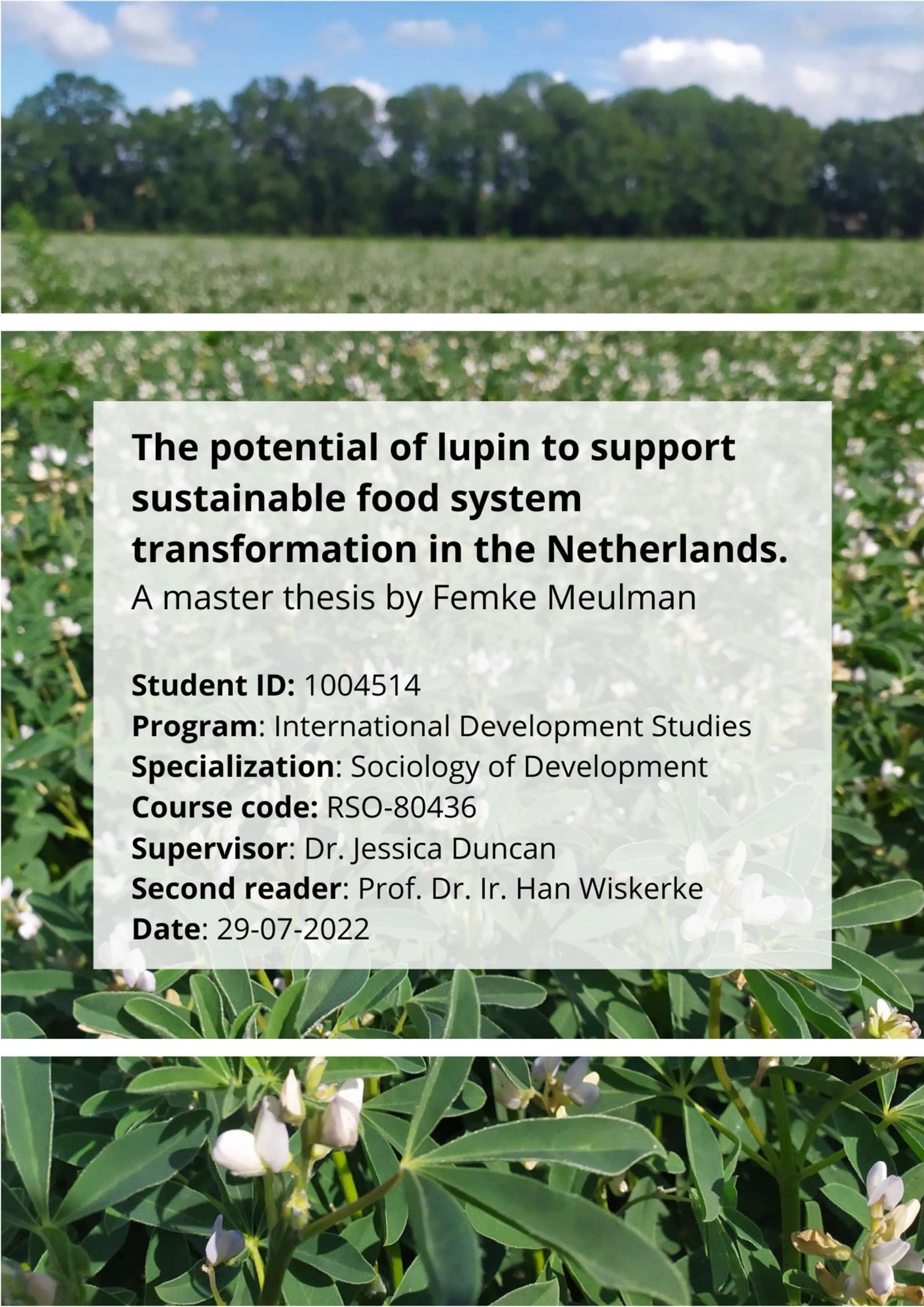




**THE POTENTIAL OF LUPIN TO
SUPPORT SUSTAINABLE FOOD
SYSTEM TRANSFORMATION IN
THE NETHERLANDS**



The potential of lupin to support sustainable food system transformation in the Netherlands.

A master thesis by Femke Meulman

Student ID: 1004514

Program: International Development Studies

Specialization: Sociology of Development

Course code: RSO-80436

Supervisor: Dr. Jessica Duncan

Second reader: Prof. Dr. Ir. Han Wiskerke

Date: 29-07-2022

ACKNOWLEDGEMENTS

I would like to take the opportunity to thank the people that have supported me while writing this master thesis.

First of all, I want to thank all my research participants for taking the time to share your visions with me. I have enjoyed our discussions a lot and learned so much from all of you. I am specifically thankful to Marieke Laméris whose endless passion for her cause has made me so enthusiastic about (researching) lupin and who has shared much of her network and knowledge. Thank you for inviting me to the Lekker Lupine community day, where I regained so much inspiration for researching lupin and where I felt so proud to be part of the change we want to realize.

Secondly, I am very grateful to my supervisor Jessica Duncan. Thank you for your good advice, your flexibility, for pushing me in the right direction, but also for allowing me to follow my own path. Thank you for believing in me and making me confident enough to change my research questions and frameworks in my final couple of weeks. It has been a real joy having you as my supervisor.

I also want to thank the people around me for getting me through this half year. Pappa, mamma, Ier en Juud, you have always been my biggest supporters and you never fail to encourage me to keep going. To my boyfriend Jonathan, I want to apologize for coming home many days stressed and tired. I am very grateful that you have been so patient and understanding. And finally, many many many thanks to Frederiek, Ninke en Tijmen who I worked with almost every day and could not have supported me better during my research. Thank you for your amazing company, for setting goals together, for the brainstorms and good advice, for endless cups of coffee, many laughs, good conversations and for making me happy to come to the Lebo every day. I could not have done it without you. Lots of love!

ABSTRACT

This study recognizes that food systems lie at the heart of some of the major challenges that humanity is facing in the 21st century (UNEP, 2016), and that therefore food system transformation is required (HLPE, 2017). Using the framework of *food utopias*, the potential of lupin for sustainable food system transformation is researched. Through participatory interviews, experts have imagined their desired visions for the future of the Dutch food system and the role of lupin herein. In addition, they have designed the pathways towards these desired futures. These interviews build greatly on a *food system framework* and *foresight studies*. Experts have identified that the potential of lupin lies in its ways to encourage more sustainable food production by allowing organic production and by being able to function in extensive crop rotation systems. In addition, it fits greatly within the protein transition, functioning as a new plant-based protein source. The experts have introduced many ideas and interventions through which lupin production and consumption can grow to take on a larger share in the Dutch food system.

Using the concept of *food utopias*, a *food systems framework* and *foresight studies* I have identified how lupin can support sustainable food system transformation in the Netherlands. Lupin can support sustainable food system transformation by presenting lupin as one of many possibilities for sustainable food system transformation, by engaging in systems thinking to not only acknowledge the effects of ideas and interventions to increase the presence of lupin throughout the whole food system, but also to be able to transform the entire food system, and, by promoting to imagine a future vision for the Dutch food system beyond the dynamics of our current food system. This study can be a basis to further research into lupin from a social science perspective as it exemplifies the many promises and perils for the role of lupin in creating more sustainable and healthy food systems.

Key words: Lupin; Protein Transition; The Netherlands; Food System Approach; Foresight Studies; Backcasting; Food Utopias

LIST OF FIGURES

Figure 1 – The food system approach by Van Berkum et al. (2018)	21
Figure 2 – Food system diagrams for expert interviews.....	24
Figure 3 – Diagram for backcasting.....	26
Figure 4 – Interview structure	27
Figure 5 – Food system vision.....	32
Figure 6 – Short term ideas and interventions.....	46
Figure 7 – Medium term ideas and interventions	50
Figure 8 – Long term ideas and interventions.....	53

TABLE OF CONTENTS

Acknowledgements.....	3
Abstract.....	4
List of figures.....	5
Chapter 1: Introduction	8
1.1 Problem statement	10
1.2 Research questions.....	11
Chapter 2: Literature review	12
2.1 The protein transition.....	12
2.2 The protein transition in the Netherlands	14
2.3 The role of lupin in the protein transition in the Netherlands.....	16
Chapter 3: Methodology.....	18
3.1 Research participants	18
3.2 Data collection methods.....	20
3.2.1 Food system framework	20
3.2.2 Foresight studies	25
3.3 Data analysis methods	28
3.3.1 The visions	28
3.3.2 The pathways.....	28
Chapter 4: Theoretical framework.....	29
Chapter 5: Visions of the 2050 food system	32
5.1 Food system activities.....	33
5.1.1 The organization of the food supply chain.....	33
5.1.2 Food production on farm level.....	35
5.1.3. The food industry	36
5.2 Socioeconomic drivers.....	38
5.2.1. Policies.....	38
5.2.2. Consumption	39
5.3 Environmental drivers	41
5.4 Food system outcomes.....	42
5.4.1 Food security outcomes.....	42
5.4.2. Socioeconomic outcomes.....	42

5.4.3 Environmental outcomes.....	44
Chapter 6: Pathways to the envisioned 2050 food system	46
6.1 Short term.....	46
6.1.1 The food environment	47
6.1.2 Policies.....	47
6.1.3 Food production.....	48
6.1.4 Research.....	49
6.2 Medium term.....	50
6.2.1 The food environment	50
6.2.2 Policies.....	51
6.2.3 Food production.....	52
6.3 Long term.....	53
6.3.1 The food environment	53
6.3.2 Policies.....	54
6.3.3 Food production.....	55
Chapter 7: Discussion	56
7.1 Food system framework.....	56
7.2 Food utopias.....	59
Chapter 8: Conclusion & Reflection.....	62
8.1 Conclusion	62
8.2 Reflection	65
Bibliography	67

CHAPTER 1: INTRODUCTION

Food systems lie at the heart of some of the major challenges that humanity is facing in the 21st century (UNEP, 2016). We need to feed a growing world population, ensure that everyone is secure of sufficient and nutritional food and make sure we realize this within the limits of our planet (van Berkum et al., 2018). In order to stand a chance to realize these objectives, food system transformation is required (HLPE, 2017) and even recognized as one of the major transformations needed to achieve the Sustainable Development Goals by 2030 (Sachs et al., 2019).

Transformation means that dominant ways of doing things and understanding the world need to be reviewed to make way for knowledge systems that can deal with change, complexity, contested perspectives and uncertainty (Pereira et al., 2020). Because transformation involves major shifts, it is important to take an holistic approach where different stakeholders from different sectors and multiple levels are engaged. This calls for a systems approach (Kusters et al., 2019). Because of the complexity of food systems, it is a challenge to design and implement interventions that strengthen food system sustainability. There are no universal pathways to create food system sustainability, and every intervention comes with its winners and losers (Dekeyser et al., 2020). According to Dorninger et al. (2020), scientific attention is mostly given to interventions that are simple to envision, but therefore lack the potential to trigger systemic change. These authors argue for research to sustainability interventions that address the underpinning, ultimate drivers of our current systems (Dorninger et al., 2020).

Although it is agreed that food system transformation is required, what should this transformation look like, and is it even feasible? The ways in which food systems are currently organized affect their social, economic and environmental sustainability in multiple ways. Agricultural production systems have impacted the environment in numerous negative ways such as by the excessive use of fertilizers and pesticides or the intensification of agriculture by creating monocultures (Oosterveer & Sonnenfeld, 2012). On the other hand, humanity's dietary habits have impacted our environment and our health. Consumption of meat and other animal-based products is high, and is expected to grow further until 2030 (Tirado - Von der Pahlen, 2020). Livestock production systems

have great environmental impact. The consumption of animal products, particularly meat and more and more dairy products as well, has therefore been debated in the context of sustainable diets (Macdiarmid, 2020). Shifting towards plant-based diets, by consuming plant-based protein instead of animal-based protein, has shown a decrease of greenhouse gas emissions, but also contributes to improved public health and nutritional outcomes (Tirado - Von der Pahlen, 2020).

In the Netherlands, the importance of a shift to more plant-based diets and the consumption of plant-based protein has increasingly been recognized. The Ministry of Agriculture, Nature and Food Quality has created a national plan for the protein transition in which they argue that the increase of plant-based protein consumption in the Netherlands is needed to realize more healthy and sustainable diets. In addition, the Ministry aims to decrease the dependency on imported soy by seeking to increase the production of plant-based protein in the Netherlands (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2020).

An example of a plant-based protein plant that would be suitable to grow in the Dutch climate is lupin. Lupin is part of the legumes species (Semba et al., 2021). Legumes have been framed as the plant-based solution to many problems that arise from modern food systems (Cusworth et al., 2021). The advantages of lupin as plant-based protein and as locally-sourced alternative to soy are very promising. Lupin beans are very nutritious and contain lots of minerals, vitamins, fibers and most importantly protein, which makes them a great replacement for animal-based proteins (van de Noort, 2016). Lupins combination of nutrient-richness, resilience to climate change and ability to grow on degraded land makes it a very promising crop for sustainable food system transformation (Bourne et al., 2020). Lupin is currently used in and known for animal feed and processed meat alternatives, but demand for human consumption remains low. Initiatives such as Lekker Lupine (elaborated in box 1) try to change this and aim to stimulate the consumption and production of locally and organically grown lupin in the Netherlands.

1.1 Problem statement

Although what is known about lupin is promising for food system transformation, to the best of my knowledge, there is little or no academic research focused on its role in Dutch food systems or any other related social-science based research to the future of production and consumption of lupin in the Netherlands. Research on the potential of legumes for food futures in Europe has been conducted by Cusworth et al. (2021) by looking at the narratives for legumes in food futures. However, any literature on the future of lupin and specifically lupin in the Dutch food system has not been found. In the context of the protein transition in the Netherlands, it has been recognized that Dutch consumers have been increasingly conscious in their food consumption patterns and that they begin to see the health and sustainability benefits of consuming plant-based protein in relation to animal-based protein (Snethlage et al., 2021). However, it is unknown what this means for the role of lupin in the Dutch food system and the potential for food system transformation.

This study thus focusses on two related problems. The first problem is the current problem of food systems and the need to transform food systems into more sustainable and healthy food systems. And, secondly, there exists a more academic problem of a scientific knowledge gap of studying lupin from a social science perspective and the role that lupin can play to support sustainable food system transformation in the Netherlands. These two problems are combined in this study using the theory of *food utopias*, and *food system* and *foresight* approaches.

1.2 Research questions

In this study, I will combine the two problems mentioned above by studying the potential of lupin to support sustainable food system transformation in the Netherlands, asking the following main research question:

How can lupin support sustainable food system transformation in the Netherlands?

With the following subquestions, I focus on the perspectives of experts in this emergent domain to help answer the main question:

- How do research participants envision the role of lupin in the Dutch food system in 2050?
- How do research participants conceptualize the pathways to realize these roles?

This study will be structured as follows. Chapter 2 will be a literature review on the protein transition and how this is currently evolving in the Netherlands. The literature review will also include an introduction to lupin and its current role in the protein transition in the Netherlands. The report follows with chapter 3 in which I elaborate on the methodology used to answer the research questions of this study. The methodology involves participatory expert interviews and builds upon a *food systems framework* and *foresight studies*. I will continue to describe the theoretical framework that will be used in this study in chapter 3, namely that of *food utopias* as a way to better understand and conceptualize future food system visions and to link this to food system transformation. Chapter 5 and 6 will show the results from data collection and answer the two subquestions posed in this study. I will discuss these results using the concept of food utopias, and the framework of food systems in chapter 7. Finally, I will conclude the study by answering the main research question in chapter 8.

CHAPTER 2: LITERATURE REVIEW

This chapter provides an explanation of the context in which this research has been conducted. This includes the call for a shift from animal-based protein sources towards plant-based protein sources for the sake of the health of humans and the planet. This chapter elaborates on this so called protein transition, while also reviewing the current state of the protein transition in the Netherlands and looking into the role that lupin currently has in the protein transition in the Netherlands.

2.1 The protein transition

Although food systems have the potential to foster human health and strengthen environmental sustainability, they currently have a negative effect on both (Willett et al., 2019). Food system transformation is key to challenges such as poverty, malnutrition and climate change and thus one of the major transformation needed to ensure that the SDGs are achieved (Sachs et al., 2019; UNEP, 2016). But what should this transformation look like?

Willett et al. (2019) have created a set of scientific targets for achieving healthy diets from sustainable food systems. They argue that current dietary trends involve unhealthy food consumption from unsustainable food production. This poses a global risk to people and planet. Therefore, this group of researchers has created dietary guidelines to achieve healthy diets from sustainable food production. Dietary shifts recommended by Willett et al. (2019) to achieve healthy diets from sustainable food systems are a doubling of the consumption of fruits, vegetables, legumes and nuts, while a 50% reduction of unhealthy foods consumption like red meat and added sugars is necessary to result in health benefits. Healthy food is greatly associated with the consumption of plant-based foods. Interestingly, studies have also found that negative environmental effects are decreased when shifting from animal-based foods to plant-based foods (Willett et al., 2019).

There has been growing demand of animal-based foods in developed countries. It has been acknowledged that within the food system, livestock production for animal-based foods has the greatest environmental impact (Macdiarmid, 2020). Therefore, the growing demand of animal sourced foods has contributed to the rise of global greenhouse gas

emissions by increasing numbers of animals in the livestock sector (Herrero et al., 2020). In addition, a lot of agricultural land is currently used to produce animal feed. This land can be used more efficiently if agricultural production was directly consumed by humans, instead of by animals. Another environmental factor that influences negative environmental impact of livestock production is a high water footprint (Macdiarmid, 2020). These impacts are much smaller when replacing animal sourced foods with plant-based foods, especially when considering protein intake (Tirado - Von der Pahlen, 2020). A transition towards consuming more plant-based protein sources instead of animal-based protein sources is thus proven beneficial to both a healthier diet as well as more sustainable food production. It is therefore considered a desired transformation.

2.2 The protein transition in the Netherlands

As a response to the desired diet proposed by Willett et al. (2019), Broekema et al. (2020) have constructed a similar, but country-specific analysis for the Netherlands. They have identified diets that meet nutritional and selected environmental requirements, modeled at a national level and with respect to cultural acceptability. To meet these environmental requirements (such as targets to greenhouse gas emissions) and maintain a healthy eating pattern, a decreased consumption of beef, pork, poultry, cheese, butter and snacks is necessary, while an increased consumption of, among others, legumes, seafood, and vegetables is required.

A report by the Rijksinstituut voor Volksgezondheid en Milieu (RIVM, 2017) also identifies the shift to a more plant-based diets in the Netherlands as an opportunity for more healthy and sustainable diets. The European Union has taken up initiatives to reduce the reliance on imported soy by producing more plant-based protein sources in its member states (Bremmer et al., 2019). This notion is also central to the National Protein Strategy (NPS) that has been introduced in the Netherlands (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2020). The reliance on imported soy is currently contested for several reasons. To start with, soy production has been associated with deforestation in the Amazon rainforest. Secondly, current soy production for animal feed has involved the production of genetically modified soy. Although this is thus soy meant for animal feed, it has caused a fear of health risks (Bremmer et al., 2019). And finally, soy cannot be grown in the European climate and therefore needs to be transported from Latin America and Asia, which comes with a fair amount of food miles and accessory greenhouse gas emissions (Voedingscentrum, n.d.).

There has thus been a growing interest in the production of plant-based protein-rich foods in the Netherlands. However, their production currently only takes up 0,5% of the total agricultural production land in the Netherlands, and therefore we rely on import to meet our demand for plant-based protein sources (Bremmer et al., 2019). In the NPS that is constructed by the Ministry of Agriculture, Nature and Food Quality in 2020, the ministry acknowledges the need for more plant-based protein production and consumption. Most importantly, the aim of the NPS is to reduce the reliance on soy and to become more self-sufficient.

sufficient in the production of plant-based proteins (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2020).

On the consumption side, we see that people from the Netherlands consume 61% animal-based protein sources and 39% plant-based protein sources (van Dooren & Seves, 2019). A study by Kloosterman et al. (2020) shows that, although 95% of the Dutch population still consumes meat regularly, 35% of the population has indicated that they have decreased their meat consumption over 2020 and 37% of the population wants to decrease their consumption of meat even more. Kloosterman et al. (2020) also highlight that environmental impact, animal welfare, health aspects and taste are important reasons for decreasing the consumption of meat (Kloosterman et al., 2020). In the NPS, it has been elaborated that consumption of protein sources in 2030 should reflect a 60% plant-based protein consumption and a 40% animal-based protein consumption, which is the opposite of the current state of protein consumption.

2.3 The role of lupin in the protein transition in the Netherlands

The Netherlands aims to increase their plant-based protein production. Because soy production is climatologically impossible in the Netherlands, it is interesting to look at alternative plant-based protein sources that will be able to grow in the Dutch climate. Lupin is mentioned as an example of an alternative plant-based protein source (Prins et al., 2017), next to field beans, peas, brown beans and white beans (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2020). In addition to replacing soy, lupin is considered to have a positive effect on the health of soils due to its nitrogen fixating characteristics. Current problems related to the production of lupin focus on the low outputs per hectare, but there are definitely opportunities to increase outputs by breeding different lupin varieties and researching the effects of these different breeds (Prins et al., 2017). These low outputs, in addition to the generally insufficient cultivation of lupin in Europe, have remained to guarantee a steady supply of lupin to the food industry. This in turn prevents continuous development and innovation of attractive lupin-based protein-rich foods (Lucas et al., 2015). This is unfortunate, because lupin has the potential, for example, to serve as a main source for meat replacements. International interest to lupin has increased because of its potential to be an alternative source of human food ingredients due to its high quality protein and dietary fiber (van de Noort, 2016). The Netherlands has developed itself as an important and innovative actor in this industry and could benefit from locally sourced lupins as meat replacements (Prins et al., 2017). Next to meat replacements, lupin can be used as flour in bread and it has been used for plant-based dairy alternatives (Voedingscentrum, n.d.) For the consumer, lupin serves as a great example of a plant-based protein product, which is both a healthy and sustainable food choice (Prins et al., 2017). However, data about lupin consumption in the Netherlands is, to the best of my knowledge, not available. An important actor that engages in bringing lupin to Dutch consumers is Lekker Lupine. A detailed explanation of the work of Lekker Lupine is given in box 1.

Lekker Lupine is founded by Marieke Laméris (marketeer) and André Jurrius (farmer). It is an initiative that aims to stimulate consumption and production of organic lupin in the Netherlands, in order to contribute to the protein transition and more localized food systems. It forms a platform for consumers, farmers, chefs, entrepreneurs, students and other food producers that engage with lupin. Lekker Lupine is involved with producing and selling lupin, but also with inspiring, informing, activating and connecting all types of actors around lupin. They have developed a community of supply chain actors, knowledge institutes, governmental institutions, and any other stakeholders that aim to work together on projects to bring lupin on the plate of consumers. This involves, for example, bringing together farmers to share knowledge on growing lupin, and storytelling to raise awareness for increased lupin production and consumption. Lekker Lupine operates in the Netherlands, but is currently mainly situated in Wageningen and surroundings.

Box 1 – Lekker Lupine

Possible limitations to the increased consumption of lupin include, firstly, the fact that lupin is fairly unknown to consumers. Most people know lupin as an ornamental plant, grown for decorative purposes. They are unaware that certain varieties of lupin can produce edible beans (Regio Foodvalley, 2021). Secondly, a limitation to the consumption of lupin is the presence of alkaloids in the beans. This causes a bitter taste and is toxic in high concentrations. Due to research into the breeding of lupin, varieties have been developed that are low in alkaloids. This makes them not only safe to eat, but also less bitter which is tastier to the consumer (Voedingscentrum, n.d.). Lupin beans cannot be eaten raw due to these alkaloids: they need to be soaked and cooked before consumption. Currently, ready-to-eat lupin beans are sold in glass pots and do not need to be prepared by the consumer in order to be safe to consume (Voedingscentrum, n.d.). Another limitation to the consumption of lupin is the presence of allergens. There exists a cross-reactivity between peanut and lupin, which has led to the inclusion of lupin in the allergen list of the EU directive on labeling. Allergic reactions to peanut are often quite severe, so potential allergic consumers need to be informed about this and people might therefore be reluctant to consume lupin (Lukas et al., 2015).

CHAPTER 3: METHODOLOGY

This study is a qualitative one, and takes the study design of a case study to the potential of lupin for sustainable food system transformation in the Netherlands. The advantages of a case study are that you can get a very holistic and in-depth understanding of a case where little is known from (Kumar, 2014). In addition, the research will involve participatory research methods, where the research participants play an active role in the creation and collection of data. This chapter involves a description of my research participants, data collection methods and data analysis methods.

3.1 Research participants

Sampling of the research participants has been done using nonprobability methods. This means that research participants has been chosen that are available to and selected by the researcher (Naderifar et al., 2017). The selection of research participants is an example of purposive sampling, where the judgement of the researcher has determined which research participants are included in the data collection (Etikan et al., 2016). As a researcher, I have applied this method because of the limited amount of experts on the topic of lupin. I have therefore selected my research participants based on my judgement of their expertise regarding lupin. This judgement has been based on the participant's personal and/or professional engagement to lupin. In addition, I supplemented this limited amount of experts on lupin with experts on the protein transition, sustainable food systems and food system transformation, provided they had at least basic understanding of lupin and its dynamics.

I have selected my research participants using my own network. This involves contacts from Wageningen University and Slow Food Youth Network. In addition, I know Marieke Laméris from Lekker Lupine for a couple of years now. Marieke has kindly agreed to give access to her network, serving as gatekeeper to experts in the field. Some limitations of this method relates to the subjective nature in choosing the research participants. Selecting research participants based on the judgements of the researcher may lead to high levels of bias, low levels of reliability and the inability to generalize research findings (Dudovskiy, n.d).

The data selection methods have allowed me to find eight experts to interview. This somewhat limited amount of research participants can be explained using the same argument as to why this research is necessary. The relevance of this study is expressed through the lack of knowledge about lupin. This was reflected in my search for research participants as many people who I contacted through my network who I considered experts responded that they felt uncomfortable to be interviewed about lupin because they did not know enough about it.

The experts that have participated in this study will remain anonymous and will not be identified by name. The research participants have all signed a research consent form that expresses that their confidentiality in this study will remain secure. Table 1 shows an overview of the professional roles of the research participants. I have sought to find a diversity of research participants that relate to lupin specifically, but also more in the context of the protein transition, sustainable food systems and food system transformation. In the remaining of this report, the research participants will be referred to according to a participant number indicated as P1 to P8. The participant numbers are not linked to the professions in Table 1 in order to secure their anonymity in the small lupin community that currently exists in the Netherlands.

Professions of research participants
Biodynamic farmer of lupin and entrepreneur in the field of lupin
Food scientist in the pulses industry
Program manager food in a governmental institution
Strategist in a youth food organization
Project manager in the protein transition
PhD candidate in consumption of protein sources in the Netherlands
Entrepreneur in the field of food and lupin
Food technology student and lupin product developer

Table 1 – Professions of research participants

3.2 Data collection methods

The main data collection method in this study is expert interviews. Within these interviews, I used a *food system framework* and *foresight studies* in a participatory way. This section of the methodology chapter aims to argue for the relevance of these methods and shows how these methods are included in the study and the interviews specifically.

3.2.1 Food system framework

Up until the beginning of the 2000s, food production and consumption have always been conceptualized in linear ways (Brouwer et al., 2020; Ruben et al., 2021; Stefanovic et al., 2020). Supply chains or value chains were used to identify the actors and activities involved in food production and consumption and their relations were often shown in terms of monetary value or the mobilization of resources from agricultural product to end-product. However, this linear approach was not extensive enough to study the problems involved in food production and consumption as it failed to cover all the dynamics. Here, the concept of the food system was introduced and presented as integrative and holistic approach that was able to show the complexities of our food provisioning (Béné et al., 2019; Lawrence & Friel, 2020). Instead of compartmentalizing different issues from different disciplinary viewpoints, all these complexities should be studied and solved together (Ruben et al., 2021). They are all interlinked and cannot be tackled in isolation. In addition, solutions for one issue can have unintended consequences for other problems (Dekeyser et al., 2020).

When dealing with complex problems such as the challenges in food systems, it is necessary to avoid disciplinary compartmentalization and take into account the many subsystems that influence the problem. In terms of food systems, social and ecological systems come together and both need to be recognized in studying food systems (Erickson, 2008). System theory allows to take a holistic perspective by examining system boundaries, and describing subsystems and their interactions and relationships. Systems can be defined as sets of elements that function together as collective units (Sobal et al., 1998). The behavior of a system is influenced by the behavior and interplay of all different subsystem (van Berkum et al., 2018). System approaches can help to understand the factors that lead to certain outcomes (Erickson, 2008). Researchers thus started using

systems approaches in order to study food provisioning. In doing this, the visual conceptualization of food systems became an important task, taken by many researchers and international organizations such as Erickson (2008), HLPE (2017), UNEP (2016) and van Berkum et al. (2018).

This study uses the food system framework by Van Berkum et al. (2018) from Wageningen Economic Research. I have chosen this framework over others for the following reasons. Firstly, this framework does not encompass one possible food system outcome but features several. In frameworks provided by GLOPAN (2016) and HLPE (2017) respectively diet quality, and nutrition and health outcomes are at the center of the food system framework with less or no attention to other possible outcomes. Hereby, they give a clear target for food systems, but also quite a limited view of other possible food system outcomes, and the (unintended) consequences that follow from certain activities and drivers in the food system. Because this study involves the future of the Dutch food system, it is important that the food system outcomes are studied broadly to gain an all-encompassing overview of possible food system outcomes. Moreover, the food system framework by van Berkum et al. (2018) takes a broad view of food system activities by including the elements of the food environment and the consumer. This has, for example, been neglected by the initial food system framework of Erickson (2008) but is deemed very important in this study as the consumption of lupin is an important element for sustainable food system transformation.

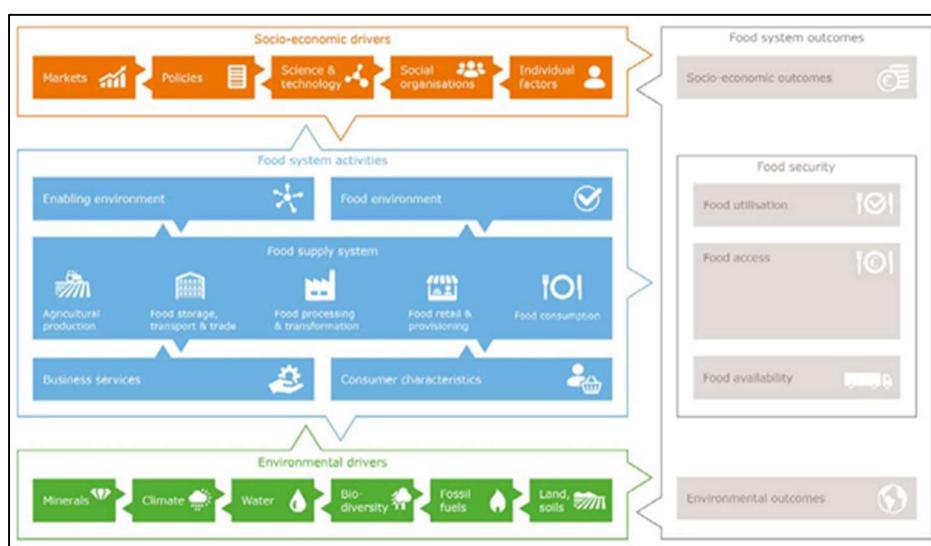


Figure 1 – The food system approach by Van Berkum et al. (2018)

According to Van Berkum et al. (2018), taking a food system approach can contribute to find solutions to produce a sufficient supply of healthy food within environmental limits. These solutions can be found by intervening in parts of the system other than where the problem occurs. The authors do not provide a single definition for a food system in order to do justice to the many different and broad definitions and conceptions of food systems that exist. They describe a food system as comprising all the processes associated with food production and food utilization. This includes growing, harvesting, packing, processing, transporting, marketing, consuming and disposing of food remains. The authors stress that these activities require inputs, but also result in certain products or services. They acknowledge the many different subsystems (social, political, cultural, technological, economic and natural) by which the food system is influenced. Similar to other food system approaches, the food system framework by Van Berkum et al. (2018) studies food system activities, their outcomes and their drivers, but also their interactions and relationships.

The food system activities consist of five components. Firstly, the food supply system. This features the value chain from production to storage and transport, processing, retail and consumption. Traditionally, food production is at the center of food supply systems. Secondly, the food supply system is surrounded by an enabling environment of transport, regulation, institutions and research infrastructure. In addition, certain business services provide goods and services to the actors in the food supply system. These services can for example be financial or technological. At the retail and consumer level, the food environment and the consumer characteristics are in play. The food environment consists of food labeling, quality and taste, physical access to food and food promotion. Consumer characteristics, finally, may point towards the consumers' knowledge of food, their time, their purchasing power and their preferences.

In terms of food system outcomes, Van Berkum et al. (2018) distinguish three types of outcomes. Firstly, socioeconomic outcomes. Indicators for socioeconomic outcomes are, for example, income, livelihoods, employment, wealth and social, political and human capital. A second type of food system outcomes is environmental outcomes. Environmental outcomes relate to land, soils, water, biodiversity, minerals and climate.

The third type of food system outcomes distinguished by Van Berkum et al. (2018) is outcomes related to food security. Food security is here defined as a combination of food utilization, food access and food availability. Food utilization points to the nutritional value, social value and safety of the product. Food access entails the affordability, allocation and preferences of food, and, lastly, food availability involves food production, distribution and exchange.

Van Berkum et al. (2018) identify two broad types of food system drivers. These are environmental drivers and socioeconomic drivers. The environmental drivers highlight the biophysical context in which the food system is situated. This consists of five components, which interact as well. Firstly, the availability of land and the quality of soils. Secondly, the fossil fuels used in the food supply system. Thirdly, the use of minerals to enrich soils which poses challenges to the system due to scarcity. Fourthly, the biodiversity that provide different services to the food system. And lastly, water, not only for production through irrigation but also for drinking, cooking and washing. The interaction between environmental drivers and the food system is mainly situated at the food supply system at the production stage. Also, other stages in the food supply system are influenced by environmental drivers. The drivers themselves are also interrelated. For example, soil quality depends on the availability of water and minerals. On the other hand, these environmental drivers also interrelated with the second category of drivers: socioeconomic drivers.

The socioeconomic drivers can also be distinguished into five categories. The authors stress that, although this distinction is arbitrary, it does stress the different aspects concisely and adequately. The first category of socioeconomic drivers to the food system is markets. They provide opportunities for matching supply and demand, as well as the producer and the consumer. The second category is policy, which seeks to guide the food system outcomes towards desired directions. Thirdly, science and technology, and research and innovation influence the food supply system. In addition, social organization can influence the positions that certain actors have in the food supply system. And lastly, individual factors such as lifestyle, norms, attitudes and culture influence the individual choices that actors in the food system make.

All drivers mentioned do not only influence the food system, but can also be influenced by what happens in the food system. This can lead to multiplier effects and feedback mechanisms. For example, food production is not only influenced by soils, but also in its turn influences soils. The same can be said for markets or policy. These effects can be made visual by using a food system framework. The framework highlights how climate change, food security, production systems, consumer behavior, ecological conditions and socioeconomic dynamics come together and interact with each other. Hereby remaining from disciplinary compartmentalization and seeking possibilities for enhancing food system outcomes not in one single subsystem but with regard to surrounding subsystems.

The food system framework by Van Berkum et al. (2018) is used in this study in the following ways. In my interviews, I have asked experts to envision their desired future food system for the Netherlands in 2050. Firstly, this will be a more general version and, secondly, this will be a version where the role of lupin in their desired future food system for the Netherlands is highlighted. I have asked my research participants to articulate this vision using a diagram of the food system framework by Van Berkum et al. (2018). I have simplified the original food system visualization into a diagram that only covers the food system activities, the food system drivers and the food system outcomes (see figure 2). Experts used this diagram to organize their thoughts and could write or draw their ideas in this diagram. Chapter 3.2.2 and chapter 3.3 elaborate on how these diagrams are used during the interviews and subsequently how the data coming from these diagrams is analyzed.

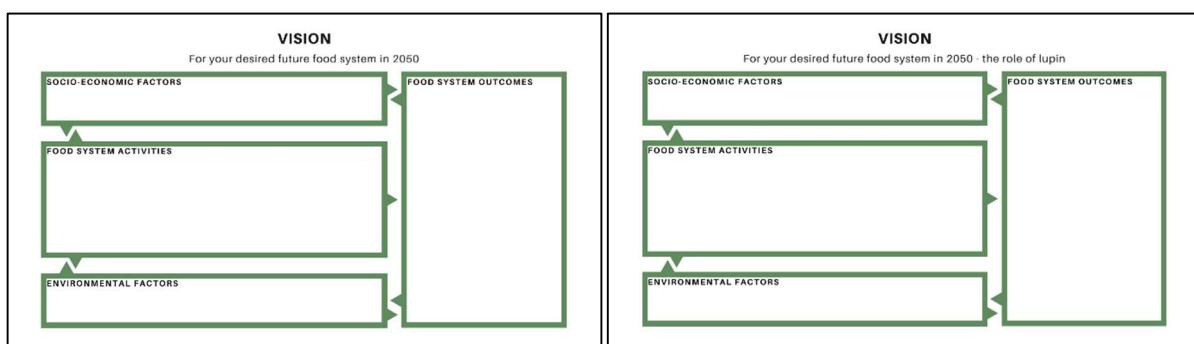


Figure 2 – Food system diagrams for expert interviews

3.2.2 Foresight studies

Foresight studies, or future studies, covers a wide range of methods to investigate the future (Hebinck et al., 2018). Through using a significant methodology from the range of foresight studies, I will investigate expert visions for their desired future food system for the Netherlands in 2050, while also looking into the pathways to get to realize these visions. Foresight is believed to be a method to promote transformative change. Foresight studies can conceptualize food system transformation and contribute to the initiation of food system transformation (Hebinck et al., 2018). Because food systems are so complex, it is difficult to make their trajectories foreseeable (Kuhmonen, 2017). Qualitative foresight studies may be able to overcome this challenge (Prager & Wiebe, 2021). Foresight studies help to shape what futures are desired and how they can be achieved through different pathways.

An important distinction in foresight studies is between explorative future scenarios, where futures are designed to investigate contextual changes that may pose challenges, and normative visions that focus on creating desirable futures to work towards and exploring the ways to get there (Hebinck et al., 2018). The latter will be central to this study, in order to find the potential of lupin for sustainable food system transformation. It has been argued that focusing on desirable futures is better to achieve trend-breaking outcomes because explorative future scenarios are more likely to be limited by current technological, political and socioeconomic trends (Doyle & Davies, 2013). Because this study highlights transformation, normative future scenarios that are not limited by current trends are desired to envision system change.

Backcasting is a method within the field of foresight studies that aims to reveal the steps between a desired future and the current. It is defined as a process of imagining desirable possible futures and working back from them to the present to consider interventions that might build towards their achievement (Davies, 2014). However, there is still a variety of ways to engage with backcasting methodologies. In this study, backcasting is used in combination with a food system framework. Experts are asked to envision their desired future food system for the Netherlands in 2050 in a more general way and specifically considering the role of lupin. After these visions are composed, a backcasting exercise will

be introduced. As the future is set in 2050, I have created a diagram of a timeline that displays the short term (present – 2030), the medium term (2030 – 2040) and the long term (2040 – 2050). I ask the experts to think of ideas and interventions that need to take place in these different time periods. Here, it is important to focus on the long term first and to think back from the long term to the current in order to identify relevant ideas and interventions to get to their desired visions.

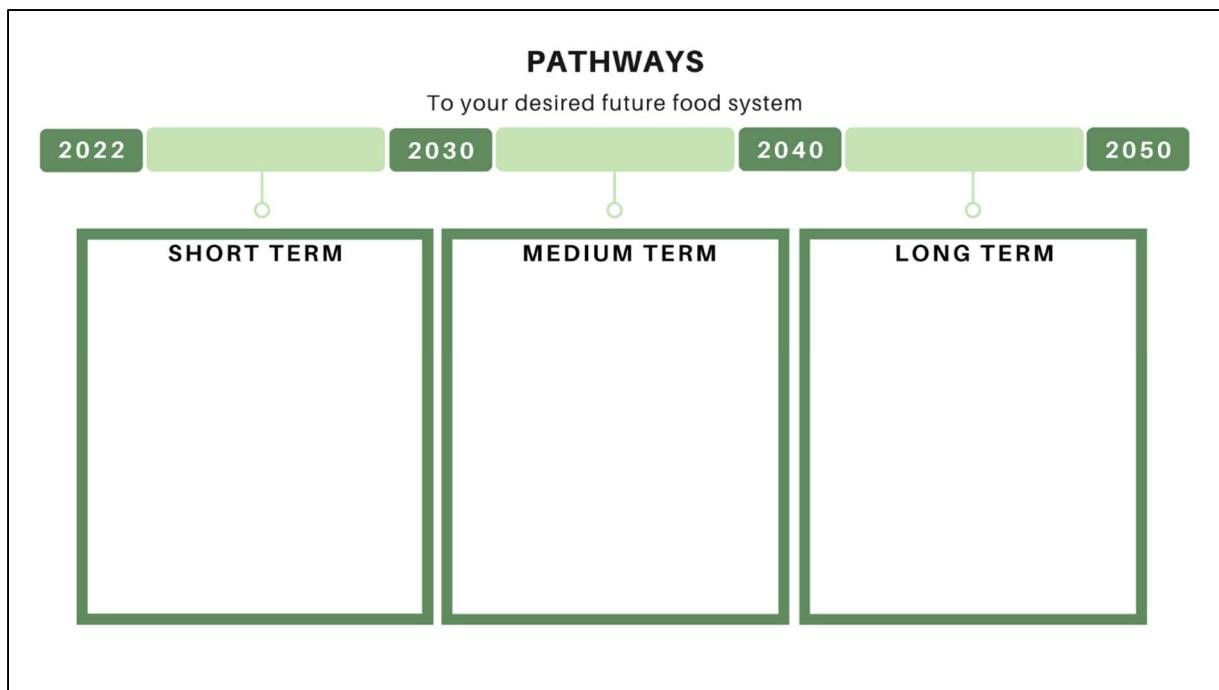


Figure 3 – Diagram for backcasting

Backcasting has often been used as a method in group setting where a research team or a professional facilitator leads workshops with various stakeholders to envision futures and work back in time to find pathways to this future (see Davies, 2014 or Mangnus et al., 2019). However, due to the scope of this study, the decision has been made to have one on one interviews with research participants. This has its advantages and disadvantages. An important advantage is that this does get rid of the potential power relations that would come up in group settings. These power relations can influence the participation of research participants and thereby influence the results of the workshops. On the other hand, doing one on one interviews with research participants causes to give up on dialogue and discussion during the workshop between the research participants. Because creating future visions in group setting is deemed impossible in this study, there is a

challenge for me as researcher to combine the visions of all research participants and create a shared future vision that can be seen as a multi-actor construction (Quist et al., 2011).

During my interviews, I have introduced three different exercises to my research participants. The first exercise is to envision their desired future food system for 2050. This is a more general understanding of how they desire the food system to be in the future. In addition, I will ask my research participants to visualize the role they desire for lupin to take in the future food system of 2050. The future is set in 2050 because this allows research participants to imagine a food system that is not limited by the structures of today's food systems. They will use a simplified version of the visualization of a food system by Van Berkum et al. (2018) to visualize and map their normative vision for the future, both for the food system in general as for the role of lupin within this food system (see figure 2). The results of these two exercises form the data for my first sub-question, namely: how do experts envision their desired future food system and the potential of lupin in the Dutch food system in 2050? Finally, I will ask for the steps that need to be taken to realize this future. I will ask for steps in the long term (2040-2050), medium term (2030-2040) and the short term (2022-2030) (see figure 3).

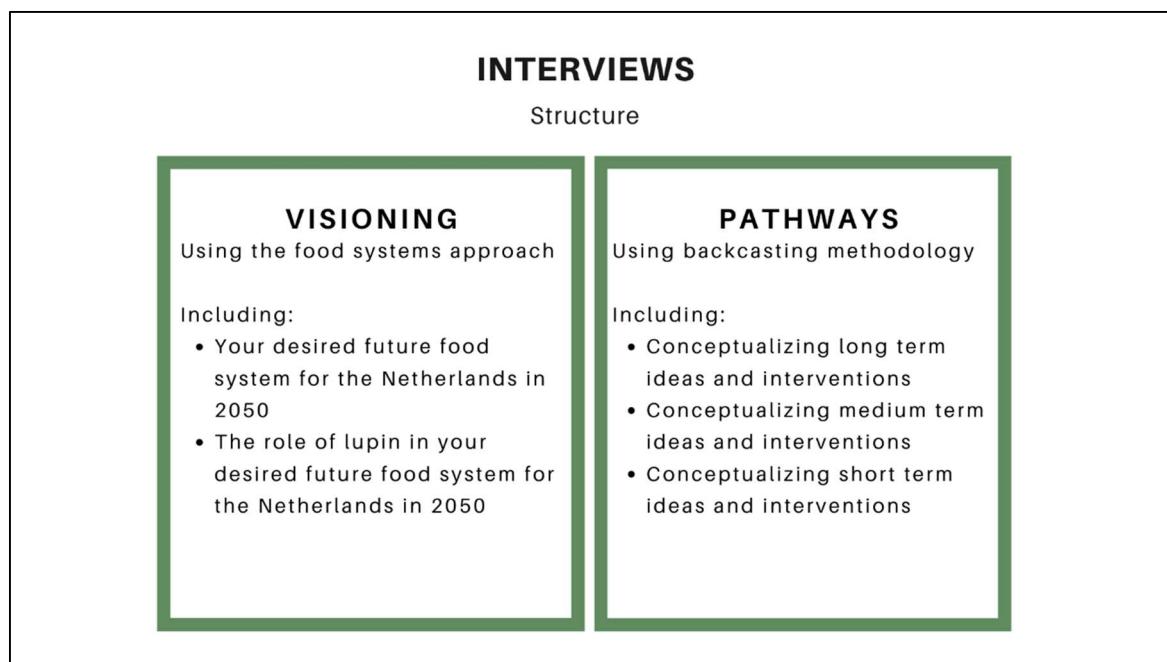


Figure 4 – Interview structure

3.3 Data analysis methods

The data collected through the participatory expert interviews has been analyzed in the following ways. I firstly transcribed the recordings that I made from the interviews. After this, I started to analyze this data in excel. I considered the data for the first sub-question, concerning the visioning exercise, and the data for the second sub-question, concerning the pathways exercise separately.

3.3.1 The visions

For the data concerning the visioning exercise that answers the first sub-question of this study, I grouped the data according to the food system elements of activities, drivers and outcomes. Each experts wrote down specific arguments for each sections of the food system framework. These arguments were brought together in excel and grouped per element of the food system. I created an overview of these main arguments, accompanied by the expert who mentioned it and their explanation from the transcript of the interview. The main arguments and explanations were used to inductively code and subcode the different themes that were mentioned for each element of the food system. This created a coding structure for the food system activities, the socio-economic drivers, the environmental drivers and the food system outcomes which ultimately forms the structure through which the result chapter of this sub-question will be written.

3.3.2 The pathways

For the data concerning the pathways exercise that answers the second sub-question of this study, Each expert wrote down specific ideas and interventions per term. I created an overview in excel of the main ideas and interventions, accompanied by who mentioned it and their explanation from the transcript of the interview. These ideas and interactions were brought together and were firstly coded according to the term they were mentioned in. The subcodes were created inductively and overlapped between the three terms. This created a coding structure involving the short term, medium term and long term and overlapping themes in the ideas and interventions that were mentioned. This ultimately forms the structure through which the result chapter of this sub-question will be written.

CHAPTER 4: THEORETICAL FRAMEWORK

The purpose of this study is to imagine desired futures and to make them real by designing the pathways towards these desired futures, supporting the potential of sustainable food system transformation in the Netherlands. In this theoretical framework, I want to highlight the idea of desired futures. Imagining desired futures is something we all do and have been doing for centuries. According to Sargent (2010), "people have always been dissatisfied with the conditions of their lives and have created visions of a better [...] life" (Sargent, 2010, p.4). In order to understand the idea of desired futures better, I introduce the concept of utopias.

According to Levitas (2010), utopias involve the imagining of a state of being in which problems which confront us are removed or resolved. They express and explore what is desired: a better way of being. These desires may be realistic or unrealistic, and may also change over time. Utopian thinking means to imagine a reconstruction of society (Levitas, 2010). As Sargent beautifully describes it: utopianism is social dreaming (Sargent, 2015). Utopias compare life in the present with life in this reconstructed society and use this comparison to highlight what is wrong with society now and to suggest what needs to be done to improve (Sargent, 2010). Utopias can thus be a critical tool for highlighting the limitations of the organization of our current society and it facilitates holistic thinking about other possible futures (Levitas, 2010).

There are two types of utopias that can be distinguished. Firstly, there are *imaginary utopias* which describes utopian thinking that seeks possibilities in pure novelty and looking beyond what we already know. Secondly, there are *real utopias*. This term is coined by Wright (2009) to describe the hidden, disproved, downplayed and/or neglected elements of our current situation in order to highlight the multiplicity of possibilities. As argued by Brower (2013), the utopian ideals that we are looking for might already be around us. Instead of envisioning a totally new and different world, we should look for utopian ideals that are hidden in our current society and make them visible (Brower, 2013). Imagining better futures can thus come from seeking possibilities outside the realm of what we know, but also from seeking possibilities in the often hidden aspects of our current situations.

Utopian thinking contributes to rebuilding a sense of possibility for social change and transformation (Wright, 2009). It is an ideal method for considering futures, especially in terms of food, given the radical changes that are needed to transform our food systems (Beck, 2018). In coining the concept of *food utopias*, Stock, Carolan and Rosin (2015) argue that we need look beyond our dominant narratives of doing food and that we need to consider multiple ways of thinking about food. Here, utopian stories of food futures can help to facilitate food system transformation by starting a dialogue on what the future of the food system should look like (Stock et al., 2015). The concept of food utopias is introduced to reveal critiques on our current dominant food narratives, while also wanting to share the new ideas of doing food and thinking about food. According to Stock et al. (2015, p.5), "food utopias are a tool of dialogue and communication that recognizes problems, but leaves hope and possibility open for discussion". Here, three layers of functions of food utopias are recognized.

Firstly, food utopias can contribute to critiquing and decentering conventional food narratives. This function of food utopias relates to the idea of real utopias, where we look at our current organization of society, identify what could be done better and look at the possibilities within this current system to change it. Hereby, utopia thus puts in question what currently exists and helps us to critique this, not for the sake of being critical but to promote and make visible the possibilities for difference.

Secondly, food utopias can help to portray experiments of where people think differently about food and where food is done differently. This experimentation aims to "change engagements and making new configurations of people and things possible" (Stock et al., 2015, p.8). What is important in the idea of experimentation is that the value of experimentation is not in the results but in the creation of visions and possibilities. It has even been argued that realizing an utopian idea is unwanted, because it ends the ongoing dialogue and experimentation about what we want the future to look like.

Thirdly, food utopias highlight that the practice of food and doing food differently is an often messy and indeterminate process. If we look at the world as a constant state of process with no predetermined outcomes, we are able to see many possible futures. The idea of food utopias to focus on the process relates strongly to arguments that

experimentation is not about the results but about making different futures visible and thereby possible. This emphasis on process “recognizes that new ideas and experiments coming from the margins of society need space to incubate” (Stock et al., 2015, p.10). We should thus not only continue to tell the stories of new food possibilities, but also help to keep them alive by rooting them in our societies.

In this study, I will explore the desired visions for the role of lupin in the Dutch food system of 2050 and the pathways towards these visions. I will analyze whether and how these visions for the potential of lupin can be understood as food utopia. In addition, I will look at how the concept of food utopias helps to better understand the value of these visions for sustainable food system transformation in the Netherlands. The concept of food utopias will thus be used as a tool to discuss the future of the Dutch food system and the specific role that lupin can play in this future.

CHAPTER 5: VISIONS OF THE 2050 FOOD SYSTEM

This chapter will present an overview of the results gathered by data collection in this study, and will give the answer to the first sub-question posed, namely: how do experts envision their desired future food system and the potential of lupin in the Dutch food system in 2050? This question involves the general vision of the desired Dutch food system in 2050, as well as the specific role of lupin within this future food system vision. The data in this chapter is presented along the division of elements that form a food system such as described in the methodological framework of this study. The chapter will start by describing the food system activities, followed by the food system drivers and the food system outcomes. For each element, I will elaborate on the main issues mentioned by research participants. In chapter 7, the discussion, I will critically engage with these results and link them to the concept of *food utopias* and the *food system framework*.

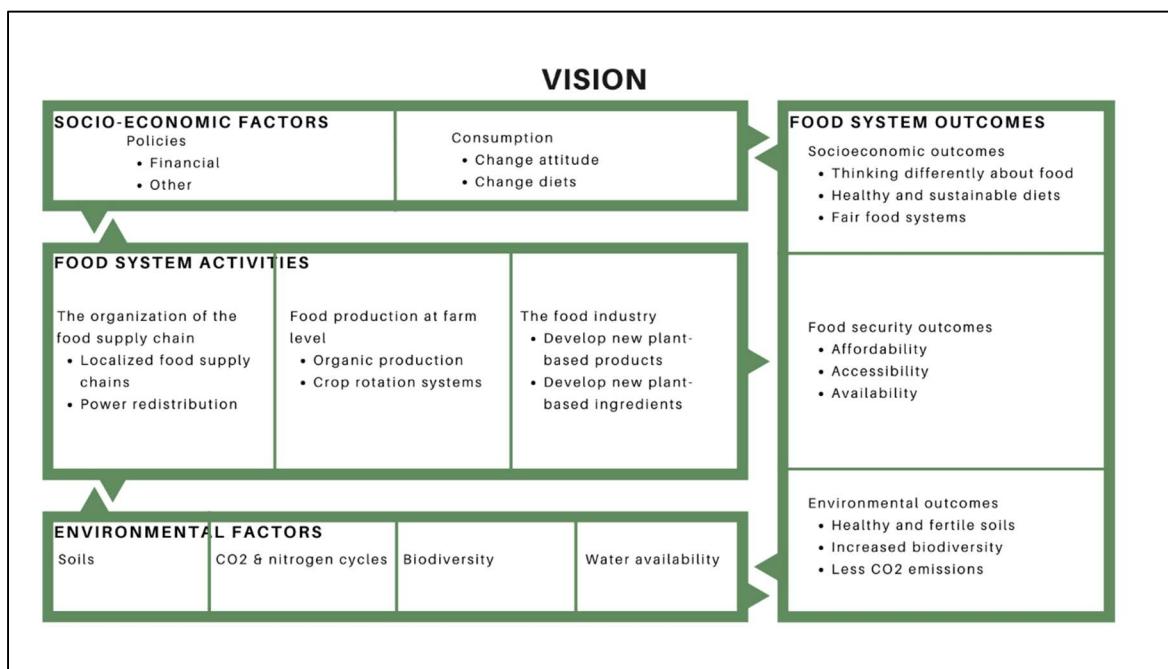


Figure 5 – Food system vision

5.1 Food system activities

Asking experts for desired food system activities in 2050 has brought three main categories to which their ideas can be ascribed. The first category involves the actual organization of the supply chain and how this could and should be improved in 2050. The second category involves the activities during food production on farm level, highlighting the ways that agricultural practices can be improved. Finally, the last category is focused on the food industry and the improvements that could and should be made at the level of product development, specifically for legumes including lupin.

5.1.1 The organization of the food supply chain

This section of the chapter focusses on the issues raised by experts concerning the organization of the food supply chain. An issue that was often mentioned in the participatory interviews included the idea of more localized food supply chains.

Three reasons for the importance of more localized food supply chains were given. Firstly, localized food supply chains can improve the health of the earth in the sense of environmental sustainability. As explained by P5, this is about the amount of food miles that are covered while transporting food products over large distances. This can be significantly reduced if consumers consume products that are produced more nearby. Moreover, it has been argued that localized food supply chains would also benefit human health. According to P3, localized food supply chains could mean that less processing of food is involved and that the food consumed is more fresh if it is bought directly from producers nearby. And finally, a third reason for more localized food supply chains is that it has a positive impact on food security. If more local food is produced and consumed, this means that the Dutch food system is less dependent on import of food products from other countries in the world. Currently, the war in Ukraine influences the food supply chains of many other places in the world that are depending on agricultural produce from this country. If production and consumption is more locally organized, dependence on political systems and consequences from other possible shocks will not affect the Dutch food system. This is ought to have a positive effect on food security.

Localized food supply chains are thus seen as an important part of the desired future food system of the Netherlands. For P1, this makes much more sense than the globalized food

supply chains that shapes our current food system: they explain that currently a lot of food produced in the Netherlands is exported, while same type of food product is also imported from other countries. Localized food supply chains will thus also mean that what can be produced here in the Netherlands, should also be eaten here.

The experts express that a shift to more localized food supply chains would need to go hand in hand with a mindset shift for consumers. According to P5, the shift to more localized food systems includes the idea that consumers need to accept that they cannot have every food product available to us at any moment. Consuming more locally sourced products involves that consumers eat more of what the land and climate in the Netherlands can produce, also with respect to the seasons. The experts acknowledge that there is a big step needed in the mindset of consumers to accept this change in availability of food supply, because they have grown accustomed to having every food product available to them at any moment. Additionally, the shift to more localized food supply chains aligns with more interaction between consumer and producer. This allows for dialogues between consumer and producer where the unavailability of certain products or the prices of food can be discussed. People currently have a disconnection between them and the way their food is made. P5 states: *"The increased interaction between consumer and producer will lead to more understanding and appreciation of our food."*

Next to organizing the food supply chain in a more localized way, the experts raised their concerns about the inequality of power that currently influences food supply chains. According to P6, a key problem in current food supply chains is power concentration. Although there is a great amount of diverse producers and consumers in current food supply chains, the amount of actors that operate between them is only little and not very diversified. Therefore, these actors hold a lot of power and control over what happens in the food supply chain. The experts express that localization can play an important role in redistributing power between food chain actors. Distributors, for example, currently have a lot of power, while providing farmers with just a marginal profit. As mentioned by P2, supermarkets currently earn more money on food than farmers, while it is the farmers that do all the work of producing the food. The experts believe that if food supply chains

are more localized, these logistical actors become less apparent and hopefully this will redistribute power and profit in food supply chains.

Because lupin can be produced in the Dutch climate, the idea of localized food supply chains for lupin is very much possible. Lupin can be produced in the Netherlands, and should thus be eaten here. The question then arises, how can this be produced in the most optimal way?

5.1.2 Food production on farm level

This section of the chapter organizes and shows the ideas of experts concerning the activities of food production on farm level. Most importantly, experts mention the importance of organic food production and crop rotation in agricultural practices.

Firstly, a common understanding among the experts is that the future should encompass organic food production. The standard of food production in 2050 (and hopefully already before that) should be to produce food without chemical fertilizers and pesticides. Lupin fits into this idea because it can be produced in an organic way. If lupin remains to be produced in an organic way, then the environmental impact of production remains low and it has the potential to positively contribute to environmental factors. Organic lupin production should thus be the standard. The lupin that is currently produced by farmers associated with Lekker Lupine all produce in an organic way and even have a Demeter certification, meaning that the lupin is produced according to strict guidelines for biodynamic agriculture. However, as importantly mentioned by P4, it is not only lupin but preferably all plant-based food should be produced this way, without the use of chemical fertilizers. An interesting solution mentioned by P7 shows the links to circularity in agriculture. They argue that instead of using chemical fertilizer and pesticides, regional resource exchange systems based on the ideas of circular agriculture could help to share waste products which functions as natural fertilizer for others.

An often mentioned second issue related to food production on farm level is the need to step away from current monocultures and prefers a shift to more extensive agriculture and more crop rotation. According to P3, depleted soil is one of the major issues that the Dutch agricultural system is facing today. The main reason for promoting more crop

rotation is the health of the soil that is currently dealing with destructive agricultural practices of monocultures and the application of lots of chemical fertilizer. Producing a larger diversity of crops on the land will allow the soil to recover more slowly from agricultural activity. According to P7, agricultural production today often crosses the boundaries of what soils are able to sustain. Therefore, as described by P7, a crop rotation system is needed that does not work at the limit of what the soil can sustain. P3 argues that leguminous crops, such as lupin, would fit very well in crop rotation systems because they are nitrogen fixing crops that can enrich and thereby improve the soils. Experts thus acknowledge that there is a great opportunity for lupin and other leguminous crops to contribute to soil health by being incorporated in crop rotation systems.

Changing the methods of agricultural production on farm-level will require some help. Although the pathways towards these visions will be elaborately explained in chapter 6 of this study, it is appropriate here to shortly write about the enabling environment of these ideas and to focus on what is needed in order to make these methods a reality. Two important conditions are mentioned by the experts. The first condition is research. According to P2, it is necessary to stimulate continuous research into agricultural production and finding the right varieties and methods to produce plant-based foods in a sustainable way. For lupin specifically, this includes researching the breeding of varieties and finding the right variety to grow in the Dutch climate which is able to grow optimally in an organic way. Secondly, P7 mentions that farmers currently often produce in the way they do for economic reasons. P3 supports this by arguing that farmers produce in the way they do because it is the most profitable option. Growing crops in monocultures and hereby destructing soils is currently more profitable than engaging in more elaborate crop rotation systems. The experts thus express that compensation for farmers should be organized in a way that they benefit from keeping their soils healthy, instead of destructing their soils by agricultural production.

5.1.3. The food industry

Moving forward in the food supply chain, there is the food industry. With this, I especially mean the activities to make agricultural products into processed products. Although some experts have argued that this part of the food supply chain needs to be decreased in order

to realize more localized food supply chains and contribute to increased human health, improvements in the food industry do have the opportunity to help consumers to eat more plant-based food such as leguminous products. Issues that were raised by experts involving the food industry were to develop ingredients and products out of leguminous products and specifically lupin.

According to P3, ingredient and product development in the food industry for legumes is almost exclusively focused on soy, mostly because it is cheaper than other legumes. Examples of products made from soy are tempeh, miso or soy sauce, which are all made with specific fermentation methods. However, as argued by P5, it would be better to work with a diversity of legumes in product development in order to reduce our reliance on soy and thereby reduce the food miles of import. P5 expresses that lupin is quite near to soy if considering the product characteristics and can be grown locally, so it would be worth it to involve lupin more in ingredient and product development. This same argument is shared by P3. They explain how legumes should be used in ingredient development, such as to develop flour, proteins, fibers and starch, and to use this in different products. Currently you already see that lupin flour is used in bread, and that lupin proteins are used in meat replacements. P5 says about this: *"I think lupin has a lot of potential for being incorporated in composite foods. You can add it into nutritional drinks and lupine flour can be easily put into bread. So, fortification of foods with lupin ingredients is important."* According to P3, the knowledge to create ingredients from lupin is complex, but available. However, there is no stable amount of produce available yet for innovation and to develop these ingredients on a large scale.

In addition, mentioned by several experts, it is not only ingredients that should be made from lupin, but also new types of products. Interestingly mentioned by P8, plant-based protein products are currently often made to replace meat and dairy. Therefore, they argue to also think outside the box in that sense to develop plant-based products that are not necessarily meant to replace meat or dairy. At Smaakpark in Ede, there is currently a lot of research done into making a cream cheese spread from lupin using fermentation techniques. P3 adds to this the examples of creating health food products or snacks with legumes such as lupin.

5.2 Socioeconomic drivers

The ideas about the socioeconomic drivers mentioned by the experts can be categorized in policy-related factors and consumption-related factors.

5.2.1. Policies

Many issues mentioned by the experts when discussing socioeconomic drivers were about certain policies that should be in place to optimize the functioning of the food system. A main point here is to improve the economic status of farmers and to link this to positive contributions to the environment. According to the experts, if policies and subsidies are organized this way, it would be financially beneficial to produce food in an environmentally sustainable way. P1 links this to the current situation where they explain how on a European level subsidies are focused on animal-based food production. This does not support farmers to switch to more plant-based food production and thus at the same time does not promote to produce in an environmentally sustainable way. The experts argue that this should be reversed: these subsidies should promote plant-based food production in an environmentally sustainable way.

On another note, many policy-related ideas raised in the interviews focus on the ability for everyone to consume healthy and sustainable food, thus increasing food security. The experts envision a great role for policy here. This involves, for example, ensuring that every consumer has sufficient income to buy healthy and sustainable food. However, other examples were making healthy food cheaper and making unhealthy food more expensive by using taxes and subsidies so that it becomes the affordable option to buy healthy food. On the other hand, true pricing is also mentioned as an important initiative here. This involves incorporating the true costs of production in the consumer price, especially considering the environmental impact of production.

Finally, the experts express an important role for the government in facilitating food education and influencing food consumption through campaigns, but also at schools. The question then remains how experts envision consumption, consumer attitudes and their diets?

5.2.2. Consumption

This section of the chapter can be divided between consumer attitudes towards food and their actual diets. It was already mentioned in chapter 5.1.1 that it is important for consumers to accept that the availability of products may differ if we commit to more localized food supply chains. However, this is not the only change in consumers' mindset that the experts have introduced in the interviews. According to P4, consumers have the biggest role in changing the food systems. If they change their attitudes and habits, the whole food system changes accordingly. Subsequently, P4 argues that consumers have to take responsibility to change the food system for the better. This requires awareness of what food production does to our soils, climate and biodiversity. Interaction between producer and consumer may help to increase this awareness, if it will lead to better communication about what farmers can provide based on their land and why.

The experts thus express that consumers need to think differently about our food, and they need to act accordingly. The ideas described in chapter 5.1.2 show the desired ways of food production in the future. The question then remains: what types of food should be produced and consumed? The experts are unanimous in that consumers should consume more plant-based foods instead of animal-based foods. This is not only more environmentally sustainable from the perspective of food production, but it is also more healthy to the consumer. It has been recognized, for example by P7, that eating meat does not necessarily have to be bad. It is more about the way that animal-based foods are produced right now that it becomes unsustainable. This aligns with the arguments for animal welfare in animal-based production, summarized by P7. They express that the ways meat is produced at the moment does not make sense ethically, because a live animal is used to produce proteins for human consumption.

An interesting argument from P6 that connects production and consumption is about the need for diversification. As mentioned above, sustainable food production methods involve leaving monocultures behind and employing crop rotation systems. This diversifies the crops that are produced. However, if you think about healthy eating, this is also linked to eating more diverse. This aligns with ideas to produce and consume more

leguminous crops, such as lupin, which improves biodiversity in agricultural production and involves a more healthy diet for the consumer.

The experts argue that changing the way consumers eat thus means that it should become the norm to eat plant-based proteins instead of meat. This requires consumer acceptance to eating differently. According to the experts, what helps here is to make available recipes that show how consumers can prepare, cook and eat with more plant-based products. Because lupin is fairly unknown to consumers, P7 proposes that it could also help to include it in ready-to-use packages such as Knorr Wereldgerechten and the Verspakketen that are gaining more popularity in Dutch supermarkets. According to P7, these ready-to-use packages take away the effort for the consumer to learn how to cook with new products, by providing instructions and having the products already incorporated in their recipes.

5.3 Environmental drivers

When identifying the environmental drivers, they should be considered as influencing the food system activities, but also as being influenced by the food system outcomes. Therefore, the environmental drivers are formulated in a neutral way. The food system activities are influenced by the state of the soil, the availability of water and the climate. On the other hand, the state of the soil, the availability of water and the climate do depend on what happens in the rest of the food system. The food system activities influence how, for example, the soil is treated and water is managed during agricultural production systems. This leads to certain outcomes which can be formulated in subjective terms, such as having more healthy and fertile soils. These outcomes influence the state of the soil as environmental driver, which then also again influences what happens in agricultural production. A couple of experts have, however, formulated the environmental drivers in subjective ways, which are thus actually more the food system outcomes. The environmental drivers that are mentioned by the experts are thus the level of biodiversity, the level of emissions of CO₂, the level of nitrogen, the state of the soil and the availability of water. In chapter 5.4.3 of this study, the environmental outcomes will be presented. Although they are quite similar to the environmental drivers in this section of the chapter, the environmental outcomes show what actually happens with the levels and states of the environmental drivers.

5.4 Food system outcomes

According to van Berkum et al. (2018) the food system outcomes consist of food security outcomes, socioeconomic outcomes and environmental outcomes. This will also be how this section of the chapter is organized. The main themes that will be discussed in this section will thus relate to food security, socioeconomic outcomes such as consumption and environmental outcomes.

5.4.1 Food security outcomes

Simply put, experts envision the food security outcomes as the availability, accessibility and affordability of healthy and sustainable food. In the food system activities and the food system drivers parts of this results section, activities and drivers have been mentioned that should lead to more food security. These were for example the economic policies that should make it more financially attractive to consume healthy and sustainable food, but also the idea of localized food supply chains should increase food security and thereby contributes to improved food security outcomes.

5.4.2. Socioeconomic outcomes

Socioeconomic outcomes mentioned by the experts often related to food consumption. This can be distinguished in what consumers eat and how consumers think about the food they do or do not eat. Considering what people should eat, there are three main categories made by the experts. It is interesting to see that lupin fits into each category.

Firstly, there is consensus among experts that consumers should eat more plant-based foods and less animal-based foods. Currently, our diets consists of 40% plant-based foods and 60% animal-based foods. The experts argue that this division should be reversed in 2030. So, that a consumption pattern of 60% plant-based foods and 40% animal-based foods can be realized. To go a step further, 2050 should thus involve a 70% plant-based and 30% animal-based division according to P1, and P3 even argues for a 80%-20% division. It is thus recognized by the experts that animals do have a role in the food system, but that their role should be conceptualized from the idea of circularity in the food system. For example, as mentioned by P7, the role of animals in the food system can be to take care of side streams of plant-based food production. As mentioned before,

within the range of plant-based food, there should also be more diversity in the types of crops that are consumed. According to P5, lupin has the potential to replace animal-based protein sources and can thus play a role in the transition towards more plant-based food consumption. Because it is not consumed a lot yet, it can also help to diversify plant-based production and diets.

Secondly, experts have argued that people should eat more healthily, because healthy food is the basis of healthy people. Although eating more plant-based foods and a larger diversity in diets are great examples of this, other ideas that have been introduced to eat more healthily is to consume more whole foods. In 2050 the food system should be organized in a way that consumption focused on more whole foods and less processed foods. This is quite difficult, according to P3. It might be more complicated for consumers to prepare whole foods and cook with them, but more importantly the food system is organized in a way that the food industry gains their profit from processing foods. If you are involved in the whole foods industry, there is less profit to be made. However, whole food consumption is more healthy than processed food consumption and should thus become a standard in 2050. Lupin can also fit into this argument because it can and is already consumed as a whole foods product.

Finally, experts have argued that food production and consumption should be organized on a local scale. This has been elaborated in chapter 5.1. The role that lupin can play in this localized food supply chains is that it can be produced locally and therefore be consumed in the Netherlands as well, as expressed by the experts. P5 argues that Lekker Lupine plays an important role in this, by connecting all different actors in the lupin supply chain and by creating a community of local actors that work together to increase lupin production and consumption.

According to the experts, people should not only consume differently, but think about food and consumption in different ways. With more localized food supply chains and increased food education, the connection to food and food production improves in general. The experts argue that consumers should become more aware of where food is coming from, how it is produced and who produced it. This way, they become more accepting of the unavailability of certain products and may learn to eat more uncommon

foods. Yet, it has also been argued by P4 that consumers could be integrated more in production. The idea has been raised that argues for the need of consumer owning systems or that consumers become shareholders of the farm. P4 sees a future in which farms will be operated by farmers, who work for the consumer. This way the consumer influences what happens on the farm and hopefully takes its responsibility. In addition, and this relates to lupin, the consumer needs to make plant-based diets the norm and lupin should be consider a standard in a (plant-based) diet.

Moreover, when discussing food system outcomes, many discussions revolve around fair food systems. Fair is here defined by the experts in terms of money. P2, for example, argues that currently supermarkets and retailers get a lot of money, while farmers do not. They argue that fair food systems should thus encompass equal shares, but also equal risks, while currently, farmers have all the risks. Other descriptions of fair food systems are given by P6. They describe fair food systems as getting a good price for producing food, giving a fair wage to all people who work in food chains and having good food available everywhere for everyone. The argument for fair food systems also relate back to fair compensation for farmers.

5.4.3 Environmental outcomes

Many environmental outcomes have been identified by experts when questioning their desired future food system of 2050. A first environmental outcome is related to the soil. P3 has argued that the soils in the Netherlands are currently in a bad state due to intensive agriculture, monocultures and the use of chemical fertilizers. As mentioned in chapter 5.3, the state of the soil is an important great factor in agricultural production, because it affects farmers productivity. In 2050, the desired state of the soils is thus to achieve improved soil health. According to the experts, food system activities that could contribute to this are organic farming and crop rotation systems. Inherent to this, the experts have identified the idea of more biodiversity to keep the soils healthy. They also argue that leguminous crops specifically can play a role in enhancing soil health through their nitrogen fixating capacities. Thus, the food system activities proposed by the experts will lead to improved soil health and fertility as environmental food system outcomes. Increased biodiversity is also mentioned as a separate outcome when considering food

system outcomes. According to P1, biodiversity is the largest planetary boundary that the system is crossing in our current society. Growing various crops contributes to biodiversity, soil health and human health if this crop diversity is translated into our diets. According to P4, because lupin is a leguminous crop, this means that it is a flowering plant which also is beneficial to insects and therefore contributes to more biodiversity in that sense as well. Another important outcome mentioned by P5 is the amount of Co2 emissions related to food production and consumption. They argue that if locally sourced lupin is consumed for example instead of soy, this means there is a decrease of food miles and Co2 emissions involved.

CHAPTER 6: PATHWAYS TO THE ENVISIONED 2050 FOOD SYSTEM

The following chapter engages with the second sub-question of this study, namely: how do experts conceptualize the pathways to realize the future of lupin in the Dutch food system? This chapter shows the results of the third exercise of the expert interviews, where I have asked the experts to identify short term, medium term and long term interventions to realize their desired future food system of 2050. This chapter will therefore be organized accordingly, describing the main ideas and interventions mentioned in respectively the short term, medium term and long term.

6.1 Short term

This section of the chapter gives a thematic overview of ideas and interventions proposed to realize desired visions of the future food system in the short term. Specific themes that are mentioned to focus on in the short term are the food environment, policies, and food production (see figure 6).

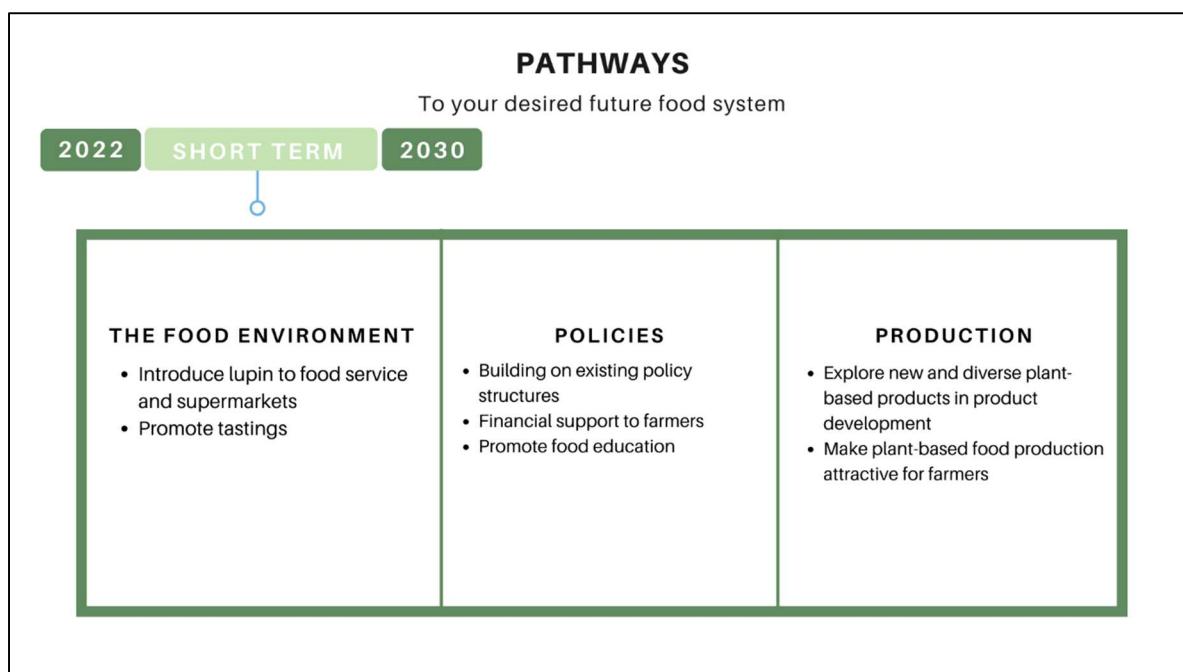


Figure 6 – Short term ideas and interventions

6.1.1 The food environment

According to the experts, an important first step to be taken in order to realize the visions described in chapter 5 is to get lupin on the plate of the consumer. An interesting way proposed by the experts to achieve this is to focus on the food environment. According to P2 and P5, lupin needs to be introduced to chefs, accompanied by information and tips on how to prepare it and how it can be incorporated in meals. They believe this will result in more vegetarian and vegan meal options in restaurants. The experts argue that consumers then will be able to get to know lupin in these environments and will be able to taste it in a comfortable setting. Other ideas mentioned by the experts to get consumers familiar with lupin is to encourage catering companies to use it, or to introduce lupin at events.

The idea to let consumers taste lupin is supported by P3 who recognizes that tastings can be a very effective tool to change consumers habits. They argue that, currently, there is a lot of marketing involved to get consumers to eat different foods which often focusses on visual methods or expressing arguments to consume specific foods. However, P3 is certain that it is with tastings that people can actually be convinced to like a food product and to buy it again themselves.

What is also related to the food environment is that the experts argue that lupin needs to be introduced and become more visible in supermarkets. According to P7, it is important to start with introducing lupin in supermarkets in the bigger cities in the Netherlands where the shift to more plant-based foods has already started. They argue that, over time, it can be introduced in the rest of the Netherlands, when the shift to more plant-based foods also spreads geographically over the rest of the country.

6.1.2 Policies

The experts interviewed have recognized that the shift to their desired future food systems will require some policy shifts as well. This section of the chapter therefore explores the different policy interventions that were proposed for the short term. P1 builds on existing policy structures that can facilitate the pathway to their desired future food systems. An important existing policy structure that is introduced at European level is the farm to fork strategy. P1 acknowledges that giving people information about healthy

food consumption unfortunately is not enough to get them to make healthy food choices. Therefore, P1 argues that the farm to fork strategy can play a role in changing the food environment to stimulate more healthy food choices, and that food policy should be implemented not only on this European level, but also on national, regional and even local levels. Another existing policy structure that P1 believes can help facilitate a desired future food system is the NPS. This is currently in progress, and should involve and promote the division of 60% plant-based and 40% animal-based food production and consumption.

A set of policies that has been mentioned before in this report is the (financial) support for farmers to grow more plant-based proteins including lupin. However, the experts believe that other initiatives such as Lekker Lupine also need to get government support in order to continue their work to inspire and connect the actors in food supply chains and to stimulate them to work together.

In order to get people connected to their food again, the experts identify a role for the government to facilitate food education. P6 argues for food education for every child in order to teach them where food comes from, who produces it and how it is produced, but also how to prepare food and how to make meals from certain products that might be uncommon or unknown. But the experts believe that also in higher levels of education, food can play an important role in the curriculum. It has been argued by P4 and P6 that that food should also be included in medicine studies, as good food is the basis for healthy people.

6.1.3 Food production

A third theme that has been mentioned in ideas and interventions to achieve desired future food systems is that of food production, not only on farm level but also in the food industry relating to product development. From the perspective of product development, P5 expresses that it is important that in the short term, there is a need for companies and maybe also restaurants that pave the way and explore what can be done with lupin in the sense of developing meals and new products. They believe it is important here to focus on diversification: there is a need for more varieties in the types of products that are developed with a diversity of plant-based products including lupin. At the same time, it is

also necessary to create and share more diverse recipes that include plant-based foods and that can show what to do with lupin. This is argued by P7 and P8.

On a farm level, the experts argue that it needs to be feasible and attractive for farmers to produce plant-based foods. P1 recognizes that, in the Netherlands, we are already quite good at producing protein and we can use this knowledge to make money out of plant-based protein production. Also, the experts believe there is an important role for farmers to start growing lupin because this contributes to research on lupin breeding and varieties, as well as spreading the word on lupin as new crop to grow and consume, hereby involving in storytelling.

6.1.4 Research

A last theme that has been mentioned is research. Experts realize that there is a lot to research about different aspects related to the production and consumption of lupin, and in general to realize their desired future food systems. A first research topic mentioned is on the varieties of lupin. P2 recognizes the importance to keep researching the ideal varieties of lupin to grow in the Dutch climate and on Dutch soils that function well without the use of chemical fertilizers and pesticides. Secondly, research has to be done in the potential for regional resource exchange systems that stimulate circular food production. This is an idea promoted by P7 which involves connecting food producers in new ways and understanding how their products and waste products can be able to help each other. Finally, P3 and P5 express that research from the perspective of product development should continue and for example focus on the functional properties of lupin proteins.

6.2 Medium term

The ideas and interventions described above can be seen as the first steps that needs to be taken in order to realize the desired future food systems that have been designed by the experts and are described in chapter 5. In the following section, I will focus on the medium term ideas and interventions that have been proposed. Often, these follow logically from the ideas and interventions that have been proposed in the short term. Therefore, largely the same themes that were mentioned in the short term section will also be structuring this section of the chapter, namely the food environment, policy and food production (see figure 7).

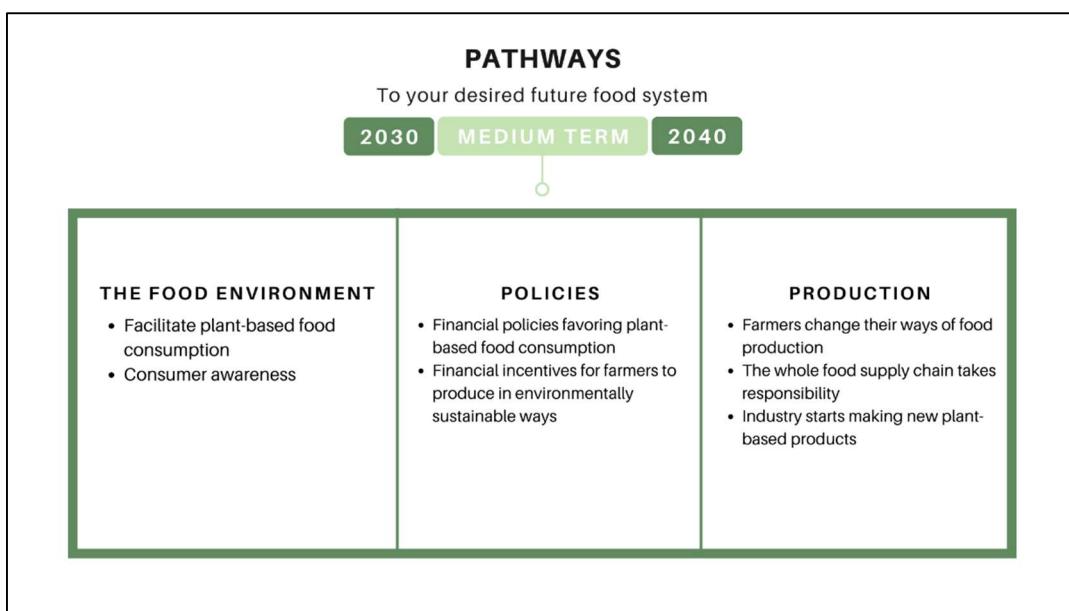


Figure 7 – Medium term ideas and interventions

6.2.1 The food environment

If compared by the short term, the experts believe that the food environment in the medium term should be facilitating a plant-based diet even more. Where it is considered that the food environment stimulates plant-based food consumption, so should the food environment offer locally sourced products in order to further stimulate local food consumption. P1 argues that the food environment should stimulate a division of 70% plant-based food and 30% animal-based food. They believe this should include more plant-based options in supermarkets, as well as in restaurants. In the case of lupin, this means that lupin becomes available in more and more supermarkets in the Netherlands

and, for example, that large meat aisles will become smaller and smaller, supported by consumers, as argued by P7. On the other hand, if considering restaurants, the experts express that the medium term should involve not only vegetarian or vegan meal options, but the standard becomes that restaurants appear that are solely offering vegetarian or vegan options. Simultaneously, according to the experts, the increase of plant-based food in the food environment means that the consumer should be aware of the importance of this shift. This involves awareness of their health and of the health effects of certain products, but also in the sense of environmental sustainability. As P1 puts it, the food environment will change according to the demand of the consumer. If they ask for more plant-based foods, then the food environment will change accordingly.

6.2.2 Policies

Multiple experts have recognized that just giving consumers information about what is healthy and sustainable food is not enough to change their behavior and food habits. This requires a governmental role in order to change the food environment as described above. This can involve regulations or subsidies on different governmental levels. Another governmental role that is proposed by the experts in order to stimulate healthy and sustainable food choices is to increase the prices of unhealthy foods and to lower the prices of healthy food. Here, food security is increased by improving the affordability of healthy and sustainable food. On the other hand, another policies that is able to improve the affordability of healthy and sustainable food is simply to raise incomes, as mentioned by P6. Yet, this does not necessarily mean that healthy and sustainable food is consumed, but it does raise the capability to consume it. Again, the argument has been coined to make it financially attractive to farmers to produce in a climate-friendly way. Farmers should have good economic status in the medium term, and this should be related to getting paid for what they produce, but also to their positive impact on the environment. According to P1, it needs to be attractive to produce in a climate-friendly way. They argue that, hopefully, financial incentives and increased social pressure will make farmers switch to more climate-friendly ways of producing. This includes producing more leguminous crops and earning a fair income for these products. This idea is shared by P8 who argues to focus on developing business models in the whole food supply chain

6.2.3 Food production

In terms of food production, production of farm level and on the level of industry is considered. What is importantly mentioned by the experts is that the market should be familiarized with lupin and lupin-based products due to the activities of some smaller food producers. As explained by P5, in the medium term there is a need for small scale producers that are making lupin-based products in such a way that they simultaneously explain the story of lupin, including to share the arguments of why lupin is important. P5 accordingly believes that consumers might notice that they did not used to see this bean but that they see it more often. This helps to plant a seed in their heads and makes them more engaged if they see it again.

According to the experts, it is also important that the medium term involves a shared responsibility of sustainable production in the whole food supply chain. This involves not only the food producers such as farmers, but also retail actors, governments and other partners. For the government, this means that they regulate sustainable production, whereas other partners have other ways to stimulate this sustainable production. For example, accepting and stimulating true pricing in the whole food supply chain. According to P3, the medium term also means that the strategies of larger companies in the food supply chain change so that values such as health and sustainability become more important.

P4 argues that change on the farm level is depending on changing consumer habits, but also on the farmers themselves. Therefore it is important to educate young farmers properly as well. According to P4, because our agricultural systems are rooted in the traditions of family farming, many young farmers will employ the same activities as their grandparents and will not just change their ways. They believe that there is thus a role for agricultural schools to be more future-forward and to educate young farmers on the risks of current agricultural systems and more sustainable practices.

6.3 Long term

The last section of this chapter displays the long term ideas and interventions to realize desired future food systems in 2050. Often, these ideas and interventions build further on ideas and interventions from the short term and medium term. Therefore the same themes structure this section, namely: the food environment, policies and food production (see figure 8).

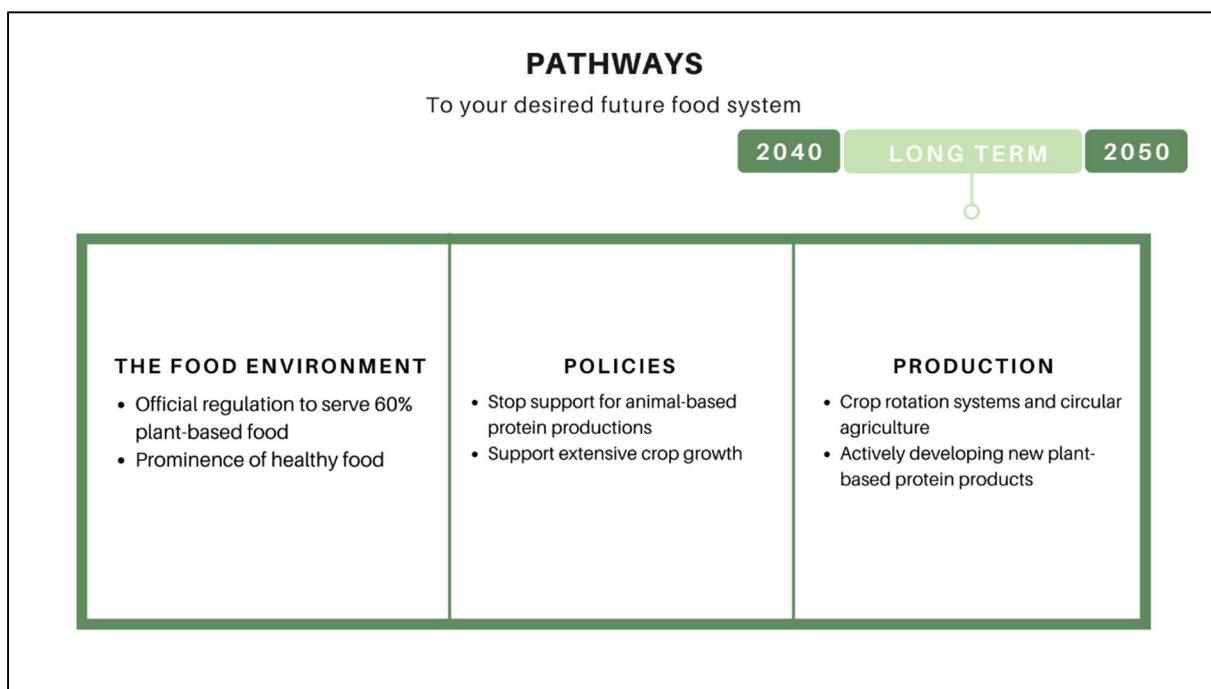


Figure 8 – Long term ideas and interventions

6.3.1 The food environment

In the long term, the experts believe that the food environment should stimulate consumption of at least 60% plant-based products. The 60% plant-based consumption versus 40% animal-based consumption is set by the Dutch government for 2030. Therefore, P3 strives for a 80% plant-based consumption versus 20% animal-based consumption division in 2050 to continue this growing share of plant-based food consumption.

The experts believe this division should be supported by the food environment. According to P7, in the long term, restaurant menus should offer at least 60% plant-based food options. Although this is currently already recommended by the Voedingscentrum and the Lancet, this should be an official recommendation or guideline by the government. P7

recognizes that restaurants are already working on this, but that a top-down push might be what is needed for other restaurants to really commit to this. Next to restaurants, supermarkets should also reflect the increase of plant-based foods by offering a diversity of plant-based foods including lupin, and by abandoning large meat aisles. Although animal-based food such as meat will probably still be sold, the experts believe this should have a smaller share of the supermarket space, definitely when compared with plant-based products. The prominent role of supermarkets in the food environment in 2050 has remained fairly undiscussed. It is desired by the experts that, in the context of localized food supply chains, consumers will buy more and more produce directly from farmers. However, the role of supermarkets remains quite unchallenged and undiscussed.

Lastly, according to the experts, the food environment in the long term should explicitly focus on healthy food. If food education has been executed in the short and medium term, then consumption of healthy and sustainable food will hopefully have been increased in the long term. This should involve more consumption of whole foods, and thereby more healthy people. In addition, P6 recognizes that people should also consider good food as a medicine where the importance of good food for healthy people is realized.

6.3.2 Policies

Although many policies have been proposed in the short term and the medium term, there are still some policy-related ideas and interventions proposed by the experts for the long term. Here the focus is mainly in changing the food environment to a stage as described above. For example, P7 argues that it should be an official regulation that restaurant menus offer at least 60% plant-based foods.

The policies proposed by experts are quite straightforward in the sense that, for example, it is proposed that governments entirely stop their support for animal-based protein production, while fully supporting the production of plant-based proteins. In addition, relating to food production methods, the experts believe that the government should support extensive crop growth instead of the intensive crop growth that happens today. According to P3, it needs to be a first priority that the soil remains fertile and suitable for

crop growth. P3 argues that, in the long term, the government can take this responsibility and support only the farmers and methods that take into account how soils are treated and what the effects of production are if considering the soil.

6.3.3 Food production

In terms of food production, there is a distinction between farm level and industry level production. On the farm level, P8 states that primary producers such as farmers should have healthy and sustainable companies in the long term. The experts believe that, on their farms, farmers employ extensive crop rotation systems that include the production of leguminous crops, including lupin. P2 identifies that continuous research should have resulted in the best variety of lupin to grow in the Netherlands. According to P4, next to improved crop rotation systems, agricultural production is circular, regenerative and requires low inputs, due to practicing organic agriculture. The experts argue that farmers' produce is more and more sold locally, so that the share of localized and sustainable food supply chains is growing. And finally, farmers and other workers in food supply chains are believed to earn a fair income.

On the level of the food industry, the experts express that companies are actively developing new plant-based protein products. Next to protein products, lupin is also used as functional ingredient in other products, replacing for example soy or egg whites, as mentioned by P3 and P5. The experts desire that years of research have given the industry a great understanding of the composition of lupin and the different treatments to it. This will also cause for the larger food processing multinationals to adopt lupin and to offer lupin-based products in their product lines replacing or alongside soy-based products.

CHAPTER 7: DISCUSSION

The results elaborated in chapter 5 and 6 show the desired visions and potential pathways to the role of lupin in the desired future food systems of experts. This chapter aims to link these results to the *food system framework* and the concept of *food utopias*. I aim to critically engage with the data collected by taking into account the food system framework that is central in this study. Moreover, I will analyze whether and how these visions can be understood as food utopia. I will look at how the concept of food utopias helps to better understand the value of these visions for sustainable food system transformation in the Netherlands.

7.1 Food system framework

Using a food system framework in order to study food system transformation definitely has had its advantages. The food system framework used in this study has contributed to the creation of holistic food system visions. The research participants have been engaged in envisioning food systems where different subsystems of the social, the technological, the natural, the cultural, the political and the economic come together. The food system framework has urged participants to think about all the different aspects of food systems instead of to focus on one element or one theme that is relevant in their perspective of food systems. In addition, bringing these visions together moves beyond disciplinary compartmentalization and shows a vision in which a diversity of perspectives to food system challenges is integrated.

However, the data collection and results also have its limitations. Firstly, a disclaimer needs to be given that in order to discuss entire desired food systems in the limited amount of time of the interviews, not every argument could have been elaborated in ways that would have been necessary to really strengthen these statements. Sometimes, the result section has incorporated simplistic arguments that might not be entirely true or lack nuancing to the critical academic reader. However, in order to answer the sub-questions of this research, these statements have been used in the report to show the diversity of ideas that have been mentioned in the interviews with the experts.

A limitation that is directly related to the food system framework that was experienced during the interviews and in the results is that the food system framework unfortunately not always achieved to produce these holistic visions of the food system. Some of the experts struggled to portray their visions as a system, and rather focused on the food system elements of activities, drivers and outcomes separately. Here, the relations between the envisioned activities, drivers and outcomes sometimes failed to be recognized and/or were incoherent. This is unfortunate, given the fact that this is one of the strengths of a food system framework.

Looking at the results of the data collection from the perspective of food system approaches, it is interesting to see the many courses of action for food system transformation. Many actors have been mentioned that could change their course of action in order to support sustainable food system transformation. Table 2 portrays a simplified overview of proposed actions that need to be taken by these actors in order to meet the desired food system based on the ideas by the experts.

Actor	Proposed course of action
Government	Create rules and regulations that aim to shape a healthy and sustainable food system
Food industry	Increase innovation and development for products and ingredients made from a diversity of plant-based protein sources
Food environment (including restaurants and supermarkets)	Offer more healthy and plant-based options
Farmers	Produce more plant-based protein sources in an organic way and integrated in crop rotation systems
Consumers	Consume more healthy and plant-based food

Table 2 – Actors and their proposed course of action

It is interesting to identify that these actions are all connected to each other, perceived from a food system framework perspective. In order for consumers to consume more healthy and plant-based food, they not only need an attitude change, but they also need

the food environment to offer sufficient plant-based food. The food environment can only supply this if farmers and the food industry can provide these products. Here, a cycle arises that has been discussed in many of the interviews. Farmers and the food industry might not produce plant-based products with lupin if there is no consumer demand. However consumer demand can never arise and grow if there is no supply of plant-based products. Yet, instead of focusing on only these market-based solutions of increasing the production or consumption of lupin, a food system approach helps to envision the totality of drivers that influence the food system activities, as well as link these to food system outcomes in order to account for feedback loops and trade-offs. Although the experts have argued that they believe lupin should take a more prominent role in the Dutch food system, from the perspective of a food system framework, this is not as simple as just increasing production and/or consumption of lupin to increase the presence of lupin in the Dutch food system. It is about facilitating this transformation at every level of the food system, considering the drivers, the activities and the outcomes of the food system and how these interrelate in order to reach this desired vision of more lupin in the Dutch food system.

As mentioned before, some of the experts struggled to portray their visions as a system, and rather focused on the food system elements of activities, drivers and outcomes separately. This shows that the experts in the field are not yet engaged as much in systems thinking. They often failed to take a systems approach in introducing their ideas, as well as did not introduce their ideas as being part of a larger system. The ideas that were proposed were all quite specific and sometimes failed to recognize the wider dynamics. Although these ideas can all be considered as pieces to the puzzle, the experts remain from putting the puzzle together. The main takeaway from taking a food system approach in this study might thus be that although the relevance of the food system approach becomes clear in theory, it has not manifested itself in the field yet in order to put it into practice. There is thus a challenge to ensure that systems thinking becomes more apparent in the field, which is where the people are working that might be able to make the changes necessary to support sustainable food system transformation.

7.2 Food utopias

The concept of food utopias can help to consider the potential of lupin for sustainable food system transformation. When linking the desired future food systems of experts to the concept of food utopias, two different subjects of analysis can be found. Firstly, the visions made by the experts separately can be conceptualized as their utopias. However, the combined visions can also be considered as a food utopia, focusing on these shared visions of the potential of lupin for the future of the Dutch food system. The latter will be the subject of this discussion.

Following Stock, Carolan and Rosin (2015), it is not the intention to present the results of this study as a single and only solution to the current problems in our food system. As expressed by P1 and P4, lupin is only one of many possible solutions, and can also be part of other possible solutions to the problems that we are facing in the food system. If solutions are presented as the only option, it does not only get rid of a multiplicity of possibilities but it divides people and cultures. However, if lupin is presented as one of many possible solution, it contributes to diversifying doing and thinking about food by expanding our understandings of what is possible.

If we bring back the three aspects of food utopias, it is interesting to see whether and how these align with the desired futures created by the experts. Beginning with *critique*, it can definitely be argued that the visions created by the experts are based on the critiques that they have on the current organization of our food system. To mention a couple of factors, the experts critique globalized food supply chains, unsustainable food production practices, and low compensation for farmers in general. However, as explained by Stock et al. (2015), the intention of critique as an aspect of food utopias is not meant for the sake of being critical. The function of critique in the light of food utopias is to put forth productive critique that enables other ways of thinking and doing about food. The experts have taken these critiques and used them in order to produce a vision of their desired future food system. For example, it has been argued that in order to make food production more sustainable, we need to take better care of the soil. The idea of more elaborate crop rotation systems and a transition to organic food production was often mentioned here by experts. The same can be said for ideas to improve the general welfare

of farmers. In that case, P7 has introduced the idea for farmers not to be paid by the quantity they produce, but for the hours they spend working on food production. Interestingly these are ideas that are already existing in our current society, but that have been deemed impossible due to the normalization of our current ways in the food system. The experts thus often have looked for possibilities from within our current systems, thus mainly envisioning real utopias.

When considering *process* as an element of food utopias, it has been argued that food utopias are not about the results and making success, but it is about making difference and doing things differently. Food utopias as a process recognizes that change does not happen overnight. Time, struggle and effort is all inherent to transformation. In the process, it is important that this diversity of new ideas that have come up through experimentation is told to the rest of the world. The importance of telling stories in the case of lupin has been recognized by the experts as well. P5 expresses that the story of lupin should be told in order to demonstrate the potential of lupin for food system transformation. Storytelling is also a major component of the work of Lekker Lupine. In this initiative, André Jurrius and Marieke Laméris work together as respectively marketeer and farmer to grow and promote lupin in the Netherlands. Here, the work of Marieke is especially interesting since she aims to share the story of lupin in as many ways as possible. Lekker Lupine tries to connect people in the food supply chain to work together on producing and consuming lupin, forming new ways of relationships and engagements.

This is also what is meant with the role of *experimentation* in food utopias as Lekker Lupine thus involves “changing engagements and making new configurations of people and things possible” (Stock et al., 2015, p.8). Experimentation shows that initiatives such as Lekker Lupine are very important in order to make different pathways visible and to explore the multiplicity of possibilities and trajectories to create food system transformation.

Framing the potential of lupin in the Netherlands as food utopia highlights that the story of lupin is one of many stories that has to be told in order to show the diversity of possibilities for food system transformation in the Netherlands. It demonstrates that we do not need to take the future for granted and that there is a sense of agency for transformation if we start with exploring and making visible the possibilities for change, whether that is found in pure novelty or from within our current systems. Experts have helped to shape these possibilities by showing the potential of lupin in their visions for the Dutch future food system and by conceptualizing the pathways towards these visions. This study thus functions to tell the story of lupin, and thereby to present the potential of lupin as one of many opportunities for a transformation of the Dutch food system.

CHAPTER 8: CONCLUSION & REFLECTION

8.1 Conclusion

In this section, I will discuss the interpretations and implications of the results and my research. However, most importantly, I will answer the main question of this study, namely: how can lupin support sustainable food system transformation in the Netherlands?

This study has aimed to focus on two identified problems. Firstly, the problems in our food systems and the need to transform food systems into more sustainable and healthy food systems. And, secondly, the problem of a scientific knowledge gap of studying lupin from a social science perspective in general and the role that lupin can play in the Dutch food system of the future more specifically. Following from these problems, the purpose of this study is to imagine desired futures and to make them real by designing the pathways towards these desired futures, supporting the potential of sustainable food system transformation in the Netherlands and looking into the role that lupin might have in this transformation. Through participatory interviews, I have asked experts to imagine their desired future for the Dutch food system and specifically for the role that lupin can play in this future. For these interviews, I used foresight studies and a food system framework in order to find the answer to the main research question and the sub-questions of this study. Both these approaches had an important role in answering the questions posed in this study.

The *food system framework* allowed to take an holistic view of food systems and to identify the relations and interactions between activities, drivers and outcomes of the food system. Here, the focus was thus not only on the food supply chain of lupin, but also on all the factors outside of the supply chain that influence the development of the lupin supply chain. To answer the main question of this study with the contribution of a food system framework, it can be argued that experts desire a growing role for lupin in the Dutch food system of the future, given its purpose as plant-based protein source and its ability to grow organically and to fit within extensive crop rotation systems in the Netherlands. However, if transformation means to change the whole system in terms of

its activities, its outcomes, its drivers and how these elements are organized accordingly, it can be argued that real transformation would not be achieved based on the desired visions of the experts. This might be due to the fact that, although the food system framework offers great opportunities to study sustainable food system transformation in theory, it can be argued that this way of system thinking has not been applied by the experts in the interviews. If systems thinking is not naturally employed by the experts, then it might become impossible to actually envision a transformation of the entire food system. If ideas are proposed without thinking about the wider dynamics of these ideas that affect the entire system, then how can sustainable food system transformation ever occur? The food system framework in this study has contributed to the idea that system thinking is essential to support sustainable food system transformation. Therefore, in order to be able to support sustainable food system transformation, taking a systems approach is key for people in the field in order to be able to work on ideas that actually support sustainable food system transformation.

Studying transformation inherently means to explore the future. This has been done in this study by using *foresight studies* to look at normative visions for the future of the Dutch food system. Normative future scenarios can be used to think beyond the current trends and therefore will be better able to envision system transformation that breaks with current trends. In addition, the backcasting exercise contributed to making desired futures and concrete pathways in order to realize them. Using foresight studies in this study has thus helped to imagine transformative futures and make them achievable so that this future and pathway can be presented as an actual possibility for food system transformation. Here, the framework of *food utopias* can help to strengthen the idea of possibilities for food system transformation. It has been established that lupin can be seen as one of many possibilities for food system transformation. Yet, the framework of food utopias also shows us that the importance of the potential of lupin comes from the act of experimentation and telling the story of lupin to make others realize the alternatives that exist and the possibilities for food system transformation. The initiatives that are actively promoting lupin, such as Lekker Lupine, are fulfilling a very important role in this experimentation and storytelling.

Reflecting on the problems that were key to this research, it can be argued that this study, with the help of a *food utopias* framework, has demonstrated to look at the potential of lupin for the future of the Dutch food system as one of many possible solutions for the current problems in our food systems. Grounding this possible solution through initiatives such as Lekker Lupine by connecting people and telling the story highlights the potential of lupin for food system transformation. Moreover, this study has shown that there is potential for sustainable food system transformation if a *food systems framework* is used to imagine ideas that can increase the presence of lupin in the Dutch food system. In addition, *foresight studies* can help to stimulate people to imagine visions that are not limited by current trends, thus allowing them to imagine systems change. Secondly, I identified a scientific knowledge gap of studying lupin from a social science perspective in general and the role that lupin can play in the Dutch food system of the future more specifically. I strongly believe that this study can be a basis to further research into lupin from a social science perspective as it exemplifies the many promises and perils for the role of lupin in creating more sustainable and healthy food systems. Because this study takes a systems approach, it leaves room for researching more specifically the aspects that were mentioned in this study. For example, this study recognizes that lupin is not produced and consumed in the Netherlands on a larger scale. A study into the decisions, motivations and considerations of farmers to grow lupin can help to find best practices to motivate other farmers to start growing lupin, whereas studying the decisions, motivations and considerations of farmers that do not grow lupin can help to identify the current barriers. In addition, research can be done to identify how consumers can be motivated to buy lupin and in what ways lupin can be introduced to the consumer so that it becomes a more standard product in the diet of the Dutch consumer.

To summarize: how can lupin support sustainable food system transformation? By presenting lupin as one of many diverse possibilities for sustainable food system transformation. By engaging in systems thinking to not only acknowledge the effects of ideas and interventions to increase the presence of lupin throughout the whole food system, but also to be able to transform the entire system. And, by promoting to imagine a future vision for the Dutch food system beyond the dynamics of our current food system.

8.2 Reflection

Writing this thesis has been a challenging process. I started in the middle of a winter lockdown and therefore was forced to start the process within the four walls of my room. I really took the time to find a research topic that I was passionate about. After all, if I would have to spend half a year on one project, it better be something that I personally wanted to study in order to keep me driven and happy. Finding my research topic was difficult. I changed course of direction many times until I came onto the idea to use the food systems approach. The idea of mapping a food system really sparked my interest, mainly because I enjoy studying interactions and cause and effect relations in the topic that I am most interested in: food. However, the challenge was to find a case in which I could apply the food system approach. When I thought of lupin, everything fell into place.

To me, studying lupin combines two very interesting sets of questions. This first set of questions comes from my development studies background. Food systems take a central place in some of today's greatest societal issues. It combines poverty, livelihoods and food security, but also the challenges we face in climate change and sustainability. They have great potential to positively impact all these challenges, but they currently seem to have lots of negative impacts. The idea of food system transformation and finding ways to make food systems more sustainable in both environmental, social and economic ways really grasps me. When Marieke Laméris was introduced at one of my courses on the future of food and farming, her story about lupin made me really enthusiastic in relation to creating more sustainable and healthy food systems. In addition, studying lupin is interesting to me if I consider it from my sociological background. Here, I have found my interests in food consumption and how and why people choose to consume different types of foods and products. From the perspective of lupin, it is so interesting to ask: why do we not consume this product yet? And how can consumers be encouraged to start consuming lupin, considering its positive effects on health and sustainability?

I was also quite happy that I could be creative in terms of methodology in this thesis. Of course, I could have done the standard type of interview where I asked every expert the same questions from a prepared interview guide. However, I was more interested in developing a creative method that would not only be enjoyable for me, but also for my

research participants. In practice, this led to so many interesting discussions and insights with the experts. It was quite difficult for me that my methods depended on the visions of the experts and that I could not introduce new topics into the discussions to remain from influencing their visions and transforming them into mine. Nevertheless, I enjoyed each interview and the new ideas the experts brought up really inspired me.

It was around the time I started with my interviews that something great happened. Together with a group of friends, we started to work together at the Leeuwenborch every day. Where I previously still worked alone from my room, this change of scenery and new company really brought some new energy into my thesis. We really helped each other through the rough patches and were able to improve each other's work by brainstorming, proofreading, giving feedback, and setting daily goals. Instead of going to the university to work on my thesis, I often felt like I went to meet up with friends which happened to be at the university and where we would almost coincidentally also worked on our theses. The analysis and writing part of the process were made much more pleasant due to working on our theses together.

In the end, I am very proud of myself for staying motivated to finish my thesis the best that I can. I am grateful for the elaborate topic determining phase that I allowed myself to have in order to really find something that I remain passionate about, even when spending half a year focusing on this topic. I can say that I am very happy with what I have achieved and how this thesis and entire process has formed itself.

BIBLIOGRAPHY

Beck, J. (2018). Utopia Landscape Food Utopia. In J. Zeunert & T. Waterman (Eds.), *Routledge Handbook of Landscape and Food* (pp. 585–597). Routledge.

Béné, C., Prager, S. D., Achicanoy, H. A. E., Toro, P. A., Lamotte, L., Cedrez, C. B., & Mapes, B. R. (2019). Understanding food systems drivers: A critical review of the literature. In *Global Food Security* (Vol. 23, pp. 149–159). Elsevier B.V. <https://doi.org/10.1016/j.gfs.2019.04.009>

Bourne, J., Hermansen, C., & Moench-Pfanner, R. (2020). Designing Future-Fit Food. *Sight and Life*, 34(1). https://sightandlife.org/wp-content/uploads/2020/03/SightandLifeMagazine_2020_Consumer_Insights_Designing-Future-Fit-Food.pdf

Bremmer, J., Janssens, B., Ruijs, M., Benninga, J., Stokkers, R., Splinter, G., Smit, P., & Puister-Jansen, L. (2019). *Plantaardige ketens in beeld*. <https://doi.org/10.18174/494597>

Broekema, R., Tyszler, M., van 't Veer, P., Kok, F. J., Martin, A., Lluch, A., & Blonk, H. T. J. (2020). Future-proof and sustainable healthy diets based on current eating patterns in the Netherlands. *American Journal of Clinical Nutrition*, 112(5), 1338–1347. <https://doi.org/10.1093/ajcn/nqaa217>

Brouwer, I. D., McDermott, J., & Ruben, R. (2020). Food systems everywhere: Improving relevance in practice. In *Global Food Security* (Vol. 26). Elsevier B.V. <https://doi.org/10.1016/j.gfs.2020.100398>

Brower, A. (2013). Agri-food activism and the imagination of the possible. *New Zealand Sociology*, 28(4), 80–100. <https://www.researchgate.net/publication/288566319>

Cusworth, G., Garnett, T., & Lorimer, J. (2021). Legume dreams: The contested futures of sustainable plant-based food systems in Europe. *Global Environmental Change*, 69. <https://doi.org/10.1016/j.gloenvcha.2021.102321>

Davies, A. R. (2014). Co-creating sustainable eating futures: Technology, ICT and citizen-consumer ambivalence. *Futures*, 62, 181–193. <https://doi.org/10.1016/j.futures.2014.04.006>

Dekeyser, K., Rampa, F., D'Alessandro, C., & Bizzotto Molina, P. (2020). *The food systems approach in practice: Our guide for sustainable transformation* (Discussion Paper No. 278). <https://www.ecdpm.org/dp278>

Dorninger, C., Abson, D. J., Apetrei, C. I., Derwort, P., Ives, C. D., Klaniecki, K., Lam, D. P. M., Langsenlehner, M., Riechers, M., Spittler, N., & von Wehrden, H. (2020). Leverage points for sustainability

transformation: a review on interventions in food and energy systems. In *Ecological Economics* (Vol. 171). Elsevier B.V. <https://doi.org/10.1016/j.ecolecon.2019.106570>

Doyle, R., & Davies, A. R. (2013). Towards sustainable household consumption: exploring a practice oriented, participatory backcasting approach for sustainable home heating practices in Ireland. *Journal of Cleaner Production*, 48, 260–271. <https://doi.org/10.1016/j.jclepro.2012.12.015>

Dudovskiy, J. (n.d.). *Purposive sampling*. Business Research Methodology. Retrieved July 26, 2022, from <https://research-methodology.net/sampling-in-primary-data-collection/purposive-sampling/>

Erickson, P. J. (2008). Conceptualizing food systems for global environmental change research. *Global Environmental Change*, 18(1), 234–245. <https://doi.org/10.1016/j.gloenvcha.2007.09.002>

Etikan, I., Abubakar Musa, S., & Sunusi Alkassim, R. (2016). Comparison of Convenience Sampling and Purposive Sampling. *American Journal of Theoretical and Applied Statistics*, 5(1). <https://doi.org/10.11648/j.ajtas.20160501.11>

GLOPAN. (2016). *Food systems and diets: Facing the challenges of the 21st century*. <http://glopan.org/sites/default/files/ForesightReport.pdf>

Hebinck, A., Vervoort, J. M., Hebinck, P., Rutting, L., & Galli, F. (2018). Imagining transformative futures: Participatory foresight for food systems change. *Ecology and Society*, 23(2). <https://doi.org/10.5751/ES-10054-230216>

Herrero, M., Mason-D'Groz, D., Bogard, J., & Howden, M. (2020). Food Production. In M. Lawrence & S. Friel (Eds.), *Healthy and Sustainable Food Systems* (pp. 63–81). Routledge.

HLPE. (2017). *Food Security and Nutrition: Building a Global Narrative Towards 2030*. www.fao.org/cfs/cfs-hlpe

Kloosterman, R., Akkermans, M., Reep, C., Wingen, M., Molnár - In 't Veld, H., & van Beuningen, J. (2020). *Klimaatverandering en energietransitie: opvattingen en gedrag van Nederlanders in 2020*. <https://www.cbs.nl/nl-nl/longread/rapportages/2021/klimaatverandering-en-energietransitie-opvattingen-en-gedrag-van-nederlanders-in-2020/6-vleesconsumptie>

Kuhmonen, T. (2017). Exposing the attractors of evolving complex adaptive systems by utilising futures images: Milestones of the food sustainability journey. *Technological Forecasting and Social Change*, 114, 214–225. <https://doi.org/10.1016/j.techfore.2016.08.015>

Kumar, R. (2014). Research Methodology: A Step-by-Step Guide for Beginners. *Sage*.

Kusters, C., ten Hove, H., Bosch, D., Herens, M., & Wigboldus, S. (2019). *Conference Report: Monitoring and Evaluation for Inclusive and Sustainable Food Systems 3-4 April 2019, the Netherlands*. <https://doi.org/10.18174/506604>

Lawrence, M., & Friel, S. (2020). *Healthy and Sustainable Food Systems* (1st ed.). Routledge.

Levitas, R. (2010). *The Concept of Utopia* (Vol. 3). Peter Lang.

Lucas, M. M., Stoddard, F. L., Annicchiarico, P., Frías, J., Martínez-Villaluenga, C., Sussmann, D., Duranti, M., Seger, A., Zander, P. M., & Pueyo, J. J. (2015). The future of lupin as a protein crop in Europe. *Frontiers in Plant Science*, 6. <https://doi.org/10.3389/fpls.2015.00705>

Macdiarmid, J. (2020). Healthy and sustainable diets. In *Healthy and Sustainable Food Systems* (pp. 125–135).

Mangnus, A. C., Vervoort, J. M., McGreevy, S. R., Ota, K., Rupprecht, C. D. D., Oga, M., & Kobayashi, M. (2019). New pathways for governing food system transformations: A pluralistic practice-based futures approach using visioning, back-casting, and serious gaming. *Ecology and Society*, 24(4). <https://doi.org/10.5751/ES-11014-240402>

Ministerie van Landbouw Natuur en Voedselkwaliteit. (2020). *Nationale Eiwitstrategie*. <https://open.overheid.nl/repository/ronl-6ea7577b-85a6-425a-9dad-b9b9cf695495/1/pdf/20298471.bijlage.pdf>

Naderifar, M., Goli, H., & Ghaljaie, F. (2017). Snowball Sampling: A Purposeful Method of Sampling in Qualitative Research. *Strides in Development of Medical Education*, 14(3). <https://doi.org/10.5812/sdme.67670>

Oosterveer, P., & Sonnenfeld, D. A. (2012). Food, globalization and sustainability. In *Food, Globalization and Sustainability*. <https://doi.org/10.4324/9781849776790>

Pereira, L. M., Drimie, S., Maciejewski, K., Tonissen, P. B., & Biggs, R. (2020). Food system transformation: Integrating a political-economy and social-ecological approach to regime shifts. *International Journal of Environmental Research and Public Health*, 17(4). <https://doi.org/10.3390/ijerph17041313>

Prager, S. D., & Wiebe, K. (2021). Strategic foresight for agriculture: Past ghosts, present challenges, and future opportunities. *Global Food Security*, 28. <https://doi.org/10.1016/j.gfs.2020.100489>

Prins, U., van de Vijver, L., & Voshol, P. (2017). *Lupine: Een gezond alternatief voor boer en burger*. <https://orgprints.org/id/eprint/19195/1/20.pdf>

Quist, J., Thissen, W., & Vergragt, P. J. (2011). The impact and spin-off of participatory backcasting: From vision to niche. *Technological Forecasting and Social Change*, 78(5), 883–897. <https://doi.org/10.1016/j.techfore.2011.01.011>

Regio Foodvalley. (2021). *Lekker Lupine zet vergeten gewas op de kaart*. Retrieved July 26, 2022, from <https://www.regiofoodvalley.nl/actueel/nieuws/lekker-lupine-zet-vergeten-gewas-op-de-kaart>

RIVM. (2017). *Wat ligt er op ons bord? Veilig, gezond en duurzaam eten in Nederland*. <https://www.rivm.nl/bibliotheek/rapporten/2016-0200.pdf>

Ruben, R., van Berkum, S., Guijt, J., Steenhuijsen-Piters, B., & Smaling, E. (2021). *Transforming Food Systems Pathways towards inclusive food system transformation*. <https://edepot.wur.nl/554383>

Sachs, J. D., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N., & Rockström, J. (2019). Six Transformations to achieve the Sustainable Development Goals. *Nature Sustainability*, 2(9), 805–814. <https://doi.org/10.1038/s41893-019-0352-9>

Sargent, L. T. (2010). *Utopianism: A very short introduction*. Oxford University Press.

Sargent, L. T. (2015). Everyday life in utopia: Food. In P. Stock, M. Carolan, & C. Rosin (Eds.), *Food Utopias: Reimagining citizenship, ethics and community* (pp. 14–32). Routledge.

Semba, R. D., Ramsing, R., Rahman, N., Kraemer, K., & Bloem, M. W. (2021). Legumes as a sustainable source of protein in human diets. *Global Food Security*, 28. <https://doi.org/10.1016/j.gfs.2021.100520>

Snethlage, J., Vonk, R., Arumugam, P., Conijn, S., Hermelink, M., Ludwig, F., Supit, I., & Chevuru, S. (2021). *Soy Transition-Ethiopia and The Netherlands*. <https://doi.org/10.18174/560794>

Sobel, J., Kettel Khan, L., & Bisogni, C. (1998). A Conceptual Model of the Food and Nutrition System. *Soc. Sci. Med.*, 47(7), 853–863.

Stefanovic, L., Freytag-Leyer, B., & Kahl, J. (2020). Food System Outcomes: An Overview and the Contribution to Food Systems Transformation. In *Frontiers in Sustainable Food Systems* (Vol. 4). Frontiers Media S.A. <https://doi.org/10.3389/fsufs.2020.546167>

Stock, P. V., Carolan, M., & Rosin, C. (2015). *Food Utopias: Reimagining Citizenship, Ethics and Community*. Routledge. <http://www.routledge.com/books/series/RSFSE/>

Tirado - Von der Pahlen, C. (2020). Co-benefits for climate and health of shifting towards plant-based diets. In *Healthy and Sustainable Food Systems* (pp. 147–158).

UNEP. (2016). *Food systems and natural resources*.

<https://www.resourcepanel.org/file/133/download?token=6dSyNtuV>

van Berkum, S., Dengerink, J., & Ruben, R. (2018). *The food systems approach: sustainable solutions for a sufficient supply of healthy food*. www.wur.eu/economic-research

van de Noort, M. (2016). Lupin: An Important Protein and Nutrient Source. In *Sustainable Protein Sources* (pp. 165–183). Elsevier Inc. <https://doi.org/10.1016/B978-0-12-802778-3.00010-X>

van Dooren, C., & Seves, M. (2019). *Naar een meer plantaardig voedingspatroon*.

<https://mobil.voedingscentrum.nl/Assets/Uploads/voedingscentrum/Documents/Consumenten/Encyclopedie/Brondocument%20-%20Naar%20een%20meer%20plantaardig%20voedingspatroon%20-%20Voedingscentrum.pdf>

Voedingscentrum. (n.d.). *Lupine*. <https://www.voedingscentrum.nl/encyclopedie/lupine.aspx>

Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., de Vries, W., Majele Sibanda, L., ... Murray, C. J. L. (2019). Food in the Anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. *The Lancet*, 393(10170), 447–492. [https://doi.org/10.1016/S0140-6736\(18\)31788-4](https://doi.org/10.1016/S0140-6736(18)31788-4)

Wright, E. O. (2009). *Envisioning Real Utopias*. Verso Books

