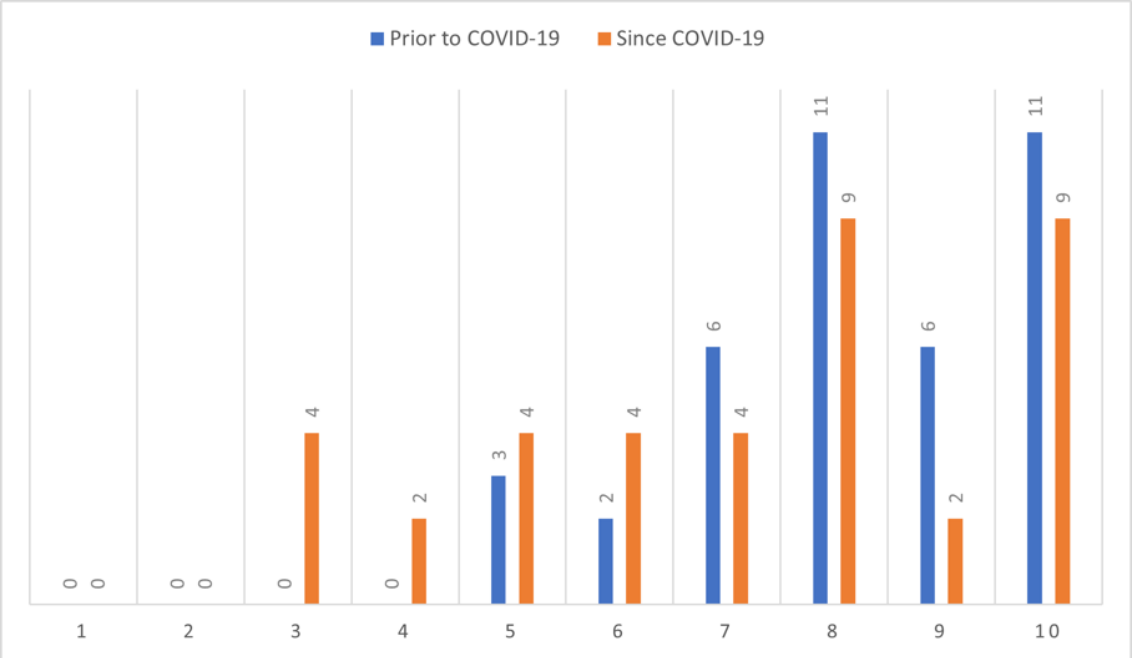

FIGURE 6.4: DISTRIBUTION SCORE STABILITY IN FOOD COMMODITIES FLOWS LOW (1) TO HIGH (10) PRIOR TO AND SINCE COVID-19 (N=61)

To measure the significance of the effect of COVID-19 on stability of food commodities, a one-tailed paired T-test was performed in Excel using the following hypothesis:

H_0: *There is no effect measured since COVID-19 on stability of food commodities*

H_1: *There is an effect measured since COVID-19 on stability of food commodities*

Calculation results in Table 6.3 show a significant effect of COVID-19 between the scores given by practitioners regarding their stability in access to food commodities prior to the pandemic and since the pandemic. This is not in agreement with the 0-hypothesis, therefore, with 95% confidence H1 is accepted which states that there is an effect. The Cohen's d shows a small effect however, which means that although there is statistical significance, the effect is small.

Variables		**Pooled Standard Deviation**	**Significance (*p*)**	**Cohen's d**
"Stability" prior to COVID-19	*"Stability" since COVID-19*	SD_{pooled} = 3.76	.000295 $p < 0.05$	0,285

TABLE 6.3: STATISTICAL CALCULATIONS OF SCORES ON STABILITY GIVEN BY PRACTITIONERS PRIOR TO AND SINCE COVID-19 (N = 61)

As the average score has declined by over a whole point, in combination with a statistical significant effect it can be concluded that COVID-19 has inflicted *instability* in the way the practitioners are able to access their food commodities, however the effect size is small.

Since the pandemic, the distribution seems to change towards a more negative pattern, with more people experiencing unstable flows of food commodities sometimes, and a growing share experiencing issues most of the time (Figure 6.5, appendix 9.3). Evidently, the share of respondents that experienced trouble all the time actually decreased by 5%, which is not

particularly in line with other researches that claim that COVID-19 has had a negative effect on stability and Food and Nutrition Security in a whole.

According to one respondent, supplies were always limited and COVID-19 did not change anything. Another respondent added "before COVID it came down to lack of organizing skills of the merchants. I guess it's due to problems with the supply chain a lot of products get stuck or aren't available (anymore). At least, that's what I hear from the store owners (R9)", which can imply that problems in supply chain and thus the flow of food commodities have always had instabilities.

One reaction to instabilities that has been found is local markets, with a respondent saying: "since the pandemic I have turned to local farmers rather than the supermarket (R12)". For some, these are options when funds allow. Another person added:

> Pre COVID most people bought stuff in the supermarket, so there was enough stock at the local markets. But during the pandemic, more people have focussed on health and food production, and have started shopping at local markets, which has inflicted a shortage of food on the market as the demand outweighs the supply. Now the markets also sell imported food, which makes it more expensive (R42).

Price seems to be an important driver for decreasing stability, as stable flows also mean stable access. One respondent said "as a result of the COVID-19 outbreak, I no longer have the necessary financial resources to buy various fruits and vegetables (R50)". Although financial means have more of an impact on accessibility than stability, it seems that many respondents bring up prices and money when it comes to stability. When asked if the fluctuation of prices on food commodities had changed the personal stability of food commodities flows, 60% answered the question with *yes*, implying that food is less affordable to many and affecting their Food and Nutrition Security. 71% of all respondents claimed to switch to cheaper brands due to them being more affordable. It is interesting that respondents respond different to instability, as one switches to more upmarket products from farmers markets, whereas others switch to cheaper brand, highlighting the disparities between respondents. Moreover it is clear that stability and accessibility are closely linked, as temporary price fluctuations seem to influence stability.

6.2.3. Accessibility

Certain entitlements define a person's ability to access commodities like food (FAO, 2008). The FAO (2008) categorised physical and financial dimensions to the aspect of accessibility, like purchasing power through income and transport and infrastructure to be able to get to channels of food supply.

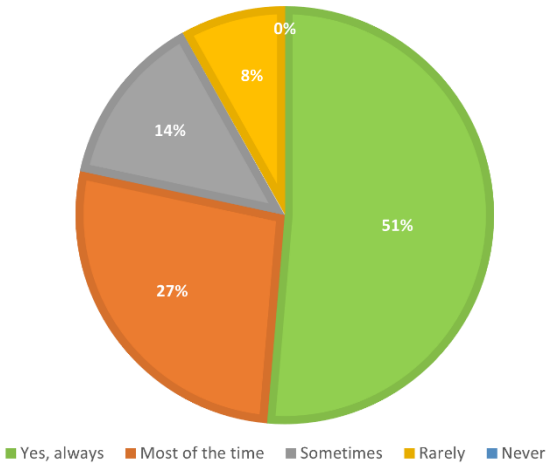

Figure 6.6: Financial security for food accessibility among respondents (N=61)

Figure 6.6 is a reflection of the financial security of the respondents to access and provide themselves with food commodities. More than half of all respondents deemed themselves financially secure at all times to access necessary food commodities, a little more than a quarter shared this notion most of the time. However, there were also about 20% of all respondents that did not always feel like they were financially secure, with 8% thereof even claiming they rarely felt secure financially. Bias in the research sample which has been discussed earlier on can achieve the misrepresentation of the financially secure group, as people in the other economic groups did not partake in this research in such numbers. Regarding physical accessibility, most respondents experienced a general capability of accessing food through physical infrastructure and transport. Figure 6.7 shows the answers of the respondents, only a few indicated to sometimes or rarely not having physical access to food commodities. When someone is not physically or financially entitled, one is not food secure, according to the FAO (2008).

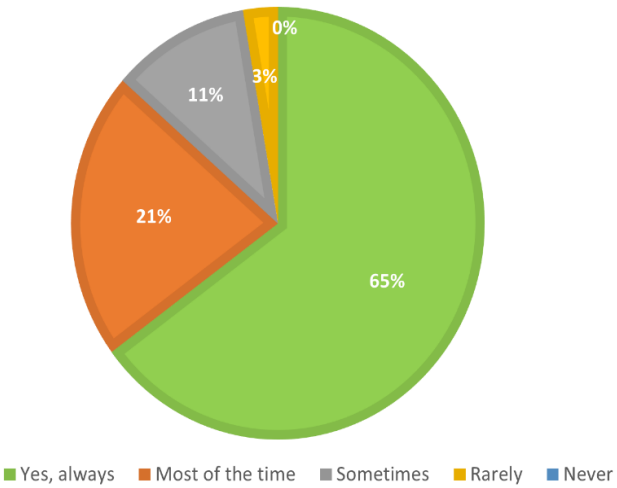

Figure 6.7: Physical capability for food accessibility among respondents (N=61)

The respondents were asked to rate their accessibility to flows of food commodities from 1 to 10, 1 being low accessibility, 10 high accessibility. The score prior to COVID-19 was an average 8.43, whereas the score since COVID-19 was almost a point lower, 7.57. the distribution is shown in Figure 6.8.

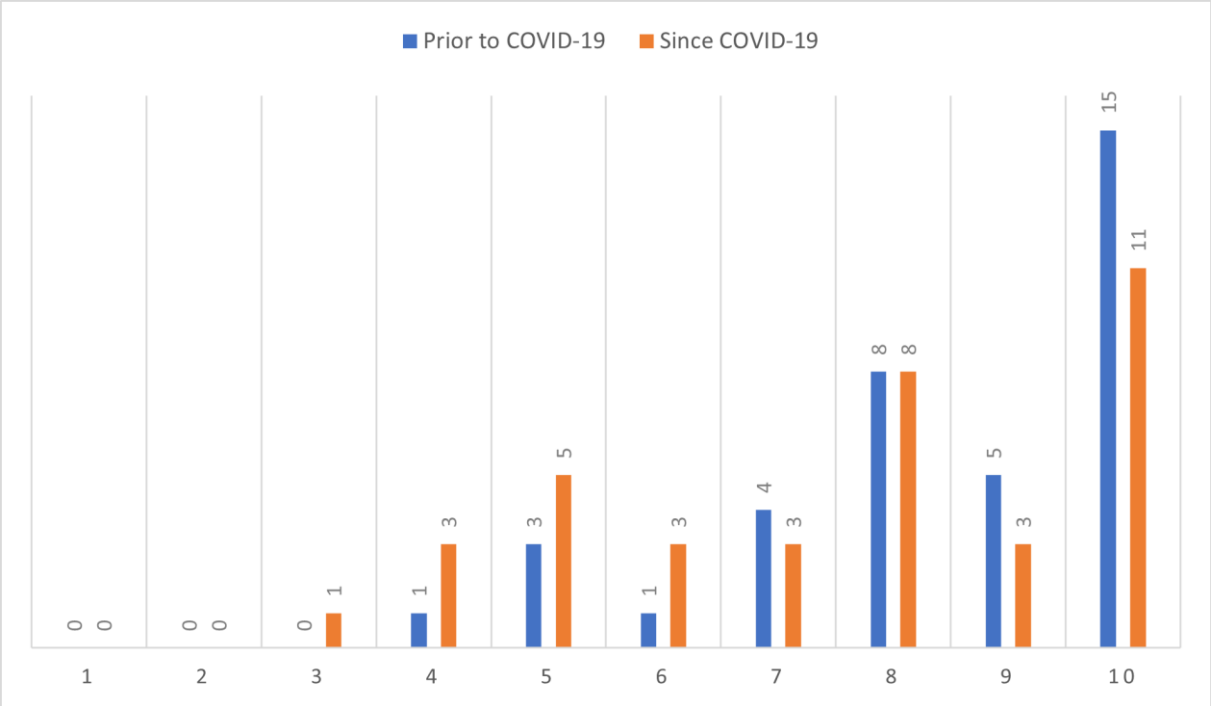

Figure 6.8: Distribution score accessibility to food commodities low (1) to high (10) prior to and since COVID-19 (N=61)

To measure the significance of the effect of COVID-19 on accessibility to food commodities, a one-tailed paired T-test was performed in Excel using the following hypothesis:

H_0: There is no effect measured since COVID-19 on accessibility to food commodities

H_1: There is an effect measured since COVID-19 on accessibility to food commodities

Calculation results in Table 6.4 show a significant effect of COVID-19 between the scores given by practitioners regarding their accessibility to food commodities prior to the pandemic and since the pandemic. This is not in agreement with the 0-hypothesis, therefore, with 95% confidence H1 is accepted which states that there is an effect. The Cohen's d shows a small effect however, which means that although there is statistical significance, the effect size is small.

Variables		**Pooled Standard Deviation**	**Significance (p)**	**Cohen's d**
"Accessibility" prior to COVID-19	*"Accessibility" since COVID-19*	SD_{pooled} = 3.81	.010382 $p < 0.05$	0,227

TABLE 6.4: STATISTICAL CALCULATIONS OF SCORES ON ACCESSIBILITY GIVEN BY PRACTITIONERS PRIOR TO AND SINCE COVID-19 (N = 61)

As the average score has declined by over a whole point, in combination with a statistically significant effect it can be concluded that COVID-19 has affected accessibility to food commodities for the practitioners, however the effect size is small. This is not completely in line with findings of others on COVID-19 and the influence on accessibility, as according to Béné et al. (2021) accessibility was the pillar that was most affected by the pandemic. The loss of purchasing power showed to have affected accessibility in mainly low and middle income countries. Food affordability decreased due to loss of jobs impacting purchasing power. Even

though according to UNIDO (2021) productivity of food was higher than population growth, and sold at lower prices, people were not able afford different types of food commodities. However, as the disposable income of the respondents is relatively high, it is not surprising that findings do not line up with findings from academic research by Béné et al., (2021) and UNIDO (2021). Accessing food chains is easier for people that have the funds to buy commodities and the necessary resources to access them.

Physical restrictions in accessibility seemed not to be the main concern, with only one respondent referring to driving restrictions and lockdown measures. The main concern in decreasing accessibility among respondents was the price of food and the depleting stocks. As said before by respondents, food became more expensive as there was not much available on the island. The demand was thus higher than supply according to some. "I have no problems going about my daily errands. The problem lies in the fact that the shelves are empty when you get to the store (R9)", says one respondent. During COVID-19, people also started hoarding food, as was also seen across the globe, with one saying that the shelves went empty during hoarding. For another "availability is not so much a problem, it's just more expensive (R11)". Pre-pandemic many seemed to be able to carry the financial burden of the already expensive commodities, but due to inflation that grew vastly in 2021 in combination with unemployment, basic necessities became hard to afford (CBS, 2021; Fredrick, 2018). This is also in line with the research carried out by CARICOM (2020) during the pandemic, which pointed out that many respondents said food security decreased due to the rising prices of food, or the lack of diversity due to decreasing imports.

6.2.4. Agency

Clapp et al. (2021) describe agency as people and groups' ability to exert some control over their own circumstances and provide meaningful input into governance processes, which is widely viewed as a critical aspect of resolving today's developing inequities in food systems . Respondents were asked whether they felt they had a certain agency when it came to different factors in the food geography of Curaçao. They scored each factor prior to the pandemic and since the pandemic, from 1 – 10, low to high. The average scores are expressed in Table 6.5.

Factors	***Prior to COVID-19***	***Since COVID-19***
Personal production	6,88	7,38
Local supermarkets	4,23	4,08
Local politicians	2,85	2,56
Local food chain	4,07	3,92
Local farmers	5,07	5,23

TABLE 6.5: AVERAGE SCORES GIVEN BY RESPONDENTS ON AGENCY PRIOR TO AND SINCE COVID-19 (0-10) (N=61)

It is interesting to see that the sense of agency on *personal production* and *local farmers* has improved since COVID-19, whereas scores on the other three factors have decreased since the pandemic. According to six respondents, a sense of agency over personal production (subsistence agriculture) has grown due to the fact that there is a realisation that a part of the solution is in the peoples' hands. Although the government has initiated programmes and subsidies and other great plans, people simply do not feel involved, perhaps having to do with the personal character of own production and local farmers. A respondent even said: "politicians only talk nice and do nothing. I myself depend on the health of my plants.

Supermarkets can take advantage of the situation, but supply and demand play a major role (R41)". Another respondent remarked that "when people grow their own food, they are more aware of what they are consuming (R49)".

Increased collective agency at the community level, as a result of more voice and participation in forming food and agriculture development programs and food system governance, is said to result in better food security and nutritional outcomes (Crocker, 2009; Bezzner Kerr et al., 2019). More contact with local farmers and farming organizations also helped the sense of agency for some respondents, as a small growth is seen in the average score in the table. One of the respondents noted that as prices in supermarkets kept rising, local farmers became a more healthy and viable option for acquiring food commodities. Some said it is because there is room for dialogue with farmers which is not the case with local supermarkets. Prior to COVID-19 agency on local supermarkets already was deemed very low, since the pandemic this has worsened. A common opinion on agency over supermarkets can be concluded in the following statement:

> Despite the increase in prices, people still buy products from the supermarkets. As a result, supermarkets make no effort to lower prices. They set their own prices. I have nothing to say about that and I can't demand anything. If I can't afford it I'll have to go somewhere else where it might be cheaper or not buy the product (R42).

These findings align with the data of the training sessions done by the Ministry of Economic Development (MEO, 2021), which was in collaboration with inhabitants of Curaçao. Main findings were that there was a lack of cooperation with locals, a lack of training and education of inhabitants and a lack of sustainable options. It was concluded was that there is no society without a social base (MEO, 2021). However, there is still much unrest about the relation between the people and politics, as apparently there has been hardly any implementation of the intended plans made by the government. Generally, respondents find it hard to negotiate with local politicians on the island. They feel like they have little to no influence on political factors and local food chains. According to numbers expressed in Table 6.2, COVID-19 has only exacerbated this problem.

To measure the significance of the effect of COVID-19 on agency of practitioners over different factors, a one-tailed paired T-test was performed in Excel using the following hypothesis for each factor:

H_0: *There is no effect measured since COVID-19 on agency over factors of food commodities*

H_1: *There is an effect measured since COVID-19 on agency over factors of food commodities*

Calculation results in Table 6.6 show a not significant effect of COVID-19 over all factors of agency. The scores given by practitioners regarding their agency over different factors prior to the pandemic, and since the pandemic were used. The *p* for all factors lie a lot higher than 0.05, which can be due to the relatively small sample, this does not always mean there is no effect. Therefore Cohen's d is calculated as well to measure the effect size. The effect size is more practical in the sense that it shows if outcomes can be meaningful in *reality*. However, the effect size of the different factors pre and since COVID-19 are close to zero, concluding that the effect size is extremely small to nihil. This is partly in agreement with the 0-hypothesis, which states that there is no effect of COVID-19 on the different variables.

Factor	Variables		Pooled Standard Deviation	Significance (p)	Cohen's d
Own production	*"Agency" prior to COVID-19*	*"Agency" since COVID-19*	SD_{pooled} = 7.05	.112695 $p > 0.05$	-0,072
Local supermarkets	"	"	SD_{pooled} = 8.95	.401214 $p > 0.05$	0,038
Local politicians	"	"	SD_{pooled} = 4.00	.123569 $p > 0.05$	0,072
Local food chain	"	"	SD_{pooled} = 7.89	.394665 $p > 0.05$	0,0129
Local farmers	"	"	SD_{pooled} = 8.43	.273778 $p > 0.05$	0,0189

TABLE 6.6: STATISTICAL CALCULATIONS OF SCORES ON AGENCY GIVEN BY PRACTITIONERS PRIOR TO AND SINCE COVID (N = 61)

6.2.5. Utilisation

The energy and nutrients consumed by a person through food consumption are referred to as utilisation (Thompson et al., 2009). In order to be food secure, it is critical to consume enough nutritious foods (Burchi & De Muro, 2012). This section begins with a discussion of general data on intake and nutrition knowledge, followed by a discussion of the impact of COVID-19 on utilisation based on survey findings.

As described in the theoretical framework, utilisation is a function of both the 'quantity' of food as well as the 'quality' of the food (Thompson et al., 2009). On average, the respondents claim to eat about three meals per day, with small deviations towards two or four meals a day. Roughly 35% of the respondents admitted to eating take-out or fast-food 1-3 times per week, whereas the rest of the respondents claimed to never eat take-out or fast-food. In the choice of what food to consume, 15% of respondents felt they were influenced by family, friends and colleagues. 35% experienced this feeling occasionally.

Most people gather their information on nutrition from internet as is portrayed in Figure 6.9, but courses, studies, scientific data and friends and family make up a large part of information channels for respondents. The influence of friends and family is thus mainly due to exchange of knowledge, disregarding authenticity of information. People were able to put in their own channels of knowledge if it was not included in the given options.

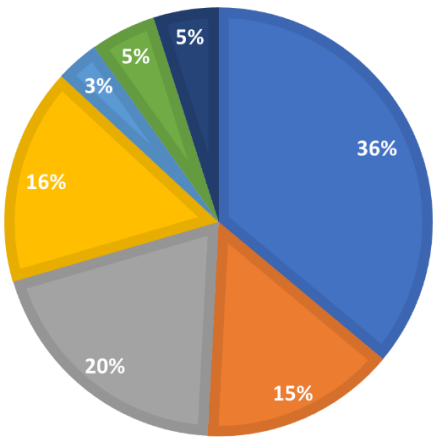

Figure 6.9: Channels of knowledge for information on nutrition (N=61)

People seem to have different notions of what nutritious consumption really entails. Some seem to have the idea that nutrition is reaching a minimum of calories, whereas others seem to acknowledge the value of a balanced diet. What stands out is that many respondents seem to stick to the five food groups. Still, some claim to avoid certain food groups, like starches and fats. However, as discussed in previous sub chapters, certain foods might not always be available to a person, as the following respondent says: "Eating healthy is quite difficult in Curaçao. It is almost impossible to follow a balanced diet (R41)". Some even have a dietary consultant, to make sure they consume nutritious foods,

which displays disparities between practitioners that are prevalent in Curaçao, which seems to influence what foods are consumed among different groups of people.

The tide is turning in Curaçao with alarming rates of overweight and obesity on the island (Koek, 2017). Globalisation and the Westernisation of the diets are to blame for the emergence of this tendency. Obesity and other diet-related disorders are on the rise in Curaçao as a result of trends like a Western diet combined with an usually low-activity lifestyle (Hawkes, 2006; CARICOM, 2010). Lack of knowledge is usually a big problem, as people can have wrong ideas on what nutritious food is. Although the government of Curaçao set out to place a greater emphasis on changing the diets of mainly young people whilst encouraging horticultural cultivation and nutritious consumption, the situation has worsened (Ministerie van Gezondheid, Milieu en Natuur, 2017), which is alarming and calls for action.

According to the WHO, the quality of dietary protein and lipids, as well as food qualities like fibre and antioxidants, and other healthy diet components, are all dependent on the consumption of specific food groups (Lele et al., 2016). These food groups are a way of classifying foods to show what a balanced diet looks like (WHO, 2020). According to the WHO (2020), a nutrient adequate diet contains adequate quantities of carbohydrates, lipids, proteins, minerals, vitamins, and health-promoting components.

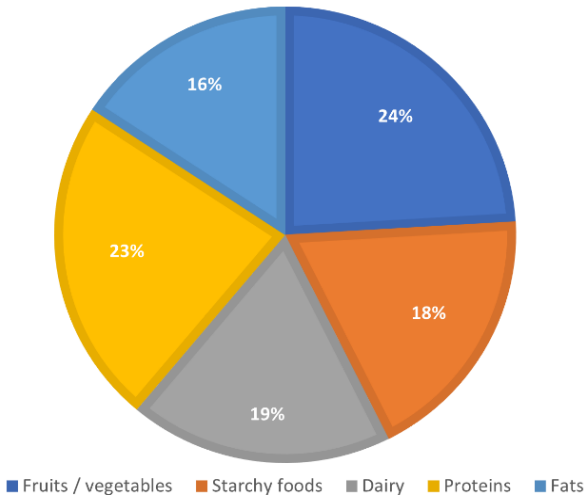

Figure 6.10: Consumption of food groups of practitioners of subsistence agriculture (N=61)

Figure 6.10 shows the food group distribution among respondents, which shows that fruits, vegetables and proteins are consumed most in general. Amounts per food group are unknown. Fats make up the smallest part of the circle, as little respondents claim to consume fats. This is not entirely in line with data from the WHO (2020) on world nutrition. In lower-middle income countries, generally starchy foods comprise almost half of all food consumed, and the share in sugars and fats is usually higher. Intake of fruits, vegetables, dairy and proteins tends to be low in countries like Curaçao. It is however important to acknowledge, that a prevalence of educated or more affluent respondents may significantly influence data outcomes. Generally, people who are economically more affluent tend to have a different diet than people in lower-income groups according to the WHO (2020).

Concerning COVID-19, 36% of respondents claimed it had affected their utilisation and thus the daily intake of food. However, the change in consumption was not related to lack of food types, but more related to other factors like stress, boredom and illness. For many, being at home all the time meant they were moving less, but eating the same, which made them gain weight. The following respondent claimed: "due to stress, caused by being stuck at home, I started eating uncontrollably, so that I usually regretted it the next day and wanted to do something about my health (R49)". Where some were eating more, few were eating less. Due to contracting COVID-19, one respondent said: "My consumption has dropped dramatically

after I got Covid-19. Fasting is my way of proving that the human body can survive without all those poisoned products we threw into our bodies (R40)". Some showed no changes in their eating patterns, and found their way around boredom. "Everything has remained unchanged for me. I have not eaten more nor less. I started growing and devoted time to my hobbies. So, I wasn't bored and I didn't consume more or less (R42)".

6.3 The influence of COVID-19 on the use of subsistence agriculture

Smallholder or subsistence farming systems with a strong focus on self-sufficiency and little reliance on external inputs were less impacted during the pandemic and showed greater adaptive capacity than medium and small entrepreneurial farming systems that rely on agriculture as their primary source of income, according to a study conducted in Mexico and Central America by Lopez-Ridaura et al., (2021). The respondents of the survey in Curaçao were asked about their production, and whether or not COVID-19 affected it. According to the survey data, 56% of all respondents claimed to have been producing more food at home since the outbreak of the pandemic. One of the respondents said: "I used to plant mainly bananas. I added papaya, spinach, peppers, okra, herbs, melon, pineapple, soursop, golden apple and lime (R11)." Another respondent said "normally I was only growing herbs and on a small scale. Since the first lockdown I have bananas, cassava, tomatoes paprikas etc and took the gardening a bit more seriously (R14)."

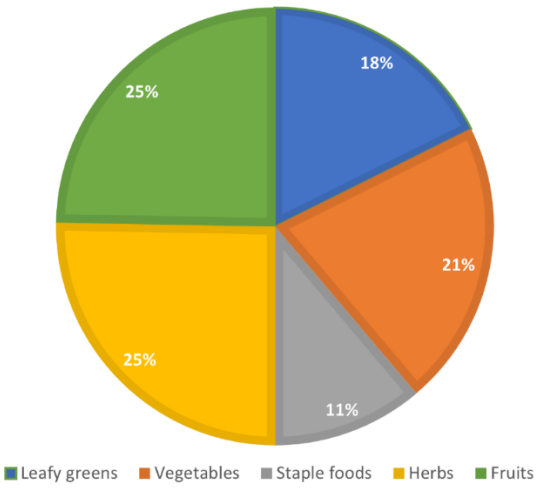

Figure 6.11: Distribution of food produced by practitioners of subsistence agriculture (N=61)

39% claimed they did not change the intensity of their production. Figure 6.11 shows the distribution of what foods practitioners generally grow. They were given five options and could tick all that applied. The figure shows that fruits and herbs were the food type grown most. Herbs can be easily grown in small pots and do not require a garden, but can also be grown indoors (Saisupriya & Saidaiah, 2021). Fruits usually grow in trees, as the fruit harvest in Curaçao usually consists of papayas, bananas and coconuts. Staple foods make up only a small share of subsistence agriculture in Curaçao. These usually consist of potatoes, cassava and corn. According to the WHO (2020) there is a prevalence of starchy foods like these staples available in the food chains at usually a very low price. This could explain why people do not tend to grow them themselves, because they can acquire them at markets and supermarkets for a lot less money, and a lot less effort. Also, not all starchy foods are grown in garden, but might be things like bread or pasta.

When asked if the pandemic had changed the type of produce being planted, 38% agreed to having changed their scheme, whereas the rest, 62%, said they had not changed their planting scheme. "As I had time, I started experimenting with pak choy, kouseband, kale and basil (R48)". Another respondent added vegetables to their planting scheme, saying: "I have more fruit usually. In the pandemic I started planting vegetables like tomatoes, bell peppers, parsley, sweet potato, corn, garlic, leak and Brussel sprouts (R39)." One of the respondents reacted to the pandemic by planting more perennial food goods, instead of seasonal or annual produce. Perennial food goods are foods that grow for multiple years, making it more sustainable and creating higher yields in the long-run.

As the survey data shows, generally there was an increase of vegetables, herbs and fruits. Due to the fact that people were staying home because of restrictions and safety, they seemed to have more time to plant vegetables, fruits and herbs to increase their food stocks. Nevertheless, it was not a necessity to all to plant more or diversify planting, as for some it remained a hobby.

6.4 The influence of subsistence agriculture on Food and Nutrition Security

Subsistence farmers produce enough food to support themselves and their families with little or no further output (Bisht et a., 2014). In order to map subsistence agricultural geographies in Curaçao, the practitioners were asked where their subsistence production yields went towards. Figure 6.12 shows the distribution of food by respondent. The majority of food is for own consumption. In line with empirical findings on subsistence agriculture, food is also shared with household members and family members (Bisht et al., 2014). However, many people also give produce to neighbours and some even give it to colleagues and acquaintances. Moreover, some even sell their surpluses to minimarkets, farmers markets, restaurants, and one respondent sold their produce to family. According to De Janvry and Sadoulet (2011), successful productivity gains in subsistence farming can pave the road for future entry into commercial farming for smallholders with sufficient productive assets and access to efficient markets. This process begins with the sale of a marketed surplus of food and can advance to the production of more lucrative food or non-food high-value cash crops based on competitive advantage. This can also be because of the fact that food supplies are satisfied at home, and the yield of subsistence agriculture to some is seen more as a bonus than a necessity.

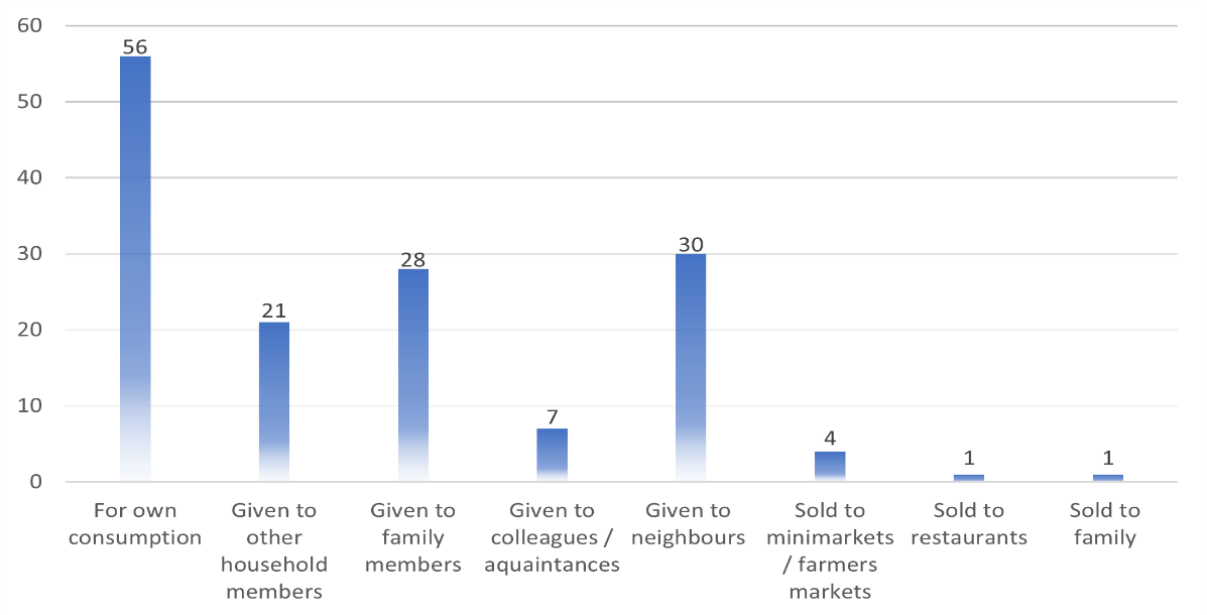

Figure 6.12: Distribution of homegrown food produce of practitioners (N=61)

Figure 6.13 shows what percentage subsistence agriculture makes up of the total consumption of the practitioners of subsistence agriculture. According to findings, about half of all respondents claimed subsistence agriculture had a rather small contribution to total consumption, with most contributions ranging from 1 – 10%. This is in line with Ambagna et al., (2012) who did statistical analyses on variables testing the impact of subsistence agriculture on Food and Nutrition Security. They found a positive although small correlation and results showed long-run elasticity of food availability compared to the subsistence farming production index.

Traditional subsistence agriculture thus appears to be relatively robust, with the ability to contribute to key aspects of food security, such as access and stability, but low productivity restricts its contributions to food availability (Adhikari et al., 2021). According to data collected by Ambagna et al., developing subsistence agriculture is the most effective way for developing countries to assure food security (2012). 51% of the respondents claimed subsistence agriculture increased their *availability* of food goods, meaning due to subsistence agriculture, more food was available to them. For the rest, nothing had changed.

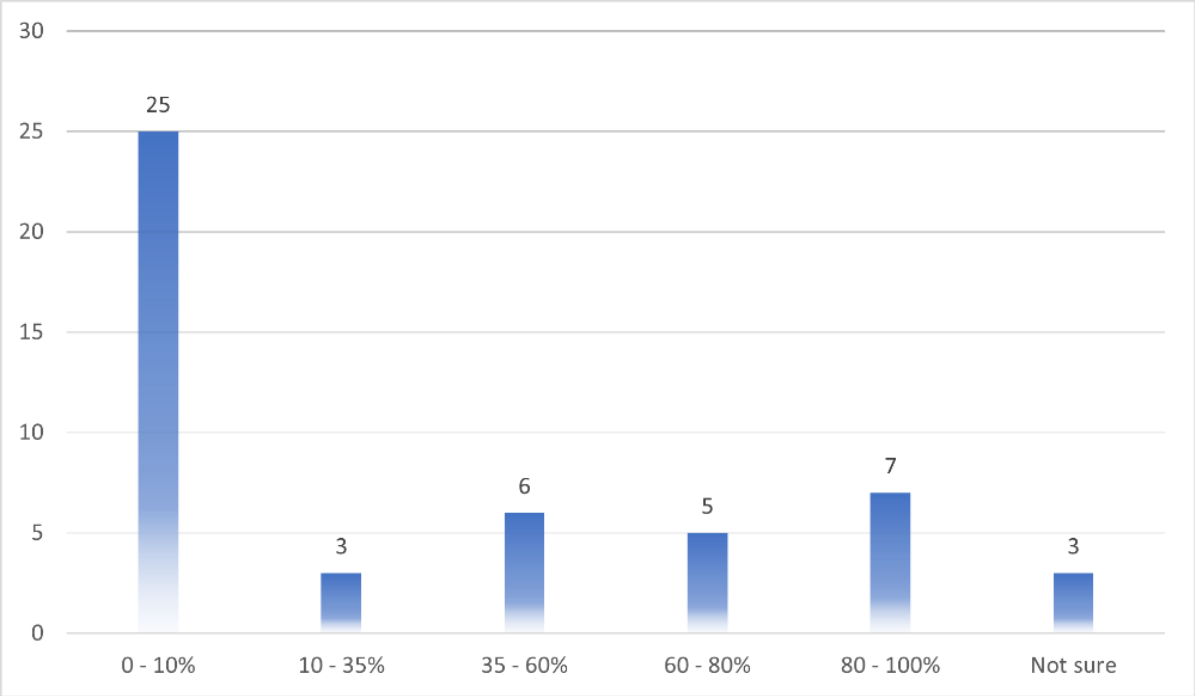

Figure 6.13: Percentage of subsistence agriculture of total consumption

Concerning stability, 34% of all respondents said subsistence agriculture had increased the stability of their food goods. People who felt an increase, said it had to do mainly with the fact that growing their own herbs, vegetables and fruits gave them a steadier flow of food goods. "Because I started growing my own fruit and vegetables before the Covid-19 outbreak, I was able to take advantage of fresh food during the pandemic (R42)", said one respondent. The remaining 66% felt no increase or decrease in stability in food goods. "Whilst the supply increased there is no daily yield yet that I can sustain myself from. I'm still heavily dependent on supermarkets (R6)", said another respondent.

Regarding accessibility, the third pillar of Food and Nutrition Security, 30% felt subsistence agriculture increased their accessibility to food goods. Due to the fact that food was now grown in the vicinity, but mostly because financial barriers were lifted as people could grow produce at home for a lower price. These findings are not in line with the findings of Adhikari et al., (2021) as contributions of subsistence agriculture are greater regarding availability of food commodities (Adhikari et al., 2021) which seems to be the opposite, as according to the practitioners in this thesis research. It is important to note, that the research population is rather small and bias could give a false image, so generalisations cannot be drawn.

Agency, which is not discussed by Adhikari et al. (2021), is also positively impacted by subsistence agriculture. Roughly 40% of all respondents saw an increase of their personal

agency, meaning they felt their influence over personal circumstances and ability to give input was increased due to subsistence agriculture. The rest noticed no change.

Utilisation, the fifth pillar of Food and Nutrition Security in this research framework, was impacted by subsistence agriculture. 56% of respondents said subsistence agriculture influenced their daily diet, and the intake of different food groups. "More vegetables, mainly legumes. Far less to no starchy food (R9)", said one respondent, another said: "I have started to eat more beans, fruits and vegetables and less meat (R11)." This is partly in line with findings of Rankoana (2017), who concluded that crops grown in household gardens mainly provide grains, vegetables and legumes. When we go back to Figure 6.11, the production of subsistence agriculture is visualised and shows that vegetables and fruits comprise the majority of yields. Staple foods (starchy foods) like legumes, are not as prevalent in production of practitioners in Curaçao, which once again is no surprise, as starchy foods can often be processed foods like pasta, rice or bread.

According to Rankoana (2017), these foods, besides having availability and accessibility benefits, also have utilisation benefits, in the sense that they have health potential. They are nutritious foods and are essential for human health (Rankoana, 2017). A bit less than half of the practitioners said to consume (utilise) more nutritious foods since practicing subsistence agriculture. Although there is a difference in respondents and how they consume, these tendencies bring to light how subsistence agriculture is influencing awareness of nutritious and healthy consumption for some respondents, and shows potential for tackling challenges that Curaçao is facing.

> I realized the fruits and vegetables had more flavour and felt healthier. I used to eat vegetables from the supermarket, but it still felt like I wasn't getting enough vitamins. This changed after I started eating my homegrown fruits and vegetables (R42).

"I have confirmed that our bodies need no more than what grows in the garden (R40)", said another respondent. Another respondent claimed to "grow varied and eat balanced (R49)", because of subsistence agriculture. However, the remainder of the respondents saw no change in nutritious intake of foods.

6.5 Subsistence agriculture: untapped potential

Through the work of the DET, using the donut model, there is a growing recognition in Curaçao that further 'development' should be pursued without crossing environmental borders (MEO, 2021). Current Food and Nutrition Security must be secured without harming Food and Nutrition Security for future generations (Clapp et al., 2021), however most indicators and social foundations that make up the donut of Curaçao show reasons for concern as there is a negative effect on the climate (MEO, 2021) According to the academic literature, subsistence agriculture has proven to be a resilient way during shocks to safeguard Food and Nutrition Security (Rankoana, 2017; Adhikari, 2021). Findings in previous chapters have also indicated how, and to what extent, subsistence agriculture has improved Food and Nutrition Security. To capture people's own perspective on how to battle challenges regarding Food and Nutrition Security, respondents were asked questions on potential paths of action and ideas to improve their Food and Nutrition Security, as an answer to sub question 4.

6.5.1 Increased local production

Principally, increasing local production was seen as the main "path forward" in securing future Food and Nutrition Security challenges. The MEO (2021) said that more local production through subsistence agriculture can increase self-sufficiency, whilst reducing imports. Respondent 11 said: "the more people plant (small) amounts of food in their garden, the more food there will be available in a continuous way". Another respondent added "we should be satisfied with what we are capable of growing ourselves, just like the old days. Back then people ate food they produced themselves five days a week, and meat and imported chicken were just for the weekend (R40).

Increased production must have a market for retail. One of the respondents stated that markets should not only be open on weekends, but also on a few days during the week "as food can be bought on multiple days of the week, so it does not rot, and multiple varieties can be sold (R42)". One respondent made a striking remark about local production, saying: "I think I have become more self-aware that we have part of the solution in our own hands (R11).

6.5.2 More variety

Respondent 1 mentioned stopping imports from the United States, but did not offer an alternative. As one respondent said "Curaçao is mainly dependent on import, so that's beyond my control (R9)", implying that improving Food and Nutrition Security was something out of their control. Essentially, more varieties grown on the island, have the ability to replace imports from other countries. As two respondents proposed "more varieties should be planted (R37)" and "we should produce other produce and have livestock (R59)".

6.5.3. Education

Increasing varieties and production is easier said than done. Without adequate knowledge of agriculture, efficiency can be low. There are multiple respondents that mentioned education as a way forward in battling future challenges. "We need to get more and better information on how to do this at a cost effective way. Just watching YouTube is not always feasible to do in Curaçao (R5)", said one respondent, "if I would get more information and training on farming, that would be helpful (R14)".

One respondent took matters in their own hands and came up with a Facebook page called "Gardening in Curaçao" where locals can share, give advice, buy/sell each other's products etcetera with the mere objective to get them to come to action and produce their own food (R9). Another respondent said: "We have to support each other in growing. There used to be agricultural areas that grew mango and corn. My soil is more suitable for growing pomegranate for instance. Maybe areas should be analysed to see what type of cultivation suits these areas best, to increase production and sharing it with each other (R40)."

Although many have good ideas for the future and the shared notion is generally that the solution is in their own hands, some feel like they do not have enough agency over decision-making to implement such ideas. According to some, the government must intervene, with subsidies and training. In the light of the Donut Economy report, the participants of the workshops expressed similar ideas to the respondents, as they saw education, cooperation, sustainability and employment as the guiding solutions (MEO, 2021). Respondent 12 remarked "the government must provide subsidies to local farmers to make it more sustainable for local agriculture to expand in other areas on the island. For example, during the pandemic there was a scarcity of limes from the US and had to be imported from Colombia, which became quite expensive. Limes can easily be grown locally and perhaps even exported to other

countries (R12)". To improve local production, subsidies on water are necessary. Respondent 20 said: "Cheap irrigation water is necessary maybe all year through, for larger production (R20)", as it is currently very expensive. Water scarcity is a big problem on the island as there are little to no aquifers (Mekonnen et al., 2015). Tourism takes up most of the drinking water, which puts a great strain on water supplies. The prices are so high that owning an agricultural business is barely profitable (Hendriksen, 2000) which calls for rapid action from the government.

6.6 Conclusion

Data on scores prior to and since the pandemic showed COVID-19 had an influence on availability, as stocks depleted due to panic buying and import increased food prices. Stability decreased due to a lack of stable flows of food and access to it, which mainly had to do with fluctuating prices, and is thus linked to the concept of accessibility, which worsened due to a loss of purchasing power, through job loss and inflation. Statistical calculations on scoring on these three pillars showed a significant effect of COVID-19, although it remained rather small. The division of respondents regarding economic status is illustrated in the divergent findings. Agency was less affected by COVID-19 according to statistical testing. However, according to qualitative data findings, agency over factors like supermarkets, local politicians and the food chain exacerbated due to COVID-19, despite initiatives and government trainings. Agency over local farmers and personal production actually increased positively, as increase in price forced practitioners to turn to local and personal supply. As for utilisation, about a third of respondents said COVID-19 affected their diet. Although malnutrition and undernourishment is still a big problem in Curaçao, respondents claimed to eat mostly fruits and vegetables. As food stocks were low and prices were high during COVID-19, the practice of subsistence agriculture also changed. More than half of respondents claimed to produce more because of COVID-19, as it has proven to be a potential resilient response in times of food shocks. Subsistence agriculture has certain health potential, when nutritious crops are utilised. Regarding its influence on Food and Nutrition Security, availability and utilisation can be seen to be most positively affected. Agency, accessibility and stability in food commodities also increased among practitioners of subsistence agriculture. Still, the contribution of subsistence agriculture to the diet remained low, with the majority of the respondents getting only 1 – 10% of daily intake from their subsistence gardening. As discussed in the previous chapter, due to the fact that the research sample is rather small, and some groups seem overrepresented, these findings must not be generalized, but viewed with a certain bias towards specific economic groups.

In an endeavour to safeguard future Food and Nutrition Security in Curaçao, subsistence agriculture has untapped potential. These findings reveal some interesting ideas for further action, especially in the light of the recently published report on the Donut Economy. Reports by experts highlight their currents concerns and make a collective call for action. The main objective among respondents is the expansion of local production through sole subsistence agriculture. A market for the retail of surplus can potentially decrease import, but varieties in produce must increase. What is still lacking is education, as people are not educated properly on agricultural practice. There are small-scale initiatives to educate the community, but this is not enough. Although there have already been workshops facilitated by the government, they need to expand their education programme and people should be consulted for input and increased agency over decision-making. Furthermore, respondents feel like subsidies must be given. Not only to larger scale farmers on the island, but also to people growing on a smaller scale. Water is currently too expensive for people to properly irrigate. The next chapter contains the conclusion to this thesis.

7. Conclusion

7.1 Introduction

Based on the analysis presented in the previous chapters, this final chapter first synthesizes the main findings and answers the research question "What is the potential of subsistence agriculture in addressing current and future Food and Nutrition Security during COVID-19 for the practitioners of subsistence agriculture in Curaçao?" (Section 7.2). Chapter 7.3 presents a reflection on the theories and concepts presented in Chapter 2. Lastly, recommendations for future research (7.4) and policy recommendations (7.5) are provided based on the findings of this thesis.

7.2 A synthesis of research findings

Sub-question 1 is: *What are the characteristics and motives of the practitioners of subsistence agriculture in Curaçao?* The answer to this question is based on survey results, which were compared with academic literature findings. The majority of the respondents to my survey are rather affluent according to the disposable income they possess. The majority is female. Although less affluent practitioners might have been excluded from the research (as discussed in the limitations of the sample) findings show that subsistence agriculture in Curaçao is a practice for different economic groups, not solely for people trying to support their livelihood through it. As subsistence agriculture is a gradient concept with different outputs of scale and intensity, it can be seen as a versatile practice. For some it is seen as a way to strengthen food and nutrition security, whereas for some it is more of a hobby. This relates to the scale of practice. The element of space influences the scale and intensity of practice of subsistence agriculture, which is related to affluence of a practitioner as people that are less affluent will have less space to perform subsistence agriculture. The full and diverse population of Curaçao is not represented among the survey respondents, as was discussed in this thesis. As a result, these findings cannot be applied to the entire population, but can still give other interesting insights.

Sub-question 2 is: How has COVID-19 affected Food and Nutrition Security and the use of subsistence agriculture for the practitioners of subsistence agriculture in Curaçao? Based on the collected data, it can be concluded that there was a measurable effect of COVID-19 on Food and Nutrition security. However, the effect of COVID-19 and the ensuing lockdowns on household food security did not seem to be that significant among these respondents. The decline in food availability was related to the fact that people were panic buying, as opposed to there not being enough food available in Curaçao. Due to prices rising, food was not available to some in the sense that they could not afford it, which links more to accessibility than availability. The findings show a division between those who are still able to afford the commodities and those who did not. Stability also declined due to COVID-19, findings showed, as the flow of food commodities became unstable for about half of all respondents. However, the impact of the pandemic on stability may not actually have been so large, as respondents claimed that food chains were already unstable, prior to the pandemic, due to the lack of organisational skills by the government and involved actors. Accessibility to food commodities also changed slightly since the pandemic broke out, according to findings. As discussed before, COVID-19 lead to prices rising (inflation). For most practitioners that was not a problem, due to the fact that they had a steady job and an adequate disposable income, but some lost their job and thus lost their means to acquire food commodities. Still, accessibility remained quite high, with an overall low percentage of respondents that experienced problems.

Generally, low and middle-income communities suffer from loss of purchasing power during crises, but the demographics of the respondents do not reflect a low-income group.

Although agency was statistically affected least of all pillars, there were still interesting implications of findings from respondents on how they experience their agency over multiple factors since COVID-19 broke out. Despite the fact that agency over different factors was already relatively low pre pandemic, agency seemed to decrease further on large scale institutions and factors like politicians, supermarkets and food chains, due to the fact that respondents felt they could not discuss issues they were experiencing and could not influence policy and action, regarding jeopardised food security. This lead to respondents having to rely more on themselves, and their own production of food goods, or the production of local farmers, as then they felt they did exert some influence. The influence on utilisation also remained rather low. Although about a third felt their diet and utilisation of food commodities was influenced by the pandemic, it evolved mainly around boredom eating. Some even said it influenced how they thought about food intake and how they saw they could survive with less than they usually consumed. However, the general consumption patterns of the respondents do not reflect that of a low or middle-income country, therefore it is hard to generalize that COVID-19 has had a small effect on utilisation.

The pandemic did have an interesting effect on the use of subsistence agriculture, according to various findings, but not a negative effect in general. For some practitioners, subsistence agriculture was used as a resilient way to bear the burden of depleting stocks. The personal production of food commodities is less impacted, as there are no external agency factors that exert a certain influence over it, but the practitioner can decide what to plant. COVID-19 intensified personal production, and for some resulted in diversification of produce, to provide more varied types of food commodities. Still, half of all respondents did not make major changes to planting schemes or sorts, as they held their garden merely as a hobby than as a as a prime source of food for themselves and their families.

The 3rd sub-question is: How has subsistence agriculture influenced current Food and Nutrition Security for the practitioners of subsistence agriculture in Curaçao? As subsistence agriculture promotes the production of healthy food commodities like fruits, vegetables and natural starches, it provides certain health benefits to its practitioners and it also provides, or has the potential to provide, larger quantities of food commodities in a stable manner. However, the contribution of subsistence agriculture in Curaçao currently remains low; subsistence agriculture only accounts for about 10% of consumption for the practitioners. This is because productivity is relatively poor, in relation to the quantities required for a person to be food and nutrition secure. The influence on accessibility is relatively low, due to the fact that financial constraints seemed to not be as prevalent among respondents as one would expect from Curaçao in general, being a rather poor country. Nevertheless, agency did increase. As discussed in the previous paragraph, lack of interference over personal production is one of the reasons that practitioners felt their agency improved. All in all, the practice of subsistence agriculture among respondents has mainly influenced the element of utilisation, as it has created awareness about nutritious, healthy foods which shows promising signs for the future. It is important to note that subsistence agriculture remains a gradient concept which has a diverse scales of practice and is therefore a rather grassrooted concept.

The future potential of subsistence agriculture is discussed in sub-question 4: What is the potential of subsistence agriculture in addressing future Food and Nutrition Security challenges as perceived by the practitioners of subsistence agriculture in Curaçao? As practitioners are gardening on small plots and only using half of all land available to them, there is untapped potential for the practitioners to obtain more from subsistence agriculture, in the sense of scale. However, the tourism industry plays a big role in Curaçao and overshadows important industries like agriculture. Furthermore, the built environment leaves little room for agriculture. Open areas are usually on the outskirts of the island, which are generally sparsely populated. There lies potential in these areas, but soil quality and accessibility is generally poor and this can impede the practice of subsistence agriculture. For the future of Food and Nutrition Security of the people of Curaçao, the prime objective of practitioners must be to increase local productivity by practicing subsistence agriculture. A surplus retail market might potentially reduce imports, but crop variety must expand to replace imports further.

Education has been partly effective, as few people are properly informed on agricultural practices. There are some small-scale community education projects, but they are few and far between. Although the government has already hosted seminars and workshops, they need to broaden their educational program and individuals should be consulted on their needs. According to practitioners, subsidies must be provided not only to the island's bigger scale farmers, but also to those who grow on a lesser scale like subsistence agriculture. Water is currently too expensive for people to irrigate correctly, preventing them from reaping the benefits that subsistence agriculture can have. In a push for development without crossing environmental borders, like a donut economy, subsistence agriculture might be a sustainable path as it has shown to be resilient during times of shocks, however more research must be done on how it directly affects sustainability. Subsistence agriculture could (and should) be a way of safeguarding future generations from increasing challenges that Curaçao will face regarding Food and Nutrition Security.

To conclude with an answer to the main question, there certainly is a contribution of subsistence agriculture towards the Food and Nutrition Security of its practitioners, although it is currently low. Better implementation of current policies but also new policies can unleash the potential that subsistence agriculture has, leading towards a more sustainable and prosperous Curaçao. Numerous ideas initiated by the Curaçaoan government could help boost resilience, however their execution appears to be lacking. Reforms to Curaçao's structural framework are required to increase the population's resistance to future shocks. COVID-19 has affected Food and Nutrition Security and has revealed the fragility of Curaçao's food chains. This research has added, albeit to a limited extent, to filling a knowledge gap on the influence of subsistence agriculture on Food and Nutrition Security. Recommendations for further research are elaborated on below.

7.3 Theoretical reflection

Academic research from Béné et al (2021) and CARICOM (2020) painted a rather grim picture of how COVID-19 influenced Food and Nutrition Security, both worldwide but also locally in Curaçao. In Curaçao, one out of 10 people even claimed to have no food at all, to provide for themselves (CARICOM, 2020). According to the four pillars that they used in their research, *accessibility* was affected most. This was mainly due to the fact that people were losing purchasing power, making it difficult to acquire the right food commodities, as inflation increased the prices of commodities and other imports (Béné et al., 2021). Poor people frequently have physically demanding jobs, which make it difficult or occasionally impossible

to continue working during lockdowns (O'Hara & Toussaint, 2020). Due to the fact that middle- and high-income households have more resources to fall back on, such as assets, savings, and human capital, they are typically more shock-resistant. The case in Curaçao seems to fit the assumptions outlined in the literature: as was determined in the previous subchapter, accessibility was impacted the most because the primary arguments were on the loss of financial entitlement. This is a result of both the declining income and the growing cost of food in Curaçao. Still the survey findings did not paint an equally grim picture. As the findings reflected mainly on more affluent middle-income practitioners, the impact of COVID-19 appeared smaller, as they generally did not have problems in providing for themselves.

Regarding a literature reflection on subsistence agriculture and the potential it offers there are also interesting similarities. According to the literature by Bisht et al (2014) subsistence agriculture is a way of providing food commodities for oneself and family. However, the contribution to Food and Nutrition Security is limited (Adhikari et al., 2021). Contributions are mainly towards availability, which generally aligns with the survey findings. The resilience potential that Adhikari et al (2021) discuss, is a bit more ambitious than findings show. However, research findings show that (contrary to literature research), subsistence agriculture shows potential in creating awareness about healthy and nutritious utilisation of food commodities, which is important in a country like Curaçao that is facing health challenges.

Reflecting on the conceptual model that was formulated in the theoretical framework, there are certain observations to be made on it with the research findings. The revised conceptual model in Figure 7.1 shows the outcomes and effects of the two main concepts, which displays what can be improved in current policy or research. This will be discussed in the following subchapters.

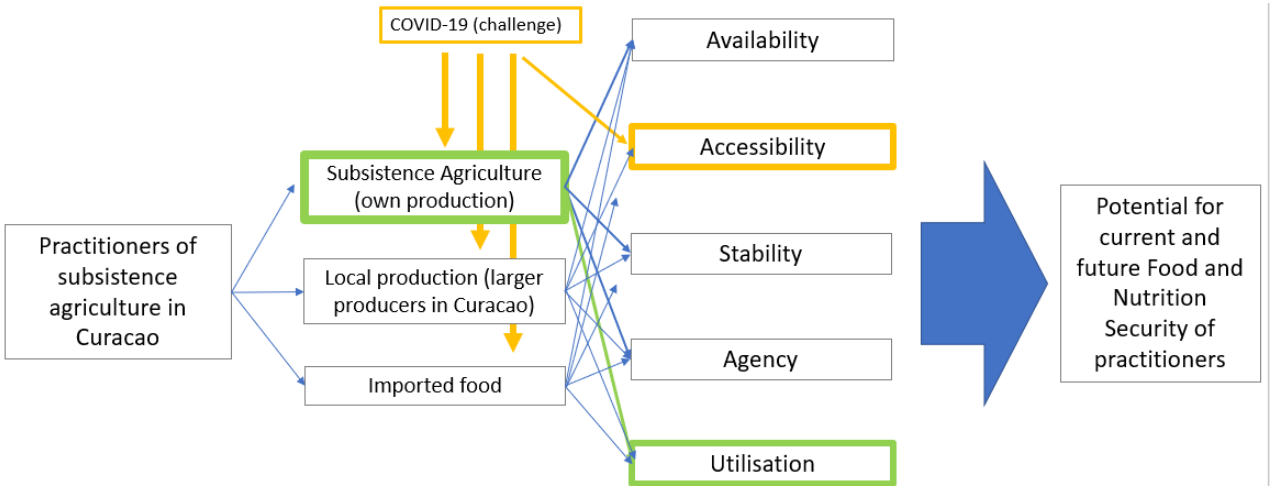

FIGURE 7.1: REVIEWED CONCEPTUAL MODEL

7.4 Recommendations for future research

Firstly, I recommend a more elaborate research regarding the practitioners, and how subsistence agriculture has impacted their Food and Nutrition Security. As discussed in previous chapters, the respondents of this survey were not a proper representation of the Curaçao population. Considering that Curaçao is most likely going to be dealing with more shocks or disasters in the coming years, research on how to protect the less fortunate against these shocks is necessary. In the light of these potential shocks and the Donut Economy Taskforce report (MEO, 2021), researching the impact of current food chains on the environment would

be an interesting way to evaluate the sustainability side of food consumption and production. Sustainability, the sixth pillar of Food and Nutrition Security, was disregarded in this thesis. Initially there was a second survey in place, to measure input and output of different types of agriculture on Curaçao. However, sustainability has many elements to be measured. As discussed in the theoretical framework, there are economic, social and physical variables, which were too elaborate to research and survey among farmers, during the time I had for the fieldwork. There was already some data gathered which is now carried over to the ZonMW group, so they can further research it.

Regarding utilisation of food commodities, more research could add more insights. Utilisation is a complicated concept, as there is more to utilisation than consumption. In this research consumption of quantities and quality food was measured, but in further research it would be interesting to research social utilisation, which looks more towards the way in which food is consumed, and also towards food safety, which focuses on preparation of food and if food is safe for consumption. This, though, might require a rather elaborate research approach.

7.5 Policy recommendations

In the five-year report by the Ministry of Health and Environment (Ministerie van Gezondheid, Milieu en Natuur, 2017), the emphasis is primarily on changing dietary patterns and reducing poverty through horticultural cultivation, mainly through providing knowledge on kitchen cultivation and nutrition. Research shows however that in times of shock still many suffer and are not food secure. I recommend the government of Curaçao to build more policy towards the poor and vulnerable in protecting them against shocks like COVID-19, but also other environmental shocks. Furthermore, I recommend that the current initiatives and communities that are in place to provide a sustainable solution towards Food and Nutrition Security, like subsistence agriculture in all its forms, are strengthened.

Even though we are living in 2022, it looks as though these policies have not been well executed and public health has declined. The government should enter into a more meaningful dialogue with locals, initiatives and other stakeholders, which will at the same time increase a sense of agency for people involved and give them a voice, and also give them a chance and space to develop themselves independently.

More focus towards the potential of agriculture within Curaçao can create more of a balance between tourism and agriculture, whilst at the same time decreasing food imports and boosting local Food and Nutrition Security. Finally I suggest that Curaçao's government publish policy documents to the general public for increased transparency on planning and execution. This can eliminate implementation issues and backlash. Regarding the revised conceptual model, these policies can contribute to the strengthening of the weaker pillars of Food and Nutrition Security.

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Appendix

Appendix 9.1. Operationalisation table

Concept	Dimension	Variable	Question
The practitioners of subsistence agriculture	The characteristics of the practitioners of subsistence agriculture in Curaçao	General demographics	- Age - Sex - Place of habitation - Employment & disposable income
Subsistence agriculture	The motives for subsistence agriculture for the practitioners of subsistence agriculture in Curaçao	Motives Agricultural information COVID-19	- Acreage - Irrigation - Productivity - Longevity - Motives - Influence of COVID-19 - Influence on health / dual burden challenge
Food and Nutrition Security	Effect of COVID-19 and Subsitence agriculture on Food and Nutrition Security	Accessibility COVID-19 Subsistence agriculture	- Capability of accessing the right food goods - The influence of COVID-19 on your personal accessibility to food goods prior to and since COVID-19 - How has the accessibility of food goods changed prior to and since practising subsistence agriculture
		Availability COVID-19 Subsistence agriculture	- Where was food available mainly before using the UFF's - Supermarket or self-growing - What type of food was available - What is the influence of COVID-19 on your personal availability pre and post COVID-19 - How has the availability of food goods changed prior to and since practising subsistence agriculture
		Stability COVID-19 Subsistence agriculture	- Effect of fluctuating food prices on personal stability - The influence of COVID-19 on your personal accessibility to food goods prior to and since COVID-19

			- How has the stability of food goods changed prior to and since practising subsistence agriculture
		Agency COVID-19 Subsistence agriculture	- Influence of practitioners on local food systems (agency) - The influence of COVID-19 on your personal agency to food goods prior to and since COVID-19 - - The personal agency before and after practicing subsistence agriculture
		Utilisation COVID-19 Knowledge Nutrition Subsistence agriculture	- Influence of COVID-19 on personal utilisation prior to and since COVID-19 (meals / hunger / daily intake) - Consumption of fast-food - Where is knowledge on nutrition gathered from - Intake of food groups (nutrition) - How has the utilisation of food goods changed prior to and since practising subsistence agriculture

Appendix 9.2: Survey Food and Nutrition Security Curaçao Practitioners research

Thank you for participating in this research. This research is a collaboration between the University of Amsterdam and the University of Curaçao. Locally, but also worldwide, we see crises arising around food availability and sustainability, such as COVID-19, fluctuating prices and climate change. This research will focus on subsistence agriculture (i.e. producing on your own for consumption) as a way to improve Food and Nutrition Security of Curaçao since the outbreak of the COVID-19 pandemic. We intend to generate valuable data on (1) the impact COVID-19 has had on our food security; (2) some technical and production parameters to compare growers and production methods with each other. We like to emphasise that this survey is completely anonymous, and the data that it generates will serve only scientific, educational and policy development.

May you have any questions regarding this survey or the whole research, my contact information is:
Sophie Mossman
sophie.mossman@student.uva.nl

Food and Nutrition Security is, according to the FAO (Food and Agriculture Organisation), when all individuals have reliable access to sufficient quantities of affordable, nutritious food to lead a healthy life.
This research focuses on 5 of the 6 dimensions of Food and Nutrition Security, namely:

- Availability: is there enough food available?
- Stability: is there regularity in food availability?
- Accessibility: is food physically and financially accessible?
- Agency: do you have influence over your own circumstances and are you able to have input in decision-making?
- Utilisation: how is food consumed by you in relation to nutrition and quantity?
-

Through different questions, some yes/no, some open, I will try and get a view of how you have been using subsistence agriculture as a way of improving Food and Nutrition Security for yourself. In times of COVID-19 where self-sufficiency has decreased, this is important to know in order to understand if and how your agriculture can strengthen Food and Nutrition Security.

Demographics. These questions will give us an idea what the demographics and motives are of the users of subsistence agriculture.	**1.** What is your nationality? (dual nationality also applicable) …… What is your age? (Check what applies to you) 0 18-22 0 23-35 0 35-45 0 45-65 0 65+ What part of Curaçao are you currently living? …… What is your sex? 0 Male 0 Female 0 Other Are you currently employed? 0 Yes

	0 No What is your disposable income in NAF per month? 0 <1000 per month 0 1000-2000 per month 0 2000-3000 per month 0 3000-5000 per month 0 5000-7000 per month 0 More than 7000 per month 0 Do not want to share
Self-sufficiency and agriculture.	In this section we like to ask you specifics about your planting situation. By collecting this information, we can make valuable recommendations to policy and organisations on how to increase our island-wide food security. Even if you are a very small grower, or hobbyist, this information is still important: we believe that a substantial production can be achieved by the individual plant lover. What type of food production are you currently engaged in (check what applies to you): 0 planting vegetables and herbs in pots 0 planting vegetables and herbs in the garden soil 0 planting fruit trees in the garden 0 aquaponics 0 hydroponics 0 food forest 0 greenhouse 0 other, namely…….. How long have you been planting for, in years? …… What are your motives for producing your own food? Please name as much reasons as possible in order of importance: …… …… What is the acreage of your allotment? In m2. …… How much of your allotment is cultivated? In m2. This question is asked to measure productivity per allotment. …… How do you irrigate your allotment? (Check all that apply to you) 0 A well with pump and drip/hose 0 A well with baki and wind mill 0 AVB water truck regular delivering 0 Aqualectra 0 Rain-fed irrigation 0 Water retention techniques (cacti, mulch, dense planting)

	0 Other, namely……. Do you have water retention systems? Check which ones apply to you. 0 No, I don't have a water retention system 0 Yes, I have a roofgutter with …… meter retention capacity 0 Water Tank ……. (fill in m3 of retention capacity) 0 Other, namely …….. Where do you get most of your information from concerning subsistence farming? 0 Internet 0 Courses 0 Through family and friends 0 Other, namely……. What type of produce have you been planting? And can you indicate how much you yield on average per month? This question serves to extract average yield numbers of different products under different planting techniques (Check all that apply and fill in the amount in kg, estimation also sufficient). 0 Leafy greens (cabbage, salad, etc.) ....kg per month 0 Vegetables (tomatoes, paprika, etc.) ….kg per month 0 Staple foods (potatoes, cassava, maishi, etc.) ….kg per month 0 Herbs (parsley, mint, etc.) …. kg per month 0 Fruits …. kg per month How has this changed during the COVID-19 pandemic? Have you been planting more, less or the same?: 0 More 0 Same 0 Less Has the type of produce you plant changed since the outbreak of the COVID-19 pandemic? 0 Yes 0 No Please elaborate on question 17. What changes were made to the planting scheme regarding types of produce? (increase / decrease in: leafy greens, vegetables, staple foods, herbs, fruit) …… …… …… …… What's the destination of your own produce? Can you give percentages of where the produce ends up? 0 Own consumption …..% 0 To other members of my household …% 0 Given to other family members …% 0 Given to neighbours …% 0 Given otherwise…. (please specify) …% 0 Sold to neighbours/family …% 0 sold to minimarket …% 0 sold to supermarket ….%

	0 sold otherwise….. (please specify) …% What share or portion does your own planting have in your personal average consumption? (an estimation in % is sufficient) ……
Availability	This section is about the availability of food. Availability of food is about whether there is any food available in the place where you are living. In other words, is there enough production or import of food so that it is available to you? Where is your daily food available normally? (i.e. supermarkets, markets, neighbours, subsistence agriculture, etc.). More options possible. 0 Supermarkets 0 Markets 0 Neighbours 0 Sustaining agriculture 0 Other, namely …… Can you give an average break-down of your regular weekly shopping? (i.e. what does your regular shopping cart look like?) Fill in the amount in kg per food type. 1. Fruits & vegetables: …kg 2. Starchy food (pasta, cassava, bread, etc) …kg 3. Dairy (milk, yoghurt, cheese, etc.): …kg 4. Proteins (meat, fish, beans, eggs, pulses) …kg 5. Fats (oils, nuts, saturated fats like chips etc.) …kg Has the fluctuation of food prices due to COVID-19 influenced your availability of food goods? 0 Yes 0 No Please elaborate on question 23. How has it influenced your availability of different food types? If the previous question is answered with “no”, please leave blank. These statements below are about the availability to food goods before and since the COVID-19 pandemic. 1 is low availability, 10 is high availibilty. • Rating availability 1-10, how was the availability of food goods **prior** to COVID-19? (1 being low availability, 10 high availability). • Rating availability 1-10, how has availability of food goods been **since** COVID-19? (1 being low availability, 10 high availability). Please elaborate as much as possible on your answer for the previous statements (i.e. how was the availability of food before COVID-19, and how has that changed during and after?) …… …… Concerning subsistence agriculture, has growing your own produce increased your availability of food goods? 0 Yes, it has increased my availability 0 Neutral, nothing has changed

	0 No, it has decreased my availability Have you thought about ways in which your own availability of food goods in Curaçao can be increased? Please elaborate on potential actions. …….
Stability	Even if your current food intake is adequate, you are deemed food insecure if you have insufficient access to food on a regular basis, putting your nutritional status at danger. Therefore, stability of food flows is an important element of Food and Nutrition Security. Instability can be caused by the weather, changing incomes, or political and economic instability. The 2 statements below are about stable access to food goods prior to and during the COVID-19 pandemic. • Have you had times before the outbreak of COVID-19 when you did not have access to adequate and stable supplies of food? 0 Yes, always 0 Most of the time 0 Sometimes 0 Rarely 0 Never • Have there been times during the past 2 years (since COVID-19 broke out) when you did not have access to adequate and stable supplies of food? 0 Yes, always 0 Most of the time 0 Sometimes 0 Rarely 0 Never Please elaborate on your answer from question 29. For instance, why was there no access to adequate and stable amounts of food? (i.e. were certain products missing or product groups in whole) ……. These statements below are about the stability of food goods before and since the COVID-19 pandemic. 1 is low stability, 10 is high stability. • Rating stability of food good flows from 1-10, how was stability of food goods **prior** to COVID-19? (1 being unstable flow, 10 being very stable flow). • Rating stability of food goods flow 1-10, how is your stability of food goods **since** COVID-19?(1 being unstable flow, 10 being very stable flow). Please elaborate as much as possible on your answer for the previous statements (i.e. how was the stability of food goods before COVID-19, and how has that changed during and after?) ……. …….

	Has the fluctuating price of food goods influenced your stability when it comes to a stable access to food goods? 0 Yes 0 No, nothing changed Have you switched to another brand of different food goods because they were more affordable? 0 Yes 0 No Concerning subsistence agriculture, has growing your own produce increased your stability of food goods? 0 Yes, it has increased my stability 0 Neutral, nothing has changed 0 No, it has decreased my stability Please elaborate further on your answer from the previous question as much as possible, how has subsistence agriculture influenced your stability of food goods? …… …… Besides switching brands for instance, have you thought about ways in which your own stability of food goods in Curaçao can be increased? Please elaborate on potential actions. …… ……

Accessibility	Accessibility concerns the physical and economic capabilities to access food goods, like being able to get to a supermarket by car for instance, but also having the financial means to pay for food. The 2 statements below are about accessibility to the necessary food goods. • Do you consider yourself financially secure to provide yourself with the necessary food goods? 0 Yes, always 0 Most of the time 0 Sometimes 0 Rarely 0 Never • Do you consider yourself capable of accessing the necessary amounts of food goods? (to have the means of transport or the physical capabilities to access places where food goods are sold) 0 Yes, always 0 Most of the time 0 Sometimes 0 Rarely 0 Never

	These statements below are about the accessibility to food goods before and since the COVID-19 pandemic. 1 is low accessibility, 10 is high accessibility. • How was accessibility to food goods **prior** to becoming the outbreak of COVID-19? (1 being low accessibility, 10 high accessibility) • How has accessibility to food goods been **since** the COVID-19 pandemic? Please elaborate on your answer for question 39. ……. ……. Concerning subsistence agriculture, has growing your own produce increased your accessibility to food goods? 0 Yes, it has increased my accessibility 0 Neutral, nothing has changed 0 No, it has decreased my accessibility Have you thought about ways in which your own availability of food goods in Curaçao can be increased? Please elaborate on potential actions. ……. …….

Agency	Agency comprises the influence that individuals have over their own circumstances and provides meaningful input into decision making. For instance, can you influence what is sold in the supermarkets by telling the shops what you would like to buy. Another example is if you can influence local politics in the decision-making of the distribution of food goods. In other words, do you feel that you have influence on the type of food, the way it has been produced, distributed, sold, and against what price? Do you have a sense of agency when it comes to your own food security? Rate on a scale from 1 (low) to 10 (high) how much influence you have on the following modes of agents **prior** to the outbreak of COVID-19: Your own production …. The local supermarket …. Local politicians …. The local food chain …. Local farmers …. Rate on a scale from 1 (low) to 10 (high) how much influence you have on the following modes of agents **since** the outbreak of COVID-19: Your own production …. The local supermarket …. Local politicians …. The local food chain …. Local farmers …. Please elaborate on your answer for question 43 & 44. ……. …….

	Concerning subsistence agriculture, has growing your own produce increased your agency over your own circumstance concerning food goods? 0 Yes, it has increased my agency 0 Neutral, nothing has changed 0 No, it has decreased my agency Have you thought about ways in which your own agency over food goods in Curaçao can be increased? Please elaborate on potential actions. ……. …….
Utilisation	The utilisation of nutrients and sufficient amounts of food is also a dimension of Food and Nutrition Security. It comprises the quality of your food, and how well your body can uptake all nutrients within your food. It also inquires about healthy and unhealthy foods. International organisations have thresholds for what good food and nutrition is. The 3 statements below are about your utilisation of food goods. • **Prior** to COVID-19, had you experienced times where you did not have enough to eat? 0 Yes, always 0 Most of the time 0 Sometimes 0 Rarely 0 Never • **Since** the outbreak of COVID-19, have you experienced times where you don't have enough to eat? 0 Yes, always 0 Most of the time 0 Sometimes 0 Rarely 0 Never • Do you ever feel hungry, like you are not satisfied by the amount of food you have? 0 Yes, always 0 Most of the time 0 Sometimes 0 Rarely 0 Never How many meals do you eat per day? ……. Are you aware of what a nutritious and balanced diet consists of? Please elaborate. ……. ……. Where do you get knowledge from on nutritious and balanced consumption of food? 0 Internet

0 Courses / school
0 Scientific articles
0 Friends and family
0 Other, namely

How many times a week do you consume fast food or take-out? (i.e. McDonalds, Truk'i pan, KFC, other food with high density saturated fats and/or sugars)
0 1 - 3 times a week
0 3 - 5 times a week
0 5 - 7 times a week
0 more than 7 times a week
0 I dont consume fast-food or take-out

Do you feel influenced by the diet choices of your close circle of friends, family and colleagues in your own consumption?

0 Yes
0 Sometimes
0 No

How much on average do you think your close circle (friends, family, colleagues) eat fast food per week?

0 1 - 3 times a week
0 3 - 5 times a week
0 5 - 7 times a week
0 more than 7 times a week
0 They don't consume fast food or take-out

A nutrient diet comprises 5 food groups. What food groups do you eat daily? Check the ones that apply to you.
0 – fruit and vegetables - daily intake in pieces of fruit / vegetable: ……
0 – starchy food (pasta, rice, bread) - daily intake in grams: …..
0 – dairy (milk, yoghurt, cheese) - daily intake in slices / grams / liters: …..
0 – protein (meat, fish, beans, pulses, eggs) - daily intake in grams: …..
0 – fat (unsaturated fat like plant-based oils) - daily intake in grams: …..
Do you also supplement your diet with products directly from nature? (i.e. apeldam, kenepa, flaira, blachi tuna, or other natural products) Please fill in all the natural products that apply to you.

…….
…….

What is your definition of a natural product for you, as named in the previous question?

…….
…….

Has the COVID-19 pandemic had an influence on your daily diet and the intake of food?
0 Yes
0 No

Please elaborate further on your answer for the previous question. In case it has influenced your daily diet and intake, elaborate on how it has (i.e. are there certain food groups that you did not / do not consume anymore? Or other types of food that have increased in your diet?

	…… …… Has subsistence agriculture had an influence on your daily diet and the intake of food groups like fruit & vegetables, starchy foods or proteins like beans and pulses? 0 Yes 0 No Please elaborate further on your answer for the previous question …… …… Do you consider yourself to utilise (consume) more nutritious foods since practising subsistence agriculture? 0 Yes, my utilisation of nutritious foods has increased 0 Neutral, nothing has changed 0 No my intake of nutritious foods has decreased Please elaborate further on your answer for the previous question. …… ……

Appendix 9.3: Figures

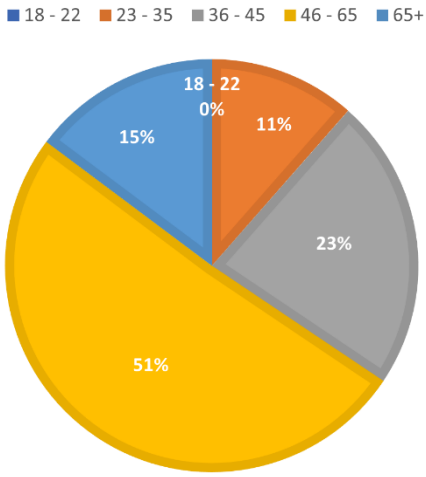

FIGURE 5.1: AGE CATEGORIES OF RESPONDENTS IN YEARS (N=61)

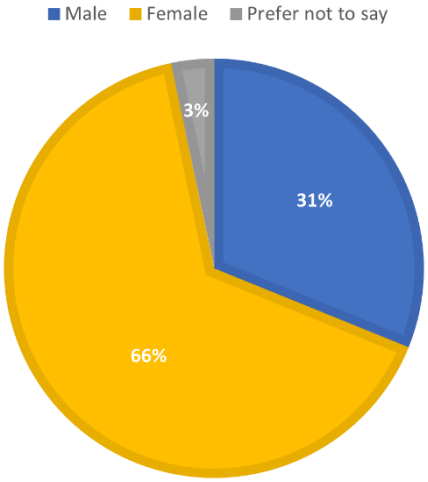

FIGURE 5.2: SEX DISTRIBUTION OF RESPONDENTS

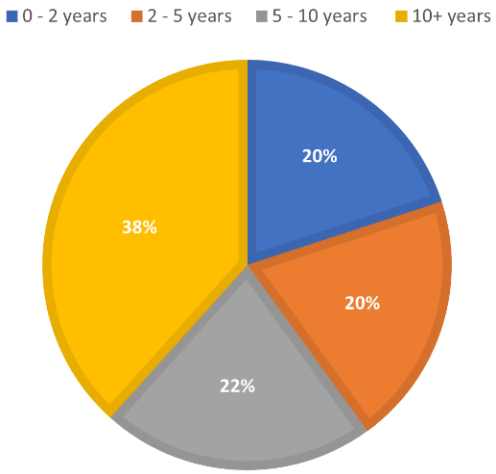

FIGURE 5.8: YEARS OF PRACTICE OF SUBSISTENCE AGRICULTURE

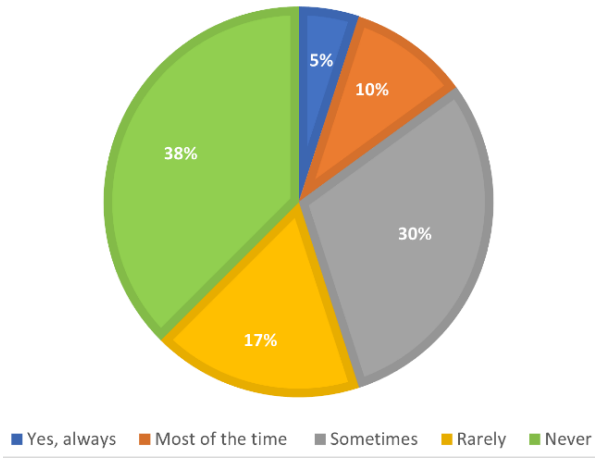

FIGURE 6.5: SHARE OF INADEQUATE STABLE SUPPLY OF FOOD COMMODITIES SINCE PANDEMIC (N=61)

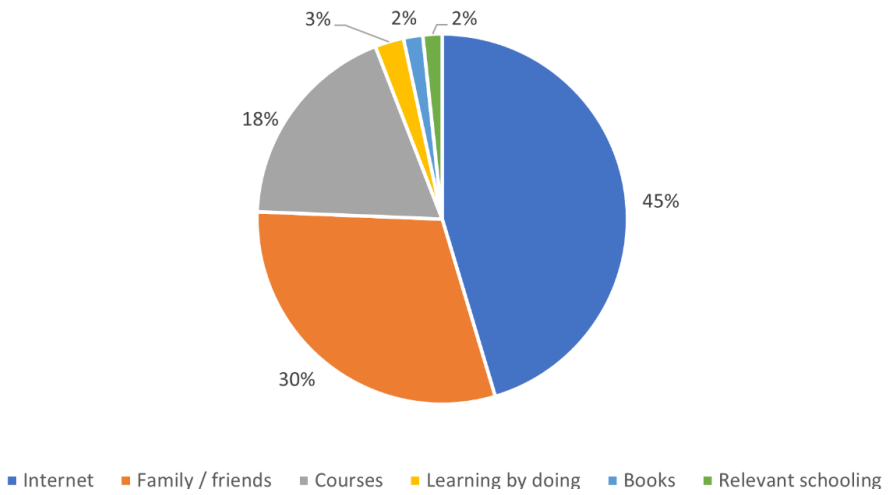

FIGURE 5.9: CHANNELS OF INFORMATION FOR SUBSISTENCE AGRICULTURE

Appendix 9.4: Respondents quoted in analysis chapters

Respondent	Quote
R19	*Sometimes fruits and vegetables are simply not available… or not available fresh and simply extremely expensive*
R49	*From the moment that Venezuela closed its borders to us, there was no fresh fruit and vegetables coming into our country any longer*
R17	*I would rather eat vegetables of which I know that they haven't been sprayed with pesticides or fertilizers*
R58	*Growing my own food enables me to feed my direct surroundings with healthy and organic foods, as I know where it is coming from*
R1	*We should be more sustainable on the island and import less*
R5	*You need to check every week, prices increase sometimes and are not reasonable and outside your budget*
R37	*Now you stop to think if you really need something before you buy it*
R18	*All prices have increased drastically, but sometimes there is also no stock of what you normally buy*
R40	*My partner has also reduced his consumption and his diet, by eating less meat and rice*
R39	*When you don't have enough money, you just eat less*
R59	*I have a steady job, so I don't see any change in my personal availability*
R5	*I myself have not noticed that the availability of food has changed as a result of the Covid-19 outbreak. I don't know anything about the decrease of foodstuffs in supermarket aisles. The products may have become more expensive, but they are still available*
R20	*It was always a bit of a gamble going shopping and hoping to find the right stuff, now going out with a shopping list can mean 25% is not in store*
R9	*Before Covid you could find what you were looking for on a near regular basis. During and after Covid I had to apply a complete adjustment to my diet*
R9	*Before COVID it came down to lack of organizing skills of the merchants (my conclusion). I guess it's due to problems with the supply chain a lot of products get stuck or aren't available (anymore). At least, that's what I hear from the store owners*
R12	*Since the pandemic I have turned to local farmers rather than the supermarket*
R42	*Pre COVID most people bought stuff in the supermarket, so there was enough stock at the local markets. But during the pandemic, more people have focussed on health and food production, and have started shopping at local markets, which has inflicted a shortage of food on the market as the demand outweighs the supply. Now the markets also sell imported food, which makes it more expensive*
R50	*As a result of the COVID-19 outbreak, I no longer have the necessary financial resources to buy various fruits and vegetables*
R9	*I have no problems going about my daily errands. The problem lies in the fact that the shelves are empty when you get to the store*
R11	*Availability is not so much a problem, it's just more expensive*
R41	*Politicians only talk nice and do nothing. I myself depend on the health of my plants. Supermarkets can take advantage of the situation, but supply and demand play a major role*
R49	*When people grow their own food, they are more aware of what they are consuming*
R42	*Despite the increase in prices, people still buy products from the supermarkets. As a result, supermarkets make no effort to lower prices. They set their own prices. I have nothing to say about that and I can't demand*

	anything. If I can't afford it I'll have to go somewhere else where it might be cheaper or not buy the product
R41	*Eating healthy is quite difficult in Curaçao. It is almost impossible to follow a balanced diet*
R49	*Due to stress, caused by being stuck at home, I started eating uncontrollably, so that I usually regretted it the next day and wanted to do something about my health*
R40	*My consumption has dropped dramatically after I got Covid-19. Fasting is my way of proving that the human body can survive without all those poisoned products we threw into our bodies*
R42	*Everything has remained unchanged for me. I have not eaten more nor less. I started growing and devoted time to my hobbies. So I wasn't bored and I didn't consume more or less*
R11	*I used to plant mainly bananas. I added papaya, spinach, peppers, okra, herbs, melon, pineapple, soursop, golden apple and lime*
R14	*Normally I was only growing herbs and on a small scale. Since the first lockdown I have bananas, cassava, tomatoes Paprikas etc and took the gardening a bit more seriously*
R48	*As I had time, I started experimenting with pak choy, kouseband, kale and basil*
R42	*Because I started growing my own fruit and vegetables before the Covid-19 outbreak, I was able to take advantage of fresh food during the pandemic*
R6	*Whilst the supply increased there is yet no daily yield I can sustain myself from. I'm still heavily dependent on supermarkets*
R11	*I have started to eat more beans, fruits and vegetables and less meat*
R9	*More vegetables, mainly legumes. Far less to no starchy food*
R42	*I realized the fruits and vegetables had more flavor and felt healthier. I used to eat vegetables from the supermarket, but it still felt like I wasn't getting enough vitamins. This changed after I started eating my homegrown fruits and vegetables.*
R40	*I have confirmed that our bodies need no more than what grows in the garden*
R49	*I try to grow varied and eat balanced*
R12	*Since the pandemic I have turned to local farmers rather than the supermarket*
R11	*The more people plant (small) amounts of food in their garden, the more food there will be available in a continuous way*
R40	*We should be satisfied with what we are capable of growing ourselves, just like the old days. Back then people ate food they produced themselves five days a week, and meat and imported chicken were just for the weekend*
R42	*As food can be bought on multiple days of the week, so it does not rot, and multiple varieties can be sold*
R11	*I think I have become more self-aware that we have part of the solution in our own hands*
R9	*Curaçao is mainly dependent on import, so that's beyond my control*
R1	*Decrease imports from US for more stability*
R37	*More varieties should be planted by farmers*
R59	*We should produce other produce and have livestock*
R5	*We need to get more and better information on how to do this at a cost effective way. Just watching YouTube is not always feasible to do in Curaçao*
R14	*If I would get more information and training on farming, that would be helpful*
R40	*We have to support each other in growing. There used to be agricultural areas that grew mango and corn. My soil is more suitable for growing*

	pomegranate for instance. Maybe areas should be analysed to see what type of cultivation suits these areas best, to increase production and sharing it with each other
R12	*The government must provide subsidies to local farmers to make it more sustainable for local agriculture expand in other areas on the island, for example during the pandemic there was a scarcity of limes from the US and had to be imported from Colombia, which became quite expensive. Limes can easily be grown locally and perhaps even exported to other countries*
R20	*Cheap irrigation water is necessary maybe all year through, for larger production*